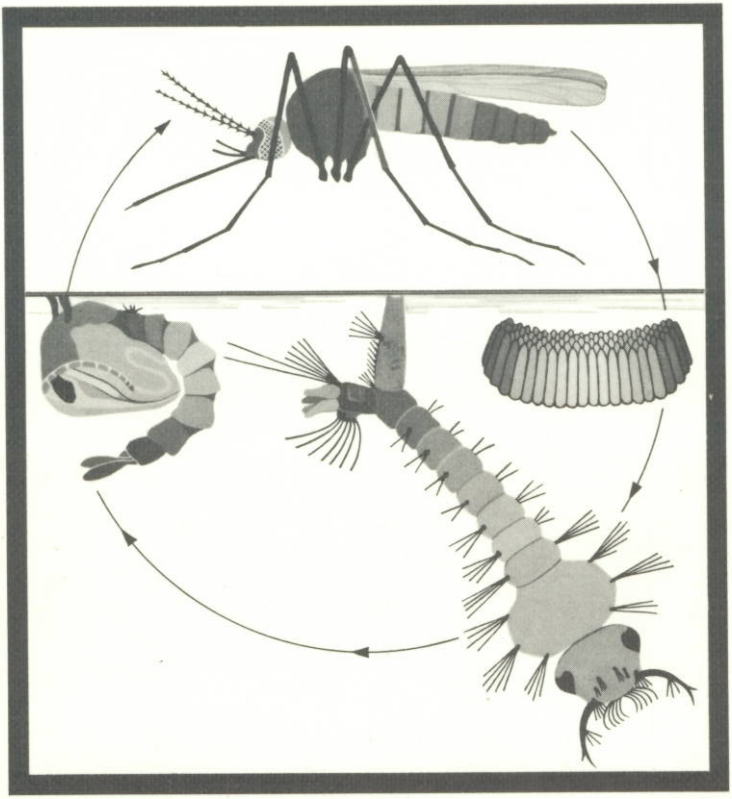
Bibliographical Series No.24



Radioisotopes and Ionizing Radiations in Entomology

Vol.III (1964-1965)

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1967

RADIOISOTOPES AND IONIZING RADIATIONS IN ENTOMOLOGY

Vol. III

(1964-1965)

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BIBLIOGRAPHICAL SERIES No. 24

RADIOISOTOPES AND IONIZING RADIATIONS IN ENTOMOLOGY VOL.III (1964-1965)

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 1967

RADIOISOTOPES AND IONIZING RADIATIONS IN ENTOMOLOGY -VOL. III (1964-1965)
(Bibliographical Series, No. 24)

ABSTRACT. This bibliography is the third volume of a series and contains over 1000 references to the literature for the two-year period 1964-1965. The first two volumes, Bibliographical Series Nos. 9 and 15, cover the 11- and 3-year periods 1950-1960 and 1961-1963, respectively. The bibliography is fully annotated and abstracts have been included whenever possible. Tables give a systematic list of insects and related arthropods, sterilization data, lethal radiation effects, and radioisotope tracer studies on insecticides. An author index, a detailed subject index, and an insecticide index are provided.

The bibliography was compiled by Mrs. M. Binggeli of the Division of Scientific and Technical Information, IAEA.

(454 pp., 16 × 24 cm, paper-bound) Price: US $9.50; £3.7.0
(1967)

BIBLIOGRAPHICAL SERIES, No. 24: RADIOISOTOPES AND IONIZING RADIATIONS IN ENTOMOLOGY (1964-1965)
IAEA, VIENNA, 1967
STI/PUB/21/24

FOREWORD

The present bibliography on Radioisotopes and Ionizing Radiations in Entomology represents the third volume of a series, and covers the years 1964 and 1965. More than 1000 references have been assembled for that 2-year period alone. Earlier volumes covered the 11- and 3-year periods of 1950-1960* and 1961-1963**, respectively. This bibliographical series, which covers the world literature, will be continued and the next volume is scheduled for 1968.

The bibliography is again fully annotated, and abstracts have been included whenever possible. The bibliography has certain unusual features: 1) The detailed Subject Index contains a routine indication for individual reference citations, of the particular radioisotope or radiation used, and a condensed notation for additional information. 2) Numerous tables have been compiled: (a) a systematic table of references listed by order, family, genus, and common names of the insects studied; (b) summarized data on sterilizing and lethal doses; (c) tracer work in the insecticide field, with two separate insecticide indexes.

The documentation will be of practical use to the specialist requiring a rapid survey of relevant publications in related disciplines, to someone in search of detailed documentation on a particular aspect of the field, and to the scientist in developing countries whose access to the world literature might be somewhat limited.

The bibliography was compiled by Mrs. M. BINGGELI of the Agency's Division of Scientific and Technical Information.

Readers are invited to address their suggestions and other correspondence regarding the "Bibliographical Series" to: The Director, Division of Scientific and Technical Information, International Atomic Energy Agency, Kärntner Ring 11-13, A-1010 Vienna, Austria.

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* Bibliographical Series No. 9

** Bibliographical Series No. 15

AVANT-PROPOS

La présente bibliographie, concernant les radioisotopes et les rayonnements ionisants en entomologie, est le troisième volume d'une série consacrée à cette question; elle porte sur les années 1964 et 1965. Elle contient plus de 1000 références pour cette seule période de deux ans. Les deux volumes précédents portaient respectivement sur des périodes de 11 ans (1950 à 1960)* et de trois ans (1961 à 1963)**. L'Agence poursuivra ce travail bibliographique touchant la documentation publiée dans le monde entier; le prochain volume doit paraître en 1968.

Cette bibliographie est entièrement annotée et contient, dans la mesure du possible, des résumés analytiques. Elle présente certaines caractéristiques: 1) dans l'index par sujets, les sujets sont groupés sous des mots-clés et suivis, non seulement d'un renvoi au corps du document, mais aussi de la mention du radioisotope ou du rayonnement utilisé; 2) on a établi plusieurs tableaux: a) un tableau systématique des références classées selon l'ordre, la famille, l'espèce et le nom vulgaire des insectes étudiés; b) des données succinctes sur les doses de stérilisation et les doses létales; c) travaux à l'aide de radioindicateurs sur les insecticides, avec deux index des insecticides.

Cette documentation aura une valeur pratique pour les spécialistes désireux de trouver rapidement une liste des publications dans les domaines qui les intéressent, pour toute personne cherchant des références détaillées sur certains aspects particuliers de la recherche entomologique et pour les hommes de science des pays en voie de développement qui éprouvent des difficultés à se procurer les publications parues dans le monde.

Cette bibliographie a été établie par Mme M. BINGGELI, de la Division de la documentation scientifique et technique de l'Agence.

Les lecteurs sont priés d'adresser leurs suggestions et toute la correspondance concernant la « Collection Bibliographies» au Directeur de la Division de la documentation scientifique et technique, Agence internationale de l'énergie atomique, Kärntner Ring 11-13, A-1010 Vienne, Autriche.

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* Collection Bibliographies n° 9.

** Collection Bibliographies n° 15.

ПРЕДИСЛОВИЕ

Настоящая библиография является третьим томом серии, посвященной использованию радиоактивных изотопов и ионизирующих излучений в энтомологии. В нее вошло более 1000 ссылок на литературу, опубликованную в 1964 – 1965 гг. Предыдущие выпуски относятся к 1950 – 1960 гг.* и 1961 – 1963 гг.** Работа по выпуску этой серии, охватывающей материалы, опубликованные в разных странах мира, будет продолжена; издание следующего тома запланировано на 1968 г.

Как и в первых двух томах, были приложены все усилия к тому, чтобы библиографические описания были как можно более информативными: каждая библиографическая справка содержит большое количество элементов, почти каждое описание – аннотацию. Отличительными чертами библиографии являются: 1) рубрики подробного предметного указателя содержат не только энтомологические понятия, но и радиоизотопы и излучения, которые приведены с указанием на номера библиографических описаний, в которых они упоминаются, и специальную нотацию, позволяющую быстро найти различные дополнительные сведения в библиографии; 2) многочисленные данные сведены в таблицы: а) систематическая таблица данных, классифицированных по отряду, семейству, роду и общепринятому названию насекомых, б) краткая таблица данных по стерилизующим и летальным дозам, в) таблица данных по исследованиям с изотопными индикаторами в области инсектицидов с двумя индексами инсектицидов.

Библиография рассчитана как на специалистов, работающих в смежной с рассматриваемой областью науки, для которых она может оказаться источником готовой экспресс-информации по интересующим их темам, так и на лиц, ведущих доскональный документационный поиск по какой-нибудь из проблем, являющихся предметом рассмотрения данного издания, а также на ученых развивающихся стран с ограниченными книжными ресурсами.

Библиография составлена сотрудницей Отдела научно-технической информации МАГАТЭ г-жой М.БИНГГЕЛИ.

Просьба все замечания, пожелания и предложения, касающиеся "Библиографической серии", направлять по адресу: Австрия, А-1010 Вена, Кернтнер-Ринг, 11–13, Международное агентство по атомной энергии, Директору Отдела научно-технической информации.

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* "Библиографическая серия", №9.

** "Библиографическая серия", №15.

PREFACIO

La presente bibliografía sobre el empleo de radioisótopos y radiaciones ionizantes en entomología abarca los años 1964 y 1965 y es el tercer volumen de la serie. Solamente para este período se recogen más de 1000 referencias. Los volúmenes anteriores abarcaban un período de once años (de 1950 a 1960)* y otro de tres años (de 1961 a 1963)**. Para 1968 está prevista la aparición de otro volumen de esta serie que contiene referencias a publicaciones del mundo entero.

Las notas bibliográficas dan todos los detalles posibles y en muchas ocasiones van acompañadas de resúmenes. Esta bibliografía tiene ciertas características nuevas: 1) en el detallado índice de materias se señala para cada referencia el radioisótopo o la radiación utilizados y se indican otros datos en clave; 2) se han compuesto numerosos cuadros: a) un cuadro sistemático de referencias según el orden, la familia, el género y el nombre común de los insectos estudiados; b) datos resumidos sobre dosis esterilizantes o letales; c) empleo de trazadores en materia de insecticidas, con dos índices distintos de insecticidas.

Esta bibliografía será de utilidad para los especialistas que necesiten un rápido análisis de las publicaciones importantes en materias afines a su especialidad, para las personas que busquen una documentación detallada sobre cuestiones determinadas y para los científicos de los países en desarrollo que a veces tropiezan con dificultades para obtener las obras publicadas.

Ha preparado la bibliografía la Sra. M. BINGGELI, de la División de Información Científica y Técnica del Organismo.

Se ruega a los lectores que envíen sus observaciones y la correspondencia relativa a la «Colección de Bibliografías», al Director de la División de Información Científica y Técnica, Organismo Internacional de Energía Atómica, Kärntner Ring 11 y 13, A-1010 Viena (Austria).

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* Colección de Bibliografías, Nº 9.

** Colección de Bibliografías, Nº 15.

CONTENTS

III. TABLES AND INDEXES

INTRODUCTION

COMPILATION OF BIBLIOGRAPHY AND GUIDE FOR ITS USE

SOURCES

The bibliography was compiled from the open literature. A first routine search consisted of scanning selected secondary sources:

(a) Abstracting journals

Biological Abstracts (BA)
Bulletin Bibliographique:
Isotopes. Rayonnements. Agriculture* (BB)
Chemical Abstracts (CA)
Dissertation Abstracts (DA)
Nuclear Science Abstracts (NSA)
Nuclear Science Abstracts Japan (NSA/J)
Review of Applied Entomology,
series A: Agriculture (RAE-A)
series B: Medicine (RAE-B)

(b) Title listings

Bibliography of Agriculture (BAg)
Biological and Agricultural Index (AI)
Bulletin Signalétique Hebdomadaire –
Périodiques de Chimie**
Current Contents –
Chemical, Pharmaco-Medical & Life Sciences**
List of References (STI/DOC/12, fortnightly***)

Subsequently, primary sources were scanned, abstracts being prepared where necessary, and references cited in original papers were followed up. Numerous books, conference proceedings, bibliographies, and reports were also scanned, including such review series as: A.Rev.Ent. 9 (1964), 10 (1965) (Smith, R.F., Mittler, T.E., Eds.); Adv. Pest Control Res. 6 (1965) (Metcalf, R.L., Ed.); "Genetics Today". 11th International Congress of Genetics, The Hague, Sep. 1963. Vol. 1-3. Geerts, S.J., Ed. Oxford, Pergamon Press, 1965.

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* Includes keywords but no abstracts.

** Lists tables of contents of variety of journals.

*** Current literature, including numerous reports, received routinely by the International Atomic Energy Agency.

Among the selected journals scanned routinely are:

Ann. ent. Soc. Am.
Atompraxis
Biochem. J.
Biochim. biophys. Acta
Bull. ent. Res.
Bull. ent. Soc. Am.
Can. Ent.
Can. Insect Pest Rev.
Can. J. Biochem.
Chromosoma
C.r. hebd. Scéanc. Acad. Sci. D
Dokl. Akad. Nauk SSSR – biol. Sect.
Ecology
Ent. Rev. (AEC-tr-Russian)
Experientia
Expl Cell Res.
Genetics
Hereditas
Int. J. appl. Radiat. Isotopes
Int. J. Radiat. Biol.
Int. Pest Control
Insectes soc.
Jap. J. appl. Ent. Zool.
(Nihon Oyo Dobutsu Konchugaku Zasshi)
Jap. J. Genet. (Idengaku Zasshi)
J. agric. Fd Chem.
J. biol. Chem.
J. Cell Biol.
J. econ. Ent.
J. Insect Physiol.
J. molec. Biol.
Mosquito News
Mutation Res.
Nature, Lond.
Nucleonics
Pesticide Prog.
Radiat. Res.
Radiobiology (AEC-tr-Radiobiologyia)
Science, N.Y.
Z. Naturf.

The omission of an abstract for a given reference may be due to one of the following reasons:

(1) the reference had originally been obtained from a title listing or quoted in a publication which had subsequently proved impossible to obtain for consultation;

(2) the contribution had appeared in an interim form intended for limited circulation only, where permission could not be obtained for quoting details of essentially unpublished work at a preliminary stage or pending publication elsewhere; and

(3) summaries of projects and research under contract are largely outdated by the time the bibliography appears in print, much of the results having been published in the literature by then.

Such references have, nevertheless, been included as title citations and appropriately indexed since some readers might wish to follow them up by establishing direct contact with the scientists concerned (cf. Author Index: Affiliations).

Reports

Numerous reports have been abstracted, and may be considered valuable as indicative of trends in the particular field or institution.

REFERENCES

References are arranged according to subject matter as laid out in the Table of Contents. Articles reviewing the particular subject or of a general or introductory nature are placed at the beginning of a section. Such reviews

are more specific than those contained in the Addendum (B. Bibliographies and General Surveys), where broad fields are surveyed.

References published prior to 1964 but not included in the preceding bibliographies are marked by an asterisk. Where new data have been obtained on references included in Vols.I or II, these are given under their original number preceded by the volume number; e.g. reference x in Vol.II becomes II/x, and an abstract may thus be added to a reference originally cited by title only. This is of interest to users who own the preceding volumes as well.

References to work published prior to 1964 which had been omitted in the preceding volumes of the bibliography are marked by a superscript [(1) or (2)] next to the reference number, to indicate the appropriate volume [Vol.I covers 1950 to 1960, Vol.II 1961 to 1963].

Cross-References

These are cited at the end of each section, giving the title (in English only), first author, year of publication, and the reference number. Despite the very detailed Subject Index, cross-referencing has been used extensively.

ADDENDUM

Techniques

Some selected papers representative of particular techniques (e.g. autoradiography, neutron activation analysis, etc.) have been grouped together.

TABLES

Four Tables have been compiled.

Table 1. Systematic Listing of Insects and Related Arthropods

The insects and related arthropods cited in the bibliography are grouped together systematically by order, family, genus, and common name*. Their place in this table is also indicated in the Subject Index where the systematic code appears next to the scientific name**.

Table 2. Sterilization Data

Data are summarized on the radiation-induced sterilization of 32 species of insects, also listing the insect (by order, family, generic and common

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* Based on the scientific and common names listed in Bull. ent. Soc. Am. 11, 4 (1965).

** Itself traceable via the common name, if the scientific name is not known.

name), the stage irradiated, the dose and radiation used, and where possible the efficacy of the technique.

Table 3. Lethal Radiation Effects

Data on lethal radiation effects are listed for 16 species, laid out as in Table 2.

Table 4. Radioisotope Tracer Studies in Insecticides

This table gives a digest of radioisotope tracer studies on insecticides. Chemical names and other designations are indicated throughout. The particular radioisotope used in an analysis or synthesis as well as the animal, plant or particular substrate used in metabolid and residue studies are given. The insecticides have been grouped in certain broad categories which have also been maintained in the two Insecticide Indexes.

INDEXES

Insecticide Indexes

To facilitate checking on an insecticide, e.g. where a synonym has been used, the following two indexes have been compiled:

(i) Common and Manufacturers' Names Index
(ii) Letter and Name Index

to be used in conjunction with Table 4.

Author Index

As far as possible, up-to-date affiliations have been indicated for each author. Sole or first authors, in cases of joint authorship, have been indicated by underlining the pertinent reference number.

A Corporate Author Index is included.

Subject Index

A detailed Subject Index is provided. The radioisotopes or radiations used are indicated for each reference. The following convention has been adopted concerning the position in which they are cited with regard to a particular study: When the radioisotopes or radiations represent the cause they precede the phenomenon; when used as a tool for analysing existing conditions they follow the phenomenon studied. Irradiation, when combined with other modifying treatments (gaseous environment or temperature at irradiation, etc.) is quoted as radiation/treatment. When a comparison between radiation and other treatments (e.g. chemosterilant) is made, a comma is used to indicate this, e.g. x, tepa: ... Further illustrations are given below.

Radioisotope	Radiation
^{14}C: mutagenic effects: 109 (genetic effects incurred through use of ^{14}C)	γ: ovary: 637 (effects of γ-irradiation on organ studied)
	γ: sexual agressiveness, ♂: 905 (actual effects produced by γ-irradiation)
	x/O: longevity: 882 (-/ ... = additional experimental factor, introduced before, during or after x-irradiation)
	x, alkylating agents: 744 (-, ... = comparison between the effects of different treatments)
trehalose biosynthesis, ^{14}C: 45 (biosynthesis traced [not effected] by ^{14}C)	habits, x: 1045 (habits of infesting insect detected and studied [not influenced] by using x-rays)

This convention enables the reader to obtain at a glance quite a considerable amount of information about a particular study.

In addition, as much other detail as possible has been condensed in the Subject Index, to include, wherever possible, information on the insect stage (in brackets) used, the tissue (in brackets), and the particular compound or process studied. Details of the energy or mode of irradiation are sometimes indicated.

GLOSSARY

The desirability of some form of shorthand notation to make the Subject Index a more potent source of condensed information has been evident for some time. A number of abbreviations, most of them self-evident, has therefore been used and will be listed below, to eliminate possible sources of error and for future reference.

α	alpha radiation
(a)	adult
ATP	adenosine triphosphate
β	beta radiation
CNS	central nervous system
(c)	cocoon
DNA	deoxyribonucleic acid

e	electrons
(e)	egg
EM	electron microscop(y) (ical findings)
(emb)	embryo
γ	gamma radiation
(ℓ)	larva
(ℓ5)	5th larval instar
n	neutron radiation
n_f	fast neutrons
	[when energy is specified suffix is dropped]
(n)	nymph
NA	nucleic acids
OP	organophosph(orus)(ate)
	[underlined to avoid confusion with elements]
(p)	pupa
(pp)	prepupa
(Dp)	Dauerpupa
R-	resistant (strain)
Rev.	Review
RNA	ribonucleic acid
mRNA	messenger RNA
tRNA	transfer RNA
S-	susceptible (strain)
I/120	Vol.I, reference 120
II/42	Vol.II, reference 42

ACKNOWLEDGEMENTS

The compiler (MB) of the bibliography is greatly indebted to Dr. L.K. Cutkomp, of the Joint FAO/IAEA Division of Atomic Energy in Agriculture, for active help, discussions and advice throughout, and to Dr. H.E. Erdman for checking the tables on radiation data. Professor W. Kühnelt, of Vienna University (Institute of Zoology), very kindly assisted in identifying the place of certain species in the systematic table.

I

RADIOISOTOPES

A. INSECT LABELLING

1. Methods

1 Andreev, S.V., Molchanova, V.A., Martens, B.K., Rakitin, A.A. RADIOMARKING IN THE STUDY OF INSECT PESTS. Vest. sel'khoz. Nauki, Mosk. 9, 2 (1964) 122-28. (In Russian, with English, German, and French summaries)

A laboratory method which was developed for labelling insects with radioactive isotopes was used under experimental conditions in order to define more precisely a number of problems concerning the biology of large numbers of parasites of the grain bug (Hemiptera: Eurygaster) and the grain moth (Hadena basilinea). Some new data were obtained on the sizes of the migrations of the grain bug during its larval and adult stages of development. A method for self-marking was worked out for the marking of H. basilinea adults. This method can be widely used in the study of the biology of other insects having positive phototaxis and chemotaxis; this method is especially valuable for marking Lepidoptera. (From translated auth. summary)

2 Chatterji, S., Sethi, G.R., Bhamburkar, M.W., Deshmukh, M.G. LABELLING OF ADULTS OF Chilo partellus Swinhoe. (C. zonellus), THE STALKBORER OF MAIZE AND "JOWAR", WITH RADIOACTIVE PHOSPHORUS (P^{32}). Curr. Sci. 33, 21 (1964) 652-3.

Fully formed caterpillars of C. partellus were starved for 17 h, then fed fresh maize stems treated with ^{32}P. These caterpillars were allowed to feed for 2 h and were washed thoroughly with water to remove surface contamination and then assayed for radioactivity. Fresh untreated maize stems were provided to them for further development. Each radioactive pupa was separated and kept in a tube until emergence of the adult. The activity of the adult moth was recorded on emergence. These moths were then separated into males and females and pairs kept separately for mating and egg-laying. The egg masses were assayed for radioactivity, and transferred to glass rearing jars for hatching. The eggs hatched within 4-6 d. On hatching, 1st-instar caterpillars were also assayed for radioactivity. The initial radioactivity ranged between 33 and 53 cpm. Radioactivity in the subsequent instars (2nd-4th) ranged from 6-29 cpm, whereas in the adults it ranged between 2828 and 22 759 cpm. When the adults were allowed to mate they laid fertile eggs with detectable radioactivity. Thus activity could be recorded not only in the adults but also in the subsequent generation up to 4th instar caterpillars. This observation may be useful in undertaking studies on the flight range and dispersal pattern, which would not be limited to the recovery of the liberated adults but also, in cases where the adults escape recovery, the range of flight will be evident from the location of the radioactive egg masses or the caterpillars which retain radioactivity up to the 4th-instar. (NSA 19: 1965, 27927)

3(2) Chigarev, G.A. THE PRESENT STATE OF THE PROTECTION OF POTATO AGAINST COLORADO BEETLE IN THE USSR AND THE PROBLEMS INVOLVED. Trudy vses. Inst. Zashch. Rast. 17 (1963) 324-43. (In Russian, with English summary)

Leptinotarsa decemlineata (Say) represents a serious menace to potato crops. Control is rendered difficult by the overwintering of adults in the soil at depths down to about 2 ft, the pupation of larvae in the soil at depths of about 1-8 in., and diapause in the soil sometimes lasting for more than a year. Moreover, the females lay an average of 300-500 eggs each, with an absolute max. of over 2500, there are two and sometimes three generations a year, the rate of population increase in high, and the beetles fly great distances (sometimes as much as 187 miles) and are resistant to adverse conditions. The present position in the Soviet Union is attributed to inadequacies in control. Where infestation is established, soil disinfestation is essential, but it has been used only for eradicating isolated foci. Imperfections are noted in the system of quarantine measures enforced, such as the procedure for detecting the numbers of adults emerging in spring. In the spring of 1960, ^{60}Co-labelled adults were released in the field, and the numbers counted on the following day. Only 6·7% of them were recovered in three repetitions, showing the ineffectiveness of visual inspection. (From RAE-A 54: 1966, 14)

4 Dafauce, C. RADIOACTIVE LABELLING OF INSECTS. Boln Serv. Plagas for. B 7, 14 (1964) 102-14. (In Spanish, with English summary)

5 [2] Dafauce, C., Cadahia, D., Astiaso, F. TRES EXPERIENCIAS CON Cryptorrhynchus lapathi L. (CURCULIONIDAE), MEDIANTE MARCADO RADIACTIVO. Boln Serv. Plagas for. 6, 11 (1963) 7-13. (In Spanish, with English summary)

In order to study the habits of the adults of C. lapathi L. on poplar in Spain, weevils were labelled in 1962 with ^{60}Co to which a coloured lacquer had been added to facilitate identification; the methods used are described. In the first experiment, 50 labelled pairs were introduced into an area measuring 3.28 x 3.28 yd in a young poplar plantation on 30th July. On 20th October, only three adults were found alive, 20 were dead and the rest had apparently been eaten by birds, radioactive droppings from which were present. The mean distance travelled per weevil was 21-63 yd, and only 10% had moved more than about 55 yd. In the second experiment, 25 marked pairs were put into a large nylon mesh cage covering 24 young poplars on 31st October, in order to protect them from predators, and were left over winter. Inspections on 26th and 28th January and 2nd May 1963 showed that the females survived better than the males and that more females died in the second part of the hibernation period than in the first; the total percentages of survival were 37.5 for females and 8.3 for males. Oviposition began before overwintering and was resumed after it. In a test on control, 50 marked adults were released into each of two poplar groves, which were then sprayed with 2% parathion, in June and October 1962, respectively; inspections in August and November showed that the spray was not effective and that again many of the weevils had been eaten by birds. (RAE-A 53: 1965, 316)

6 Davies, J.B. THREE TECHNIQUES FOR LABELING Culicoides (DIPTERA: HELEIDAE) WITH RADIOACTIVE TRACERS BOTH IN THE LABORATORY AND IN THE FIELD. Mosquito News 25, 4 (1965) 419-22.

Three techniques were developed for labelling larvae of Culicoides furens Poey and C. barbosi Wirth and Blanton, from the Jamaican swamps. They consisted of (1) direct application to larvae in the laboratory (by placing them directly in solutions containing from 0.5-5 μCi ^{32}P/ml, the larvae becoming labelled within 24 h); (2) direct application to mud in the laboratory (larvae in mud samples from the field were labelled by spreading out the mud into a 1"-layer and applying 200 ml of a solution containing 50 μCi ^{32}P (0.25 μCi/ml) to each square ft of mud surface, sandflies emerging over the following 9 weeks being radioactive); (3) direct application to mud in the field (^{32}P applied at 50 μCi/ft^2 to the mud of the larval habitat; about 50% of the emerging adults proved radioactive).

7 Gangwere, S.K., Chavin, W., Evans, F.C. METHODS OF MARKING INSECTS, WITH ESPECIAL REFERENCE TO ORTHOPTERA (SENS. LAT.) Ann. ent. Soc. Am. 57, 6 (1964) 862-9.

Radioactive and non-radioactive methods used in the past for marking insects, and their applicability to orthopterous insects (sens. lat.), are evaluated on the basis of experimentation, prior field and laboratory experience, and critical analysis of pertinent literature. Radioactive methods based on external application of the isotope are found unsatisfactory for use on Orthoptera; but internal application by ingestion, by surgical insertion, and especially by injection, are suitable for this group of insects, though the ingestion method is subject to several limitations. The non-radioactive methods, grouped into 13 broad categories, are virtually all unsatisfactory for Orthoptera. Fluorescent materials (for nocturnal species) and various kinds of paints indicate some promise, but their applications are limited. One method, the amputation of tegmina, is useful, especially in combination with the new "notch technique". This latter consists of the removal, with fine iris scissors, of V-shaped portions of exoskeleton from the fore, hind, and lateral margins of the pronotum. Various assortments of these notches, in combination with half or full amputation of tegmina, yield a large number of distinctive marks which are readily applied and interpreted in the field, easily supplemented with paint, and reasonably persistent through at least the later life stages; yet they do no apparent harm to the tagged insects. (Auth.)

8 McAllan, J.W., Neilson, W.T.A. LABELING THE APPLE MAGGOT WITH STRONTIUM 89. J. econ. Ent. 58, 1 (1965) 168.

When newly emerged adults of Rhagoletis pomonella (Walsh) were allowed access to pads of absorbent cotton soaked in 50% apple juice containing ^{89}Sr at 2 μCi/ml, all the flies became labelled with the isotope within 6 d and retained measurable amounts for at least 46 d. There was wide variation in the amounts ingested by different flies, and there was no significant difference between the sexes; there also appeared to be no relation between mortality and the dosage rate. (RAE-A 53: 1965, 245)

9 Peleg, B.A., Gothilf, S. LABELING OF EGGS OF THE CAROB MOTH, Ectomyelois ceratoniae (Zeller), WITH P^{32} FOR ECOLOGICAL STUDIES. Israel J. agric. Res. (Ktavim) 14, 2 (1964) 75-76.

Radioactive eggs of the carob moth were obtained by introducing ^{32}P into the diets of the larvae. Females which had, in the larval stage, been fed 10 μCi of ^{32}P/g of dry food laid eggs yielding an average count of 56 cpm, which is sufficient to enable subsequent adult migration to be tracked (females start ovipositing shortly after emergence, and incubation of the eggs is completed within 3-10 d).

10 Peleg, B.A., Nadel, D.J. A NEW METHOD OF P-32 LABELLING OF THE SCALE PREDATOR, Chilocorus bipustulatus L. (COCCINELLIDAE), WITH POSSIBLE APPLICATION TO OTHER SCALE PREDATORS. WP/31/7, International Atomic Energy Agency, Vienna (Austria). 1965, p.3. Unpublished. Preliminary communication.

11 Rahalkar, G.W., Doutt, R.L. A COMPARISON OF PROCEDURES FOR MARKING ADULT ENDO-PARASITIC WASPS WITH P^{32}. J. econ. Ent. 58, 2 (1965) 278-81.

Two methods of labelling adults of Phanerotoma flavitestacea Fischer (Hymenoptera: Braconidae) with ^{32}P have been compared. Freshly emerged adult parasites fed on honey mixed with ^{32}P acquired radioactivity that was detectable up to 36 d. Longevity was not seriously affected. Although ingested radiophosphorus was lost mostly through excretion, some was lost through oviposition. Host eggs parasitized by marked female parasites showed detectable levels of radioactivity. Marking adults by rearing them in hosts feeding on radioactive food is not a satisfactory technique with Phanerotoma. The higher concentrations of ^{32}P in the host food adversely affected emergence of the adult parasites, while at the lower concentrations the emerging adults showed only very low levels of radioactivity. (Auth.)

See also:

12 Effects of the ingestion of radioactive phosphorus by the fruit fly (Ceratitis capitata Wied.) on the eggs laid. (Arroyo Varela, M., Mellado Brauns, L., 1964)
40 Retention of radioactive phosphorus in the body of the human louse (Pediculus humanus L., Anoplura). (Piotrowski, F., Rudnicki, T., 1965)
262 Labelling of certain areas of pigmentation on butterfly wings with ^{35}S-sodium sulphate and ^{35}S-DL-cystine solutions. (Luedicke, M., Peterhänsel, H., 1965)
276 Observations on the feeding habits of the mosquito Aëdes (Stegomyia) aegypti (Linnaeus): The loss of fluid after a blood-meal and the amount of blood taken during feeding. (Boorman, J.P.T., 1960)
282 Relation of distance to foraging intensity of honey bees (Apis mellifera) on natural food sources. (Lee, W.R., 1965)
286 ^{32}P-labeled semen for mosquito mating studies. (Dame, D.A., Schmidt, C.H., 1964)
291 Etude du comportement alimentaire et des relations trophallactiques des mâles au sein de la société de guêpes au moyen d'un radio-isotope. (Montagner, H., 1964)
292 The dispersal flight of Meligethes beetles and spring migration of delphacids with special reference to the application of the tracer method. (Dlabola, J., Taimr, L., 1965)
293 Tagging the oriental fruit moth, Grapholitha molesta (Busck) with radioactive phosphorus for flight and dispersal studies. (Dustan, G.G., 1965)
297 The use of radioactive tracers in the study of dispersion of Orthotylus virescens (Douglas and Scott) (Miridae, Heteroptera). (Lewis, C.T., Waloff, N., 1964)
303 Dispersal studies of Trichogramma semifumatum (Hymenoptera: Trichogrammatidae) tagged with radioactive phosphorus. (Stern, V.M. et al., 1965)
314 Predators of Aedes atropalpus (Coq.) (Diptera: Culicidae) and of other mosquitoes breeding in rock pools in Ontario. (James, H.G., 1965)

319 Les radioisitopes en écologie animale: I. Expériences sur le marquage de pucerons vecteurs de la jaunisse de la betterave. (Impens, R. et al., 1965)

2. Developmental, Physiological, and Genetic Effects of Isotopic Labels

12 Arroyo Varela, M., Mellado Brauns, L. EFECTOS DE LA INGESTION DE FOSFORO RADIACTIVO EN LA PUESTA DE LA MOSCA DE LAS FRUTAS (Ceratitis capitata Wied.). Boln Patol. veg. Ent. agric. 27 (1964) 183-200.

The possibility of introducing and releasing Opius concolor Szépl. against Dacus oleae (Gmel.) on olive in Spain is being considered, and large numbers of the parasite are being reared in the laboratory on C. capitata (Wied.). Since radioactive labelling, particularly of the eggs, would greatly facilitate evaluation of the parasite's effectiveness when released, various techniques of labelling C. capitata were studied, and details are given of them and of the results obtained. When ^{32}P was incorporated into food supplied to the adults, 1% of the total amount of radioactivity supplied was detected in the eggs laid and the degree of radioactivity varied hardly at all between eggs. When larvae were given food containing ^{32}P, about 40% of the radioactivity supplied was detected in the resulting pupae (excluding those formed on the first day of pupation). It is thought that these percentages could be increased by improvements in the techniques employed. (RAE-A 53: 1965, 594)

13 Bennett, G.F. THE EFFECT OF PHOSPHORUS^{32} ON THE FECUNDITY OF Aedes aegypti (L.) AND ITS USE IN DETERMINING BLOOD MEAL VOLUMES. Mosquito News 25, 4 (1965) 465-9.

The volume of blood ingested by A. aegypti was determined by a gravimetric method and found to be 1.63 mm^3/mosquito. The volume of blood ingested, determined by a method involving ^{32}P was 3.0 mm^3. The isotope was administered to young ducklings in the form of $H_3{}^{32}PO_4$, 3-10 d prior to allowing mosquitoes to feed. (See II/276 and 483). The fecundity of mosquitoes fed on ^{32}P-labelled blood proved lower than that of mosquitoes fed on non-labelled blood. The lowered fecundity persisted when radioactive mosquitoes were fed on non-labelled blood. The viability of radioactive eggs (at the level of radiation used) was not affected by the presence of the isotope.

14 Kaplan, W.D., Gugler, H.D., Kidd, K.K., Tinderholt, V.E. NONRANDOM DISTRIBUTION OF LETHALS INDUCED BY TRITIATED THYMIDINE IN Drosophila melanogaster. Genetics 49, 4 (1964) 701-14.

Mutations have been induced in Drosophila males by ^3H-thymidine fed to larvae or injected into adults. Radioautographs of testes of treated males demonstrated a correlation between the occurrence of mutations and the presence of labelled sperm bundles. In addition to the presence of sex-linked recessive lethals, dominant lethals were also measurable. Mapping of the induced sex-linked recessive lethals disclosed a non-random distribution which differed from reported distributions of mutations induced by x-rays and γ-rays. Distribution of mutations induced by ^3H-thymidine appears to reflect the varying frequency with which thymidine bases occur along the length of the Drosophila X-chromosome. (Auth. summary)

15 Kaplan, W.D., Gugler, H.D., Kidd, K.K. THE DISTRIBUTION OF SEX-LINKED RECESSIVE LETHALS INDUCED IN Drosophila MALES BY TRITIATED DEOXYCYTIDINE. Genetics 52, 2, Pt. 2 (1965) 451. Abstr.

In previously reported work the distribution of sex-linked lethals induced by ^3H-thymidine was shown to be non-random along the length of the X-chromosome. Furthermore, the distribution differed from those obtained by others following x- or γ-irradiation. The deoxycytidine distribution differs from the thymidine distribution in two regions of the chromosome, the other regions being similar. These results are in accord with the hypothesis that the relative frequencies of thymine and cytosine bases vary significantly along the length of the chromosomes. (Abstr.)

16 Kent, E. THE EFFECT OF TRITIATED THYMIDINE AND GAMMA IRRADIATION ON THE MORTALITY OF ADULT Drosophila melanogaster. ÇNAEM 32, Turkey. Atomic Energy Commission, Çekmece Nuclear Research Center, Istanbul. Nov. 1965, 11p.

Several factors which might affect the mortality rate in adult D. melanogaster exposed to ionizing radiations as larvae were studied. 72-h-old larvae were irradiated (whole-body γ-irradiation for 2 h) and/or irradiated nutrient containing ^{3}H-thymidine given; in some cases the same larvae received repeated treatment. Hot nutrient consisted of a homogenized mixture of 3 g of banana, 20 mg of sugar, 20 mg of dried yeast, and of ^{3}H-thymidine. The exposure of the same larvae to ^{3}H-thymidine and γ-irradiation at different times caused a high additive mortality rate. Simultaneous application of the two treatments (β-irradiation from ^{3}H-thymidine, and γ-irradiation) produced a greater than additive rise in mortality rate. Irradiated hot nutrient proved harmful to larvae, and seemed responsible for the increased mortality rate when both factors were involved simultaneously.

17 Kent, E. THE EFFECT OF TRITIATED THYMIDINE AND GAMMA IRRADIATION ON THE MORTALITY OF Drosophila melanogaster LARVAE. ÇNAEM 16, Turkey. Atomic Energy Commission. Çekmece Nuclear Research Center, Istanbul. 1964, 7p.

(Orally administered) ^{3}H-thymidine and total body radiation (from a 1.02 Ci ^{60}Co-source) increased the mortality rate of 72-h-old larvae when applied simultaneously at certain ratios. A comparable rise was not observed when only one was administered. The combined effect of the two factors was higher than additive, and ^{60}Co-irradiation was the more effective one. The phenomena are discussed.

18 Kent, E. THE EFFECT OF TRITIATED THYMIDINE AND GAMMA IRRADIATION ON THE MORTALITY OF Drosophila melanogaster LARVAE. A/CONF. 28/P/856, 3rd UN International Conference on the Peaceful Uses of Atomic Energy. May 1964, 7p.

See ref. 16

19 Kharlamov, V.P. SOME PHYSIOCHEMICAL INDEXES OF GASEOUS EXCHANGE IN THE HOUSEFLY Musca domestica AND OF DNA NUCLEOTIDE COMPOSITION OF FIRST-GENERATION LARVAE, FOLLOWING INTERNAL β-IRRADIATION BY PHOSPHORUS-32. Radiobiologiya 4, 6 (1964) 893-5. (In Russian).

Following feeding ^{32}P for two consecutive days at a rate of 2 and 0.02 μCi/ml feed (milk), the average radioactivity of house flies was 5200-7500 and 50-60 cpm, respectively. The retention time of ^{32}P was 40 d at the higher dose, and 25 d at the lower dose. Five days after the introduction of ^{32}P, the total dose absorbed was 8030 and about 80 rad, at the higher and lower dose, respectively. At this irradiation stage, flies receiving the higher dose of ^{32}P showed a reduction of O consumption, and a reduction of the R.Q. by 27%. The smaller dose had the opposite effect (the increase of R.Q. was 8%). Histological study showed that the isotope was distributed mainly in the intercellular spaces of the abdominal cavity with higher amounts accumulating in the gonads. Irradiation, even at the higher dose, caused no changes in the nucleotide composition of the DNA of the progeny (larval stage). (CA 62: 1965, 5618c)

20 Kharlamov, V.P. A CHANGE IN THE ACTIVITY OF FEEDING AND MOBILITY OF THE FLEAS Xenopsylla cheopis MARKED WITH RADIOACTIVE PHOSPHORUS ^{32}P. Zool. Zh. 44, 4 (1965) 547-51.

A change in the feeding activity and mobility of X. cheopis resulting from internal β-irradiation caused by labelling with different concentrations of ^{32}P was studied. When animals were labelled with ^{32}P, giving an initial activity of 0.5 μCi/g, feeding activity increased by 22% and mobility by 31% compared with controls. When an initial activity of 60 μCi/g was used, the contrary was observed, i.e. feeding activity decreased by 46% and mobility by 32%. Under the given experimental conditions, a direct correlation was found between feeding activity and mobility, with a highly significant correlation factor of 0.956.

21 Kuzin, A.M., Glembotskiĭ, Ya. L., Lapkin, Yu. A., Kalendo, G.S., Bregadze, Yu.I., Mamul, Ya. V., Myasnyankina, E.N. ON THE MUTAGENIC EFFECTIVENESS OF INCORPORATED ^{60}C. Radiobiologiya 4 (1964) 804-9. (In Russian)

Incorporated ^{14}C had a dose-dependent mutagenic effect on Drosophila melanogaster from 444-610 sex-linked recessive lethal mutations for 1 rad/10 gametes. A 2.7-fold increase in the dose increased the percentage of mutations 3.5-fold. Gamma irradiation of the eggs, larvae, and pupae caused from 192-264 lethals, averaging 207, per rad/10^{7} gametes. In adult males the figure was

162 per rad/10^7 gametes. The ^{14}C effect was 2.5 times that of chronic external γ-irradiation from ^{60}Co. Chronic γ-irradiation at all stages of development was 20% more effective than that of adult males. (Tr-auth.)

22 Lee, W.R., Oden, C.K., Bart, C.A., Debney, C.W. MUTAGENIC EFFECT ON MATURE Drosophila SPERMATOZOA OF P^{32} INCORPORATED INTO DNA. Genetics 52, 2 Pt. 2 (1965) 455. Abstr.

Transmutation of ^{32}P to ^{32}S and the accompanying energy released by steric changes in the molecule and recoil of the ^{32}S nucleus have been separated from the mutagenic effect of the accompanying β-radiation. Spermatozoa were labelled by feeding ^{32}P to young, 3rd instar larvae which, upon eclosion, were divided into two groups and mated to: (1) females from whom brood was immediately produced; (2) females who after mating were stored for 3 weeks at 18°C before being allowed to produce a brood. Mutation rate in progeny of the second group less that of the first group was taken as the mutation rate induced into mature spermatozoa by ^{32}P decay. Incorporation of ^{32}P was determined by counting spermatozoa microscopically, washing with cold trichloroacetic acid, and determining the radioactivity with a liquid scintillation detector. Assuming that 2/15 of the ^{32}P incorporated into DNA is in X-chromosome euchromatin, there were from 10-60 disintegrations in the X-euchromatin during storage. Because of the high energy of the ^{32}P β-particle, only a negligible dose is received by sperm from β-radiation during storage. No differences were found in the relative rate of chromosome breakage in the two groups, as the frequency of loss of marked B^s. Y in F_1 males was 1.3% ±.2% (N=12 781) and 1.2% ±.2% (N=9 531) for the first and second group, respectively. The frequency of sex-linked recessive lethals was 1.7% ± .3% (N= 8 888) and 1.6% ± .3% (N=7 593) in the first and second group, respectively. Therefore, less than one ^{32}P disintegration in 2000 will produce a "complete" recessive lethal. (Abstr.)

23 Olivieri, G., Olivieri, A. THE MUTAGENIC EFFECT OF TRITIATED URIDINE IN Drosophila SPERMATOCYTES. Mutation Res. 2, 4 (1965) 381-4.

Experiments were carried out to determine whether β-irradiation emitted by ^3H-uridine incorporated into RNA would be mutagenically effective. Since actinomycin D may be expected to inhibit its incorporation but not that of ^3H-thymidine, a comparison of the mutagnic effectiveness of the two tritiated nucleotides was made, with and without actinomycin D co-treatment. Under the prevailing experimental conditions ^3H-uridine proved more mutagenic than ^3H-thymidine despite the greater specific activity of ^3H-thymidine and the only transient presence in the nucleus of ^3H-uridine. Actinomycin D greatly inhibited the labelling of the cytoplasm (noticeable some hours after the administration of uridine). It does not, however, inhibit the nucleolar labelling during the first 30 min after isotope administration. Actinomycin D increases the frequency of x-ray induced mutations when irradiation is carried out within 1 h after actinomycin D administration which is in agreement with the fact that actenomycin D enhances the frequency of ^3H-uridine induced mutations.

24 Purdom, C.E. GENETIC EFFECT OF INCORPORATED ^{14}C IN Drosophila melanogaster. Mutation Res. 2, 2 (1965) 158-67.

A method was described for the quantitative incorporation of ^{14}C into Drosophila. Recessive lethal mutation frequencies were measured in successive 2-d-broods for male and female flies grown on media containing ^{14}C-labelled glucose of specific activities of 0.1 and 0.05 mCi/g. Although there was some evidence that incorporated ^{14}C might be excessively toxic to the developing organism, preliminary genetic results suggested that the mutagenic effect of incorporated ^{14}C was due largely to the emitted β-radiation. The possibility remained that a small transmutational genetic effect was not detectable on statistical grounds. The upper limit to such an effect in females was less than 0.01 but in males this level of effect could not be ruled out. No evidence was found for the production of mosaic mutations by the $^{14}C \rightarrow {}^{14}N$ transmutation. (Auth.)

25 Riordan, D.F. EMERGENCE AND FERTILITY OF Aedes aegypti (L.) REARED IN VARIOUS CONCENTRATIONS OF P^{32}. Can. J. Zool. 43 (1965) 497-501.

A. aegypti (L.) was reared in eight concentrations of ^{32}P from 0.05-0.8 μCi/ml to test the effects on fertility of the adults. Up to 0.3 μCi/ml little effect was seen in the numbers pupating, but at 0.2 μCi/ml and higher many of the adults were so weakened as to be unable to leave the surface of the water. At 0.6 and 0.8 μCi/ml no adults lived to become parents of a succeeding generation. No

progeny were produced by females reared at 0.2 μCi of ^{32}P/ml or by non-radioactive females mated to males reared at 0.3 μCi of ^{32}P/ml. Amounts of ^{32}P in the adults of males and females were calculated. (Auth.)

26 Rudkin, G. T. THE RELATIVE MUTABILITIES OF DNA IN REGIONS OF THE X-CHROMOSOME OF Drosophila melanogaster. Genetics 52, 3 (1965) 665-81.

The relative DNA contents of ten regions of the X-chromosome in four salivary gland nuclei of fully grown larvae and prepupae were determined by cytophotometric measurements of ultraviolet absorbance (λ = 257 nm) of chromosomes treated with ribonuclease. The regions were bounded by the cytogenetic loci of the 11 marker genes, y, z, w, spl, ec, ct, v, g, f, car and bb. The "apparent relative mutability" of a chromosome region is defined as the ratio of the percentage of all mutations that were found to occur in the region to the percentage of DNA in the region. Apparent relative mutabilities were determined for 7-10 regions on the basis of eight published sets of sex-linked lethal and visible mutations: five sets produced by x-ray treatment, one set by a "mutator gene", one set by incorporated ^{3}H-thymidine and one set by incorporated ^{32}P. The apparent relative x-ray sensitivities of the regions were not demonstrably different from one another. Lethal mutations induced by Ives' mutator gene hi were not randomly distributed among four chromosome regions; visibles were. Differences between the susceptibilities of the regions to the different mutagenic treatments are suggested but not established by the data. The theory of chromosome evolution by duplication would predict redundance of genetic function in duplicate regions after the duplication event and until the two regions had diverged by mutation to have different functions. No evidence for different degrees of redundance was found, for the distribution of the observed mutations was not related to the number of bands, the ratio of single to double bands, or to the average DNA contents of the bands in the regions analysed. (Auth. summary)

27 (1) Suomalainen, E., Turpeinen, O., Niini, R. MUTATIONS IN Drosophila melanogaster GROWN ON MEDIA CONTAINING CARBON-14 LABELLED SUGARS. Nature, Lond. 178 (1956) 357-8.

The mutagenic action of ^{14}C was investigated by rearing D. melanogaster from eggs to adults on ^{14}C-containing media (a modification of Spencer's medium was used to which labelled sugars from Canna indica were added at concentrations of 0.1 mCi or 1 mCi per culture bottle). In the course of of their 15 d development the flies received 800 R; no one stage was involved exclusively. The frequency of X-chromosome lethals (2.2-2.8%) was approximately the same as that reported by other workers after a dose of 100 R. The increase in mutation rate may, on the whole, be accounted for by released β- radiation.

See also:

35 Localization, persistence and resultant genetic effects in invertebrates of ingested fourth period metals in stable and radioactive forms. (Grosch, D. S., 1964)

134 Some factors influencing the utilization of tritiated thymidine in grasshopper embryos. (Leach, W. M., 1965)

681 Comparative studies of mutation frequencies induced by ^{32}P treatment and γ-irradiation in the male silkworm. (Ikenaga, M., Kondo, S., 1965)

699 Comparative studies of mutation frequencies induced by ^{32}P treatment and γ-irradiation in the male silkworm. (Mituo, I., Kondo, S., 1965)

780 Fifth report from Norsk Hydro' Institute for Cancer Research for 1963-1964. (Norsk Hydro's Institute for Cancer Research, Olso, 1965)

B. INSECT PHYSIOLOGY AND BIOCHEMISTRY

1. General Articles. Surveys

28 SEMINAR ON INSECT BIOCHEMISTRY. "Seminar on Insect Biochemistry, Chiba, Japan, 20 Jun.-3 Jul. 1965".

see Levenbook, ref. 136.

29 Barton-Browne, L. B. WATER REGULATION IN INSECTS. A. Rev. Ent. 9 (1964) 63-78.

Review article, divided into sections dealing with tolerance to osmotic and ionic changes in body fluids, cuticular transpiration, water loss from spiracles, the control of excretion, of water ingestion, regulation involving endogenous materials, the role of behavioural mechanisms in water regulation, and water relations of insects in nature. Radioisotopes had been used in a number of studies cited but are nowhere mentioned specifically in the text.

30 Winteringham, F. P. W. SOME DISTINCTIVE FEATURES OF INSECT METABOLISM. p. 29-37 of "Aspects of Insect Biochemistry. Biochemical Society Symposium No. 25, London, 1 Apr. 1965". Goodwin, T. W., Ed. London, Academic Press. 1965, 107p.

A survey article, stressing differences in metabolism at the molecular level between insects and other animal classes, of importance for the development of safer and more selective chemicals in insect pest control. The roles of certain compounds in metabolism are discussed, such as vitamin K, nicotinic acid, sterols, amino acids, trehalose, glycerol, ecdysone and other enzymes, juvenile hormone, etc. Numerous studies are cited in which radioisotopes had been used.

31(2) Wyatt, G. R. METABOLIC REGULATION IN THE DEVELOPMENT OF INSECTS. p. 179-88 of "Control Mechanisms in Respiration and Fermentation". Wright, B., Ed. Cardiff, The Ronald Press Company. 1963.

Review article. Respiration during insect metabolism, and the control of respiration in the diapausing pupa are discussed, drawing freely on evidence obtained in studies in which radioisotopes had been used. The production of glycerol and its regulation are considered. The considerable range in biosynthetic rates between diapause and development is illustrated in work on the incorporation of ^{14}C-leucine into Cecropia fat body proteins.

See also:

43 Some comparative aspects of the metabolism of carbohydrates in insects. (Chefurka, W., 1965)

2. Elements. Ions. Inorganic Salts

32 Crossley, D. A., Jr. RADIOCESIUM ACCUMULATION AND FEEDING BY WILLOW LEAF BEETLES (Chrysomela knabi Brown). p. 73-4 of "Health Physics Division Annual Progress Report for Period Ending July 31, 1964". ORNL-3697, Oak Ridge National Lab., Tenn. Oct. 1964.

Experiments were carried out to test the validity of predicting ^{137}Cs accumulation in the field from laboratory data. Larvae conveniently feed only on willow leaves, remain on the host plant, and are easily collected. ^{137}Cs concentrations in willow leaves and in various stages of C. knabi are tabulated for 1962-4, in collections made from May-June from White Oak Lake bed. Samples in 1963 and 1964 had to be taken by boat due to reflooding of the bed. ^{137}Cs-concentration in samples of other stages of the beetle appeared to be consistent with results in the laboratory. Reduction in ^{137}Cs concentration in pupae was apparently due to clearance of stored metabolites from the larvae immediately prior to pupation. Adult stages were more active than larvae, with more rapid elimination rates and lower ^{137}Cs equilibrium concentrations.

33 Crossley, D. A., Jr. BIOLOGICAL HALF-LIFE FOR RADIOCESIUM IN APHIDS. p. 74 of "Health Physics Division Annual Progress Report for Period Ending July 31, 1964". ORNL-3697, Oak Ridge National Lab., Tenn. Oct. 1964.

Experiments were aimed at checking whether available information on biological half-lives could be applied to insect species with sucking rather than chewing mouthparts. Bases of nasturtium (Tropaeolum majus) twigs infested with bean aphid, Aphis fabae, were inserted in aqueous solutions of $^{134}CsCl$. After 3 d ~ 30 aphids were transferred to unlabelled twigs. Estimates of biological half-lives at 8, 18, and 28°C were 42, 23, and 11 h, respectively. A doubling of the elimination rate for each 10°C increase was indicated. Small beetle larvae (Chrysomela

knabi, weight ~2 mg) had biological half-lives > 6 h at 24°C for Cs. Biological half-lives were longer than expected for insects of that size (live weight ~0.51 mg). Size-elimination rate relations are being studied further (on Oncopeltus fasciatus).

34 Getsova, A.B., Volkova, G.A. ACCUMULATION OF RADIOACTIVE ISOTOPES OF PHOSPHORUS, YTTRIUM, IODINE AND MERCURY BY LARVAE OF AQUATIC INSECTS. Zool. Zh. 43 (1964) 1077-80. (In Russian) Translation available in Fedn Proc. 24, Transl. Suppl., part II (July-Aug. 1965) T683-4.

Larvae of seven representative aquatic insects were placed in separate aquaria containing pond water and 10 μCi/l of ^{131}I, ^{203}Hg, ^{32}P, or ^{91}Y was added to each aquarium. Experiments were conducted on Glyphotaelius punctatolineatus Retz., Halesus interpunctatus Zett., Eristalis tenax L., Cloën dipterum L., Aeschna grandis L., Lestes sponsa Hans, and Leucorrhinia rubicunda L., There was maximum accumulation of Y by most of the species investigated, the next highest being Hg. There was high accumulation of P by only two species: E. tenax and G. punctatolineatus; all species showed least accumulation of I. Highest accumulation of all four elements was consistently demonstrated by G. dipterum, followed by G. punctatolineatus, while A. grandis demonstrated lowest accumulation. (See NSA 19: 1965, 8774 and 42247)

35 Grosch, D.S. LOCALIZATION, PERSISTANCE AND RESULTANT GENETIC EFFECTS IN INVERTEBRATES OF INGESTED FOURTH PERIOD METALS IN STABLE AND RADIOACTIVE FORMS. Final Report. TID-21559, North Carolina State Coll., Raleigh. Oct. 1964, 22p.

The effects of the ingestion of a single meal of sucrose solution containing sulphates of Mn, Fe, Co, Ni, Cu, or Zn on the fecundity, fertility, life span, and phenotype of the wasps, Habrobracon juglandis and H. seriopae, were measured. Co and Ni were the most toxic from the standpoint of altered fecundity and fertility. Cu and Zn had only moderate effect at sublethal doses, and Mn and Fe had little effect. Exposure of females fed Mn, Ca, Ni, Cu, or Zn to single or fractionated non-sterilizing doses of x-radiation showed a synergistic effect for x-radiation and feeding of these cations. Feeding ^{58}Co, ^{63}Ni, or ^{65}Zn at concentrations of 100 μCi/ml gave results characteristic of metal poisoning rather than radiation damage. Results are included from measurements of radioisotope distribution using standard counting and autoradiographic techniques, determinations of the relative radioactivity of eggs, and studies on the effects of tissue transplants on egg production. (NSA 19: 1965, 10741)

36 Kormondy, E.J. UPTAKE AND LOSS OF ^{65}Zn IN THE DRAGON-FLY Plathemis lydia. Limnol. Oceanogr. 10 (1965) 371-78.

Study of uptake and loss of ^{65}Zn in the dragonfly P. lydia employed concentrations of 0.005 - 0.5 μCi $^{65}ZnCl_2$/ml water on 200 early, middle, and late instar larvae. Rate and amount of uptake are independent of temperature (10, 20, and 30°C); equilibrium is attained in 24 - 48 h. Loss rate is significantly greater at 10°C than at 20 and 30°C. Uptake and loss rates are independent of body size (= age), but the amount concentrated is inversely related to body size, the coefficient of accumulation being 68 in small larvae, 28 in larger ones. Total uptake is directly proportional to isotope availability in the medium; owing to experimental error, it could not be determined whether rate of uptake is affected by concentration. Loss rates in the field and the laboratory do not differ. Feeding experiments are inconclusive. Loss rate in dead animals is the same as in live larvae, and 95% of initial activity remains on the cast exuvium at moulting and final metamorphosis. Uptake is concluded to be by surface adsorption or cation exchange thereby imposing difficulty in using ^{65}Zn as an indicator of metabolic activity in energy flow studies. Odonata may function significantly in redistributing Zn, the bulk of which localizes in the upper sediments. (Auth.)

37 Martoja, R. DONNEES BIOCHIMIQUES ET HISTOCHIMIQUES SUR L'INCORPORATION DU SULFATE DE SODIUM RADIOACTIF, CHEZ Gryllus bimaculatus de Geer (INSECTE, ORTHOPTERE). C.R. hebd. Séanc. Acad. Sci., Paris 258, 13 (1964) 3550-3.

Après injection ou ingestion de sulfate de sodium radioactif (10 à 20 μCi), une forte radioactivité est mise en évidence, par chromatographie, dans les acides aminés soufrés du Grillon. Par l'analyse histochimique et histoautoradiographique, on peut situer l'origine de l'émission radioactive à la fois sur les protéines sulfhydrilées de nombreux organes, et, pour une moindre part, sur les sulfomucopolysaccharides du tissu conjonctif. (Auth.)

38 Mitlin, N., Bartlett, A.C., Keller, J.C. ELIMINATION RATE AND EFFECT ON REPRODUCTION OF INGESTED RADIOPHOSPHORUS IN THE BOLL WEEVIL. J. econ. Ent. 58, 1 (1965) 119-21.

The biological half-life of ingested ^{32}P in the boll weevil, Anthonomus grandis Boheman, was 5.3 d in females and 7.3 d in males. Germ cells were relatively resistant to effects of the isotope. Ingested amounts up to 3.5 μCi caused only a small decrease in fecundity, and when either the male or female was fed no effects on progeny or genetic changes could be detected. Sterile matings resulted only when both sexes were fed the isotope. There was no obvious chromosomal damage in the germ cells and no phenodeviants appeared in insects reared to the third filial generation. By feeding ^{32}P, sperm or seminal fluid or both could be labelled and traced to the spermatheca and ovaries of mated females. Larvae reared in a radioactive medium were inhibited in their development and only a small percentage developed to adulthood. (Auth.)

39 (2) Odum, E.P., Marples, T.G. BIOELIMINATION OF Zn^{65} AND Fe^{59} IN RELATION TO KIND OF FOOD EATEN. Bull. ecol. Soc. Am. 44, 3 (1963) 74-5. Abstr.

In a continuing effort to explore the possibilities of using radionuclide tracers as indices of activity and feeding rates in nature, a series of experiments are in progress in the laboratory in which bioelimination of ingested tracers is measured in individuals maintained on different kinds of food. So far no effect of kind of food has been demonstrated in larval chewing insects or adult sucking insects. However, high concentrations of malic acid added to drinking water of the latter resulted in increased bioelimination suggesting that plant juices, which may contain such chelators, could be a factor affecting the elimination rate in nature. (Abstr.)

40 Piotrowski, F., Rudnicki, T. RETENTION OF RADIOACTIVE PHOSPHORUS IN THE BODY OF THE HUMAN LOUSE (Pediculus humanus L., ANOPLURA). Acta physiol. pol. 16 (1965) 435-39. (In Polish)

Retention of radioactive phosphorus in the body louse was investigated. It was found that the mean effective half time of ^{32}P was 2.2 d. Excretion of ^{32}P takes place in the phases: in first with the turnover rate $k_1 = 0.2$, and in the second with $k_2 = 0.02$. The method employed permits labelling of body lice for a period of 1-2 weeks. (Auth.)

41 Reichle, D.E., Dodson, G.J. BIOLOGICAL HALF-LIVES OF ^{134}Cs IN FOREST-FLOOR ARTHROPODS. p. 70-71 of "Health Physics Division Annual Progress Report for Period Ending July 31, 1965". ORNL-3849, Oak Ridge National Lab., Tenn. Oct. 1965, 263p.

The retention of ^{134}Cs by two cryptozoan species (Spaeroderus stenostomus, Coleoptera, and the wood roach, Parcoblatta) are shown graphically. The biological half-lives, T_b, are tabulated for 12 cryptozoan species. Coleoptera (Carabidae, Passalidae) were all characterized by single-component systems, regardless of feeding mechanisms or trophic position. In the Orthoptera, crickets (Gryllidae) also exhibited single-component retention curves, although the retention curve for the wood roach (Blattidae) consisted of two components. T_b averaged about 1 d. Further factors affecting elimination rates were body size and temperature.

42 Stobbart, R.H. THE EFFECT OF SOME ANIONS AND CATIONS UPON THE FLUXES AND NET UPTAKE OF SODIUM IN THE LARVA OF Aedes aegypti (L.) J. exp. Biol. 42 (1965) 29-43.

Starved 4th-instar larvae of A. aegypti, when put into deionized water at a density of ten larvae/30 ml, are able to achieve sodium balance at the low external concentration of 5 μM Na/l. The balancing process involves a 10% drop in total sodium content, a more or less complete activation of the mechanism for sodium transport, and a reduction in the permeability of the larva to sodium as measured by the net sodium loss into deionized water. It is very probable that most of this reduction occurs in the anal papillae. The relationship between external sodium concentration and sodium influx in larvae previously 'balanced' in deionized water is described approximately by the Michaelis equation. The sodium outflux also increases with increasing external sodium concentrations. ^{22}Na was used. The net uptake of sodium by 'balanced larvae' appears to be significantly greater from solutions of NaCl than from solutions of $NaNO_3$, $NaHCO_3$, and Na_2SO_4. The ions K^+ Ca^{++} Mg^{++} and NH_4^+ when present as chlorides stimulate the influx of sodium from 0.1 mM/l. sodium chloride. When present as nitrates or sulphates they either have no effect or

cause an inhibition of influx. The results in 4 and 5 suggest that movements of chloride may be important in sodium uptake, and chloride uptake has been found to occur independently of sodium uptake. Measurements of potential difference between haemolymph and medium demonstrate active transport of both sodium and chloride. (Essentially auth. summary)

See also:

306 Biological vectors and reservoirs of strontium-90. (Nelson, D.J., 1964)

3. Carbohydrates

43 Chefurka, W. SOME COMPARATIVE ASPECTS OF THE METABOLISM OF CARBOHYDRATES IN INSECTS. A. Rev. Ent. 10 (1965) 345-82.

A comparative and critical discussion is presented. Whenever possible, results for insects are related to corresponding data for other members of the animal kingdom. Carbohydrates are discussed in terms of their degradation, synthesis and function (glycogen, trehalose and other carbohydrates being considered), and their metabolism (glycolysis, and the pentose phosphate and citric acid cycles). The discussion of terminal respiratory pathways is divided into sections on the constituents of the respiratory chain, mitochondrial stability and respiration, respiration control, and oxidative phosphorylation. The extensive bibliography (225 references) contains many references to radioisotope studies.

43-a(2) Brown, W.H., Felauer, F.E., Smith, M.V. BIOSYNTHESIS OF ROYAL JELLY FATTY ACID FROM SUCROSE. Nature, Lond. 195 (1962) 75-6.

Sucrose uniformly labelled with ^{14}C was fed to 1.5 lb worker bees deprived of their queen; they were confined on two frames of honey and pollen and forced to rear queen cells. 5 h after confinement 13 grafted queen cells were given to the confined bees. Royal jelly was collected at the end of 1, 2 or 3 d and the cells immediately regrafted and returned to the bees. Two collections of jelly at 3 d intervals gave optimum yield. A total of 8.8 g (fresh weight) of labelled royal jelly was produced. Its identity with an authentic sample of inactive royal jelly was confirmed by infra-red absorption spectra.

44 Egorova, T.A. TREHALOSE IN INSECTS. Uchen. Zap. mosk. gos. Univ. ped. Inst. 212 (1965) 14-24. (In Russian)

A review with 43 references.

45 Bricteux-Grégoire, S., Jeuniaux, Ch., Florkin, M. THE BIOCHEMISTRY OF THE SILKWORM. XXVIII. BIOSYNTHESIS OF TREHALOSE FROM PYRUVATE. Archs int. Physiol. Biochim. 72, 3 (1964) 482-8. (In French)

When pyruvate-^{14}C was injected into silkworms at the end of the 5th-instar, no radioactivity was found in glycogen from the adipose tissue, whereas plasma trehalose contained 1.2% of the injected activity. (CA 61: 1964, 7422a)

46 Chino, H., Gilbert, L.I. STUDIES ON THE INTERCONVERSION OF CARBOHYDRATE AND FATTY ACID IN Hyalophora cecropia. J. Insect Physiol. 11 (1965) 287-95.

The interconversion and catabolism of fatty acid and carbohydrate were studied in H. cecropia during pupal-adult development. There was no detectable conversion of (1-^{14}C)-palmitate or (1-^{14}C)-acetate into carbohydrate (glycogen and trehalose). However, the label from ^{14}C-glucose was recovered in long-chain fatty acid glycerides. An appreciable quantity of radioactivity from uniform-^{14}C-glucose was recovered in glycogen. There was no appreciable difference in the

incorporation or the breakdown of palmitate, acetate, or glucose between male and female except that the incorporation of ^{14}C-glucose into glycogen in the female exceeded that in the male during later developmental stages. A large portion of ^{14}C-palmitate but only a small amount of ^{14}C-acetate was incorporated into the neutral fat fraction. (Auth.)

47 Heslop, J.P. THE IRREVERSIBLE NATURE OF GLYCOLYSIS IN THE HOUSEFLY, Musca domestica. Biochem. J. 95 (1965) 40p.

Adult houseflies were injected with 1 μCi of aqueous [2-^{14}C] acetate (30 μM/g of fly) in 1 μl. Thoracic extracts, prepared 30 min after injection, were chromatographed and showed a similar pattern of labelling to the whole fly extracts of Price*. Only small traces of radioactivity coincided with added trehalose or glycerol 1-phosphate. Perchloric acid extracts were made from thoraces and abdomina of flies labelled for 1 h with 1 μCi of [U-^{14}C] pyruvate (12 μM/g). Amino acids were removed from the extracts. The amounts of ^{14}C that were found in glycogen (prepared from whole flies), trehalose and glycerol 1-phosphate, although readily detectable were too small for accurate measurement. Experiments indicated the existence of a highly active, soluble fructose diphosphatase in houseflies, implying that the glycolytic pathway should be reversible from hexose diphosphate. The finding that injection of [^{14}C]glycerol into flies causes intense labelling of hexoses (R.G. Bridges, personal communication to the author) supports this conclusion.

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* Biochem. J. 80: 1961, 420.

48 Lambremont, E.N. THE METABOLISM OF GLUCOSE AND ITS CONVERSION INTO LONG-CHAIN FATTY ACIDS BY THE BOLL WEEVIL. Bull. ent. Soc. Am. 11, 3 (1965) 159. Abstr. 89 Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov. - 2 Dec. 1965".

Glucose and related carbohydrates are important precursors of the acetate units from which boll weevils synthesize fatty acids. A significant portion of injected ^{14}C-labelled glucose is concurrently converted to $^{14}CO_2$. The route of conversion of glucose to $^{14}CO_2$ and to fatty acid has been studied using variously labelled intermediates. (Abstr.)

49 Lipke, H., Graves, B., Leto, S. POLYSACCHARIDE AND GLYCOPROTEIN FORMATION IN THE COCKROACH. II. INCORPORATION OF D-GLUCOSE-^{14}C INTO BOUND CARBOHYDRATE. J. biol. Chem. 240, 2 (1965) 601-8.

The metabolism of polysaccharide and of glycoprotein-bound hexosamine and neutral sugar was studied in the tissues of the intact nymph during moulting. Following the injection of either uniformly labelled D-glucose- or D-glucose-1-^{14}C, the specific activity of cuticle D-glucosamine was 3 - 10 times higher than that of carbohydrate bound as plasma glycoprotein, fat-body glycoprotein, fat body glycogen, or in the wall of the proventriculus. Throughout the moult cycle, only free plasma trehalose acquired sufficient radioactivity to qualify as a precursor of chitin. Amino acids, lipid, and the N-acetyl group of chitin showed low specific activity compared to the glucosaminyl moiety of the cuticle glucosamine. Synthesis and degradation of cuticle polysaccharide was continuous throughout the moult cycle, although the two processes varied in relative magnitude according to the stage. The rate of incorporation of glucose into chitin varied from a value of 12.5 μM/d early in the moult cycle to 4.7 μM/d in the middle of the moult cycle. For these same moult stages the rates of glucosamine removal from the cuticle were 9.2 μM/d and 3.2 μM/d, respectively. The period between moults is characterized by an average rate of addition of bound neutral sugar to the cuticle of 0.26 μM/d and a rate of removal of 0.20 μM/d. Following the administration of glucose-1-^{14}C, about 80% of the label was recovered from C atom 1 of the glucosaminyl residue of the chitin when the period of incorporation was short. The pattern of isotope accumulation in the hexosamine moiety of the plasma and fat body glycoprotein suggested periods of little or no turnover and other periods when significant rates were manifest. In the middle of the moult cycle, $t_{\frac{1}{2}}$ was 16 d for fat body hexosamine and 29 d for plasma hexosamine with no obvious precursor-product relation between the two compartments. For plasma trehalose, $t_{\frac{1}{2}}$ was 0.37 d. The conversion of 1-^{14}C-glucosamine, and N-acetylglucosamine to labelled carbon dioxide was observed, suggesting the recycling of cuticle constituents following resorption of the integument. (From auth.)

50 Payne, D.W., Evans, W.A.L. TRANSGLYCOSYLATION IN THE DESERT LOCUST, Schistocerca gregaria Forsk. J. Insect Physiol. 10, 5 (1964) 675-88.

The hydrolysis of maltose, sucrose, methyl α-glucopyranoside, cellobiose, and raffinose by a freeze-dried enzyme preparation of the foregut and midgut contents of the desert locust S. gregaria is accompanied by transglycosylation. The transglycosylation products were identified as far as possible by comparing their Rg values with those of authentic markers and by the use of specific paper partition chromatogram development techniques. In addition to glucose, maltose digests contained isomaltose, panose, maltotriose, and two other unidentified oligosaccharides which were probably of the panose series. Maltose reformation was detected by the incorporation of [^{14}C] glucose into maltose. Transglucosylation in maltose digests can explain the apparent loss of reducing sugar when incubated maltose reaction mixtures samples are fractionated on activated carbon columns. (Auth.)

51 Sridhara, S., Bhat, J.V. INTERCONVERSION OF CARBOHYDRATE AND FAT IN THE SILKWORM Bombyx mori L. Life Sci. 4, 9 (1965) 979-82.

Mature silkworm larvae, 3-4 d prior to spinning, were injected with palmitic acid-1-^{14}C and glucose-U-^{14}C. Glycogen isolated after 24 h, 48 h, 7 d, and 14 d of administering palmitic acid-1-^{14}C was found not to contain any radioactivity thus indicating that there was no conversion of fatty acid to carbohydrate in this insect. This and other results lead to the conclusion that fatty acids do not serve as the source of energy for B. mori.

See also:

37 Données biochimiques et histochimiques sur l'incorporation du sulfate de sodium radioactif, chez Gryllus bimaculatus de Geer (Insecte, Orthoptère). (Martoja, R., 1964)
139 Cytochemical investigation of silk glands in Antheraea pemyi. (Makarov, P.V., 1965)
235 Carbohydrate-amino acid conversions during cuticle synthesis in Periplaneta americana. (Lipke, H. et al., 1965)
240 Incorporation of H^3-D-glucose during oogenesis in Apis mellifica L. (Engels, W., Drescher, W., 1964)
246 Intermediary metabolism and the insect fat body. (Kilby, B.A., 1965)
270 Flight exhaustion studies on the blow fly Phaenicia sericata using C^{14}-labeled sucrose. (Yurkiewicz, W.J., 1965)
271 The assimilation of acetate and propionate by Prototheca zopfii. (Lloyd, D., Callely, A.G., 1965)
408 The effect of malathion on the catabolism of labelled glucose in Blattella germanica (L.). (Mansingh, A., 1964)

4. Amino Acids. Pteridines, Pyrimidines, Purines. Proteins. Enzymes. Hormones

52 Brunet, P.C. THE METABOLISM OF AROMATIC COMPOUNDS. p.49-77 of "Aspects of Insect Biochemistry. Biochemical Society Symposium No.25, London, 1 Apr. 1965". Godwin, T.W., Ed. London, Academic Press. 1965, 107p.

After discussing the requirements and intake of aromatic amino acids the author deals with the products of the metabolism of tyrosine and phenylalanine and their biological function. The section is broken down into discussions of proteins in which aromatic amino acids are incorporated: the resilins which are elastic cross-linked proteins, and sclerotin, a rigid cross-linked protein. Frequent use was made of radioisotopes in studies on quinone tanning and quinone-tanning agents. The metabolism of tyrosine and phenylalanine, and the metabolic pathways and products of tryptophan are all considered at some length. Radioisotopes were involved in numerous studies.

53 Akai, H., Kobayashi, M. SITES OF FIBROIN FORMATION IN THE SILK GLAND IN Bombyx mori. Nature, Lond. 206 (1965) 529.

Glycine-2-^{3}H was injected through the mouth into the digestive tract of 5th-instar 4-d-old larvae by means of a microsyringe. The silk gland was dissected out 15 min later. Results obtained by electron microscopic autoradiography showed that labelled glycine was incorporated into the rough endoplasmic reticulum for fibroin formation within 15 min of glycine ingestion. Newly synthesized, radioactive fibroin is subsequently transported to the Golgi region and concentrated there.

54 Ammon, H., Karlson, P. ZUM TYROSINSTOFFWECHSEL DER INSEKTEN. XIV. RADIOAUTOGRAPHISCHE LOKALISATION DER SKLEROTISIERUNGSSUBSTANZ IN PUPPENTÖNNCHEN VON Calliphora erythrocephala. (Tyrosine metabolism in insects. XIV. Autoradiographic localization of tanning agent in the puparium of Calliphora erythrocephala). J. Insect Physiol. 10, 3 (1964) 525-7. (In German, with English summary)

When labelled tyrosine, dopamine, or N-acetyl-dopamine is injected into mature larvae of C. erythrocephala, the radioactivity appears mainly in the sclerotized parts of the puparium. There is no difference in the picture after administration of (α-^{14}C)-dopamine or N-[1-^{14}C-acetyl]-dopamine. It is concluded that the tanning agent, i.e. N-acetyl-dopamine, is incorporated as a whole entity. The tanning agent is also present though in lower concentration in the outer endocuticle. It is presumably transported from the haemolymph through the epidermal cells into the exocuticle. This renders the concept of "self-tanning cuticular proteins" unlikely. (Auth.)

55 Baliga, B.S., Srinivasan, P.R., Borek, E. CHANGES IN THE t-RNA METHYLATING ENZYMES DURING INSECT METAMORPHOSIS. Nature, Lond. 208 (1965) 555-7.

RNA and DNA methylases are species specific. In a study involving the cycle of metamorphosis in Tenebrio molitor alterations were found to occur in the t-RNA methylases not only at the transition from larva to pupa but also throughout the duration of the pupal stage right up to the emergence of the imago. Enzyme extracts were prepared from larvae or pupae. Methylase activity of the extracts was assayed by measuring the incorporation of ^{14}C-methyl from [methyl-^{14}C]-s-adenosyl-L-methionine into methyl-deficient Escherichia coli t-RNA (Fig. 1). Marked changes occurred in the activity of the t-RNA methylases almost daily within the pupae. A reproducible pattern of enzyme activity was obtained. A minimal activity on the 3rd day was followed by a maximum on the 4th. On the 7th day, just prior to the emergence of the beetle, enzyme activity proved at its lowest. The extent of methylation of the substrate was measured (Fig. 2). Large differences in total enzyme activity were apparent. Between the 1st and 7th day in the life of a pupa a ~50% reduction of enzyme activity occurs. The almost daily alterations in RNA methylase levels during the pupal stage are highly suggestive of some basic function. The t-RNA methylases alter the structure of one of the cardinal components of the protein synthesizing machinery of the cell.

56 Beermann, W. STRUCTURE AND FUNCTION OF INTERPHASE CHROMOSOMES. p. 375-83 of "Genetics Today. Proceedings of the 11th International Congress of Genetics, The Hague, Netherlands, Sep. 1963, Vol. 2". Geerts, S.J., Ed. Oxford, Pergamon Press. 1965.

Review article. Reference is also made to studies using ^{14}C-labelled precursors of proteins and RNA in chironomids. (See also p. 387 of B.P. Kaufmann's "Synthesis")

57 Bloch, D.P., Brack, S.D. CYTOPLASMIC SYNTHESIS OF NUCLEAR HISTONE DURING SPERMIOGENESIS IN THE GRASSHOPPER Chortophaga viridifasciata (de Geer). J. Cell Biol. 22, 2 (1964) 327-40.

Histone synthesis during spermiogenesis was studied by means of autoradiographic and cytochemical methods. Labelled material (from 2-10 μl of ^{3}H-thymidine, ^{3}H-cytidine, or ^{3}H-arginine in doses of 1, 10 and 25 μCi, respectively) was injected into anaesthetized animals, usually nymphs, at the third segment. It was found that meiosis is followed by a cessation of RNA synthesis, an elimination of RNA from the nucleus, and, during the cytoplasmic sloughing accompanying the initial cytoplasmic elongation, a loss of most of the RNA from the cell. The initial phase of cell elongation results in a long spermatid headed by a spherical RNA-less nucleus bounded by a thin RNA-containing layer of cytoplasm. Subsequent nuclear elongation is accompanied by a replacement of the typical histones by others rich in arginine. This replacement is the result of synthesis of new protein. Incorporation of arginine is first seen to occur in the thin cytoplasmic layer surrounding the nucleus.

This layer was shown by staining and electron microscopy to contain aggregations of ribosome-like particles. These observations support the conclusion that the histone is synthesized in association with the RNA granules in the cytoplasm, then migrates into the nucleus where it combines with the DNA.

58 Brenner-Holzach, O., Leuthardt, F. BIOSYNTHESIS OF PTERINS IN Drosophila melanogaster. III. ORIGIN OF THE SIDECHAIN IN DROSOPTERIN. Helv. chim. Acta 48, 7 (1965) 1569-78. (In German)

Drosopterin (I) and isoxanthopterin (II) isolated from extracts of hatched D. melanogaster larvae which had been fed glucose-1-^{14}C (III) had the same specific activity, whereas after feeding with glucose-U-^{14}C or glucose-6-^{14}C (IV), I had a larger activity than did II. C-8 and C-9 obtained from II as CaC_2O_4 after degradation of the pterin with Cl, contained much more ^{14}C after the administration of III than after IV. Terminal C atoms of I extracted from flies after administration of IV contained twice the activity found when the larvae were fed III. I synthesized in the presence of glucose-2-^{14}C (V) contained most of the activity in the pteridine skeleton. HOAc obtained from I synthesized in the presence of IV or III contained most of the radioactivity in C-2, whereas synthesis in the presence of V produced greater activity in C-1. A close relation existed between the side chain of I and C-4 and C-6 of glucose. (CA 63: 1965, 18715-cd)

59 Brosemer, R.W. THE EFFECT OF PUROMYCIN AND ACTINOMYCIN D ON THE DEVELOPMENT OF GRASSHOPPER FLIGHT MUSCLE GLYCEROLPHOSPHATE DEHYDROGENASE. Biochim. biophys. Acta 99, 2 (1965) 388-90.

Grasshoppers (Melanoplus differentialis and Schistocerca vaga) were reared. Antibiotics were injected into newly moulted adults and the effect on glycerolphosphate dehydrogenase specific activity measured. The range of antibiotic dosage which produced a significant effect on dehydrogenase specific activity proved relatively narrow, ~1-4 µg actinomycin D/g body wt. and 1-4 mg puromycin/g body wt. In order to confirm that actinomycin D and puromycin inhibit muscle protein synthesis under these conditions, [^{14}C] valine or [1-^{14}C]leucine was also injected and the incorporation of label into muscle protein determined. The results indicate that puromycin affects enzyme development only under conditions where it simultaneously inhibits protein synthesis. Actinomycin D also inhibits protein synthesis when dehydrogenase specific activity increase is blocked. The increase in flight muscle glycerolphosphate dehydrogenase after the last moult is therefore due to net enzyme synthesis de novo, not activation of pre-existing apoenzyme. Present results are consistent with the hypothesis that ecdysone also controls the synthesis of glycerolphosphate dehydrogenase in developing insect muscle.

60 Bücher, Th. FORMATION OF THE SPECIFIC STRUCTURAL AND ENZYMIC PATTERN OF THE INSECT FLIGHT MUSCLE. p. 15-28 of "Aspects of Insect Biochemistry. Biochemical Society Symposium No. 25, London, 1 Apr. 1965". Goodwin, T.W., Ed. London, Academic Press. 1965, 107p.

Radioisotopes have been used in studying mitochondria which are reponsible for the extreme respiratory rate of flight muscle during activity. Locusta migratoria was used. Cited studies* show that the process of formation of these mitochondria can be observed in vitro by measuring the incorporation of labelled amino acids ([^{14}C]isoleucine). The incorporation rate into isolated mitochondria in vitro is found to be dependent on the stage of development of the muscle from which the mitochondria have been isolated. The amino acids are incorporated in vitro only into the non-extractable part of the mitochondrial protein, possibly the structural protein, whereas the easily extractable proteins of the mitochondria are labelled only when the amino acids are administered in vivo. Accordingly, mitochondrial growth depends on co-operation with extra-mitochondrial ribosomes; mitochondria in the essential phases of growth are, in fact, densely surrounded by polysomes. Interfibrillar tracheoles and myofibrils, and their growth are discussed.

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* Papers presented by U. Bronsert and H. Schott, and by W. Neupert and Th. Bücher at the "Herbsttagung der Gesellschaft für Physiologische Chemie, Cologne, Federal Republic of Germany".

61 Clever, U. ACTINOMYCIN AND PUROMYCIN: EFFECTS ON SEQUENTIAL GENE ACTIVATION BY ECDYSONE. Science, N.Y. 146 (1964) 794-5.

A temporary inhibition of RNA synthesis leads to a corresponding delay in the formation of all puffs which are stimulated by ecdysone in the salivary gland chromosomes of Chironomus tentans. Inhibition of protein synthesis does not influence the induction of those puffs which appear shortly after injection of ecdysone. Puffs which develop after a longer period are delayed in appearance. It is concluded that early reacting genes are involved in those processes leading to the sequential activation of the puffs which appear later. ^{3}H-uridine (1.29 Ci/mM; 1.0 μCi/ml) was used. (Essentially auth.)

62 Das, C.C., Kaufmann, B.P., Gay, H. AUTORADIOGRAPHIC EVIDENCE OF SYNTHESIS OF AN ARGININE-RICH HISTONE DURING SPERMIOGENESIS IN Drosophila melanogaster. Nature, Lond. 204, 4962 (1964) 1008-9.

Microscopic examination of testes offers clear evidence that ^{3}H-arginine is incorporated into the nuclei of mature spermatozoa. This distribution parallels that of arginine-rich histone as revealed by alkaline Fast Green stainability after deamination. The uptake increases as the time and temperature of treatment increase. Puromycin is an inhibitor of the process. (CA 62 : 1965, 5615h)

63 Emmerich, H., Drews, G., Trautmann, K., Schmialek, P. ÜBER DEN STOFFWECHSEL DES FARNESOLS IN Tenebrio molitor-LARVEN. (Farnesol metabolism in Tenebrio molitor larvae). Z. Naturf. 20b, 3 (1965) 211-3. (In German)

Farnesol and some of its derivatives have the same morphological and physiological effects as juvenile hormones. Farnesol degradation was studied by means of optical tests and metabolites formed from 1,2-^{14}C-farnesol. As had already been shown in rat liver homogenates, the reaction sequence is farnesol → farnesal → "farnesenic" acid (Farnesensäure). Possible alternative metabolic pathways are discussed.

64 Filippovich, Yu. B. THE BIOSYNTHESIS MECHANISM OF SILK FIBROIN. Usp. sovrem. Biol. 57, 2 (1964) 192-210.

A review with numerous references, some of them dealing with radioisotope studies.

65 Frontali, N. BRAIN GLUTAMIC ACID DECARBOXYLASE AND SYNTHESIS OF γ-AMINOBUTYRIC ACID IN VERTEBRATE AND INVERTEBRATE SPECIES. p. 185-92 of "Comparative Neurochemistry. Proceedings of the 5th International Neurochemical Symposium, St. Wolfgang, Austria, 1962". Richter, D., Ed. Oxford, Pergamon Press. 1964.

^{14}C-L-glutamic acid (0.3 μCi/μM) was used in a method for the simultaneous determination of the CO_2 and γ-aminobutyric acid production from glutamic acid in nervous tissue preparations. Tissue from different species, including Apis mellifica, was examined under a variety of conditions. Discrepancies between the production of γ-aminobutyric acid and of CO_2 were demonstrated in two instances — at the higher of two pH optima and in subcellular fractions. A quantitative analysis of the free amino acids of the honeybee brain is appended.

66 Goto, M., Okada, T., Forrest, H.S. BIOSYNTHESIS OF DROSOPTERIN IN THE EYE PIGMENT OF Drosophila melanogaster. Seikagaku Zasshi (J. Biochem., Tokyo) 56, 4 (1964) 379.

^{14}C-labelled 2-amino-6-hydroxy-7,8,9,10-tetrahydropteridine (I), first fed to 100 larvae then extracted from 80 hatched flies, was shown to be a precursor of drosopterin of D. melanogaster. The distribution of radioactivity between isoxanthopterin, drosopterin, and 2-amino-6-hydroxypterin was 70, 20, and 10%, respectively. The microsynthesis of I from 2,4,5-triamino-6-hydroxypyrimidine sulphate monohydrate-5-^{14}C was described. (CA 62 : 1965, 2020f)

67 Goto, M., Okada, T., Forrest, H.S. SYNTHESIS OF 2-AMINO-4-HYDROXY-6-(D-ERYTHRO-1',2',3'-TRIHYDROXYPROPYL) PTERIDINE-3'-PHOSPHATE-10-^{14}C, AND ITS METABOLISM IN Drosophila melanogaster. Archs Biochem. Biophys. 110 (1965) 409-12.

The synthesis of (2-amino-4-hydroxy-6-pteridinyl)-glycerol phosphate-10-^{14}C is reported. When this compound is reduced and then fed to D. melanogaster, the major radioactive component isolated is 2-amino-4-hydroxy-6-methylpteridine-10-^{14}C. (Auth.)

68 Hackman, R.H., Saxena, K.N. TYROSINE METABOLISM IN BLOWFLY LARVAE AT PUPATION. Aust. J. biol. Sci. 17, 3 (1964) 803-5.

Fully grown last instar larvae of Lucilia cuprina were injected with L-tyrosine-U-^{14}C (I) just before pupation. A small fraction of I is incorporated as such into the pupa. Most of the radioactivity is incorporated into the puparium, where it exists as phenolic material, probably derived from the compounds used to cross-link the protein to form the hard, dark puparium. Colour reactions indicate that this material is probably not composed of simple o-dihydric phenols. The remaining I is incorporated into a thin membrane which is insoluble in constant boiling HCl at 100°. It is suggested that this membrane is part of the outer epicuticle or paraffin layer. The stability of this membrane suggests that I may exist in the form of cross-linkages. (CA 62 : 1965, 3127d)

69 Henry, S.M., Block, R.J., Cook, T.W. METHIONINE SULFOXIDE AND OTHER COMBINED AMINO ACIDS IN THE GERMAN COCKROACH. Adv. Chem. Ser. 44 (1964) 85-95.

Alkaline hydrolysis of cockroach residues subsequent to extraction under N with 80% EtOH yielded methionine and methionine sulphoxide in a ratio of 10 : 1. Additional evidence for the presence of combined methionine sulphoxide was obtained by measuring the amount of methionine sulphoxide-^{35}S in acid and enzymic hydrolyzates after assimilation of $Na_2{}^{35}SO_4$. The data are believed to be indicative of naturally occurring peptide- or polysaccharide-bound methionine sulphoxide. Other combined amino acids were determined by ion exchange of the 5% Cl_3CCO_2H-insoluble cockroach residues after hydrolysis with acid or alkali. Beta-alanine, normally present only in the soluble fraction of an organism, was found in the insoluble, proteinaceous residue. (CA 60 : 1964, 14881e)

70 Hill, L. INCORPORATION OF C^{14}-GLYCINE INTO THE PROTEINS OF THE FAT BODY OF THE DESERT LOCUST DURING OVARIAN DEVELOPMENT. J. Insect Physiol. 11, 12 (1965) 1605-15.

The rate of incorporation of ^{14}C-glycine into the fat body proteins of the female desert locust depends upon the reproductive state of the animal. Before the start of oocyte development the rate of incorporation is low, but increases during the period of yolk deposition in the terminal oocytes and then decreases again at the end of oocyte development. This cyclic incorporation rate can thus be correlated with the cycles of oocyte growth and neuroendocrine activity. Cautery of the cerebral neurosecretory cells or allatectomy results in a lowered incorporation rate and the implanation of a corpus cardiacum increases the incorporation rate. It is concluded that the rate of incorporation of ^{14}C-glycine into the fat body proteins is related to the rate of protein synthesis by the fat body and that this process is under neuroendocrine control. The role of the neurosecretory system in this process is discussed in relation to its further role in the control of water balance. (Auth.)

71 Happ, G.M., Meinwald, J. BIOSYNTHESIS OF ARTHROPOD SECRETIONS. I. MONOTERPENE SYNTHESIS IN AN ANT (Acanthomyops claviger). J. Am. chem. Soc. 87, 11 (1965) 2507-8.

Groups of 1000-1500 worker ants were fed portions of Na acetate-1-^{14}C, Na acetate-2-^{14}C, and mevalonic-2-^{14}C lactone. After 7-10 d the ants were frozen and extracted with CH_2Cl_2. Thin-layer chromatographic purification suggested that the normal mevalonic acid pathway of terpene biosynthesis is utilized. (CA 63 : 1965, 7399g)

72 Hoffmeister, H. KONSTITUTIONSAUFKLÄRUNG DES ECDYSONS. (Elucidation of the structure of ecdysone). Thesis. Naturwissenschaftliche Fakultät, Ludwig-Maximilians-Universität. Munich 1963, 53p. (In German)

A mol. wt. of 464 and a summation formula of $C_{27}H_{44}O_6$ were determined. Ecdysone was found to belong to the steroid hormones. Structural details were obtained from chemical, biochemical and spectroscopic analyses. The biosynthesis of ecdysone in the insect organism starts with the precursor cholesterin. Following the injection of ^{3}H-cholesterin into Calliphora larvae, ^{3}H-ecdysone was isolated.

73 Kamon, E. DISTRIBUTION OF SCORPION VENOM IN LOCUSTS. J. Insect Physiol. 11, 7 (1965) 933-45.

Redissolved freeze-dried venom of Leiurus quinquestriatus H. & E. was labelled with ^{131}I, and injected into adults of Locusta migratoria migratorioides R. & F. which were dissected at intervals of 5 min - 216 h following injection. Radioactivity was measured separately for cell-free haemolymph, circulating haemocytes (obtained by centrifugation), intestine, fat body, muscles, thorax, reproductive system, pericardial cells, Malpighian tubules, faeces, central nervous system, and remaining body parts including body wall, legs, and wings. Two counts were taken for each dissected part, the first immediately following dissection and the second after rinsing the tissue in saline. The difference in radioactivity before and after rinsing indicated that 20-30% of the venom was rinsed out. Part of this was undoubtedly venom from haemolymph adhering to the dissected tissues. A significant part of the venom (about 25%) was found to be absorbed by the pericardial cells. Percentage radioactivity for each consecutive 24 h collection of pellets was: 50.80, 8.42, 4.45, 1.39, 0.97, and 0.59 respectively. With time, most tissues showed a decline in radioactivity, except the cuticular parts of the body where percentage radioactivity remained constant from 5 min - 216 h following injection of labelled venom. (Auth.)

74 Karlson, P. BIOCHEMICAL STUDIES OF ECDYSONE CONTROL OF CHROMOSOMAL ACTIVITY. J. cell. comp. Physiol. 66, 2/II (1965) 69-76 (discussion 71-74).

The production of puffs in the salivary gland chromosomes of the midge Chironomus have been investigated. In the blowfly Calliphora the synthesis of messenger RNA has been demonstrated; this messenger carries the information for the enzyme dopa decarboxylase. The enzyme is induced in vivo by ecdysone; the induction can be inhibited by actinomycin, puromycin, and other inhibitors of RNA and protein synthesis. Dopa decarboxylase is one of the key enzymes in the process of sclerotization, in which tyrosine metabolites are incorporated into the cuticle, resulting in tanning. All steps from gene activation through RNA and protein synthesis to the final physiological response have therefore been demonstrated experimentally. Radioisotopes were used to elucidate many of the processes cited in this review.

75 Karlson, P., Herrlich, P. ZUM TYROSINSTOFFWECHSEL DER INSEKTEN. XVI. DER TYROSINSTOFFWECHSEL DER HEUSCHRECKE Schistocerca gregaria Forsk. (Tyrosine metabolism in insects. XVI. Tyrosine metabolism in the locust Schistocerca gregaria Forsk). J. Insect Physiol. 11, 1 (1965) 79-89. (In German, with English summary)

In Schistocerca tyrosine is metabolized by two main pathways. Catabolism is initiated by transamination and the resulting p-hydroxyphenylpyruvate is then converted to p-hydroxyphenylpropionate and p-hydroxybenzoate. The second pathway leads to tyramine and dopamine, the precursors of the tanning agents; these amines are then N-acetylated. The fate of tyrosine depends on the stage of development. Between the moults, phenolic acids are the main metabolites. Production of dopamine and tyramine prevails at the moult; the activity of the corresponding decarboxylases shows maxima shortly before and after moulting. The following radioactive compounds were used: generally ^{14}C-labelled tyrosine, β-[3,4-dihydroxyphenyl]-alanine-α-^{14}C (= dopa), β-[4-hydroxyphenyl]-ethylamine-α-^{14}C (tyramine), β-[3,4-dihydroxyphenyl]-ethylamine-α-^{14}C (= dopamine), and generally ^{14}C-labelled p-hydroxyphenylpropionic acid obtained on incubating generally ^{14}C-labelled tyrosine with Calliphora homogenates.

76 Karlson, P., Peters, G. ZUM WIRKUNGSMECHANISMUS DER HORMONE. IV. DER EINFLUSS DES ECDYSONS AUF DEN NUCLEINSÄURESTOFFWECHSEL VON Calliphora-LARVEN. (The mechanism of action of hormones. IV. The effect of ecdysone on nucleic acid metabolism in Calliphora larvae). Gen. comp. Endocr. 5, 2 (1965) 252-9. (In German, with English abstr.)

Injection of ecdysone into larvae of C. erythrocephala results in the stimulation of RNA turnover. ^{32}P-orthophosphate was used. By 4-7 h after hormone injection, the incorporation of inorganic phosphate into RNA has increased by 50-80%. The results corroborate the postulated mechanism of hormone action via activation of genes and stimulation of messenger-RNA synthesis.

77 Karlson, P., Mergenhagen, D., Sekeris, C.E. TYROSINE METABOLISM IN INSECTS. XV. THE o-DIPHENOL OXIDASE SYSTEM IN Calliphora erythrocephala. Hoppe-Seyler's Z. physiol. Chem. 338, 1/2 (1964) 42-50. (In German, with English summary)

Haemolymph from C. erythrocephala larvae was taken up in phosphate buffer, centrifuged, and fractionated with $(NH_4)_2SO_4$. The fraction obtained was then chromatographed on Sephadex G-50.

The purity of the purified pre-enzyme was examined by paper chromatography and analytical ultracentrifugation. The $s_{20,w}$ of the main peak was 15.4 S. The diphenol oxidase activity was determined with 2,4-dihydroxyphenylalanine as substrate and measuring the increase in absorbance at 480 mμ. A crude preparation of the activator-enzyme was obtained by extraction of acetone powder with a dilute ascorbic acid solution with subsequent centrifugation and filtration over Sephadex G-50. A highly purified preparation was obtained from fresh larvae cuticles with a dilute ascorbic acid solution and fractionation of the extract with $(NH_4)_2 SO_4$. The activation-time curves of the pre-enzyme in crude homogenates were sigmoidal, whereas those of purified preparations showed an initial, rapid increase leveling off with time, which does not seem to indicate autocatalysis. Activation of the pre-enzyme in the presence of mitochondria resulted in adsorption of the active enzyme on the mitochondria under which circumstances the enzyme also displayed a high tyrosine hydroxylase activity, as measured by the incorporation of radioactivity from tyrosine-^{14}C into 2,4-dihydroxyphenylalanine. (CA 61:1964,15087d)

78 Karlson, P., Sekeris, C.E., Maurer, R. ZUM WIRKUNGSMECHANISMUS DER HORMONE. I. VERTEILUNG VON TRITIUM-MARKIERTEM ECDYSON IN LARVEN VON Calliphora erythrocephala. (The mechanism of action of hormones. I. Distribution of tritium-labelled ecdysone in larvae of Calliphora erythrocephala. Hoppe-Seyler's Z. physiol. Chem. 336, 1/3 (1964) 100-6. (In German, with English summary).

The distribution of ^{3}H-ecdysone in the haemolymph, epidermis, and fat body of Calliphora larvae in the final stadium was followed. The max. concentration in the epidermis was obtained 1 h after injection, whereas the fat body showed a more gradual increase. In ligated animals (ecdysone-deficient animals), the incorporation into the epidermis was retarded. In the fat body, most of the activity is localized in the microsome fraction while in the epidermis, a large amount appears in cell nuclei. This supports the authors' hypothesis that hormones function via gene activation and enzyme induction.

79 Kasting, R., McGinnis, A.J. AMINO ACID REQUIREMENTS FOR THE WHEAT STEM SAWFLY DETERMINED WITH GLUCOSE-U-C^{14} AFTER VACUUM-INFILTRATION. Can. Ent. 96, 8 (1964) 1133-7.

Glucose-U-^{14}C was incorporated into immature larvae of the wheat stem sawfly, Cephus cinctus Nort., by vacuum-infiltration. These insects were too small to be conveniently injected and could not be easily fed on artificial diets. About half of them survived the infiltration treatment. $^{14}CO_2$ was produced by the organism showing that the radioactive substrate was metabolized. Of the amino acids isolated from the larvae, proline, alanine, glutamic acid, serine, aspartic acid, and glycine contained relatively large quantities of ^{14}C indicating biosynthesis, and are classed as nutritionally non-essential. In contrast, arginine, isoleucine, leucine, lysine, phenylalanine, threonine, tyrosine, and valine contained little, if any, radioactivity and are classed as nutritionally essential. The concentrations of some of the amino acids in the larval tissues are also presented. (Auth.)

80(x) Kobayashi, M. THE CHEMISTRY AND PHYSIOLOGY OF THE BRAIN HORMONE. p.226-33 of "Proceedings of the 16th International Congress of Zoology, Washington, D.C., 20-27 Aug. 1963, Vol. 4". Moore, J.A., Ed. Washington, D.C., 16 International Congress of Zoology. 1963.

The author discusses the location and action of neurosecretory cells in the brain, the hormonal system of growth and development, the physiology of metamorphosis, and the extraction, crystallization, and chemical character of the brain hormone. Purified brain hormone has been shown to be identical with pure cholesterol, the main sterol of most insects. While ^{14}C-acetate was incorporated into digitonide in the prepupal and pupal stages, it was incorporated very weakly (if at all) in the larval stage of Bombyx mori. The "Dauer-pupa" (30-d-old) was effectively unable to synthesize sterol from ^{14}C-acetate.

81 Lunan, K.D., Mitchell, H.K. TYROSINE METABOLISM AND TYROSINE-O-PHOSPHATE IN Drosophila. Fedn Proc. Fedn Am. Socs exp. Biol. 23, 2 Pt.I (1964) 370. "48th Annual Meeting, Chicago, 12-17 April 1964". Abstr. 1618.

Extracts of early Drosophila pupae rapidly metabolize large amounts of L-tyrosine at 30°C. The reactions are easily studied at 0°C by incubation with L-tyrosine-U-^{14}C: by 15 min, the protein

fraction contained 22% of the added ^{14}C; no more label was incorporated. This material could be released by acid hydrolysis and was not tyrosine. By 35 min, 58% of the added tyrosine was converted to soluble non-tyrosine material; 1/3 of this was L-DOPA. The amount of pupal extract was rate-limiting. Tyrosinase was present but melanin was not formed. Extracts of late larvae carried out similar reactions. From such incubations, 3 alcohol-soluble ninhydrin-positive compounds were formed; their isolation is in progress. Also, tyrosine-O-phosphate was isolated from late larvae and characterized by several physical and chemical criteria. This compound accumulated slowly to a peak of 6.4 μM/g larvae at 105 h. Within 1 h, at the time of puparium formation, the level dropped to 0.6 μM/g. Chromatographic data indicate that ATP is required for the formation of this compound by larval extracts. These observations suggest that tyrosine plays a critical role in the metabolism of Drosophila. (Abstr.)

82 Makarov, P.V. AUTORADIOGRAPHIC STUDY OF PROTEIN-PRODUCING CELLS. Arkh. Anat. Gistol. Embriol. 48, 4 (1965) 3-16. (In Russian)

The incorporation of different precursors into nucleic acids and proteins of the spinning glands of Antheraea pernyi and the oocytes of Rana temporaria was investigated. In A. pernyi thymidine-^{3}H was detected in nuclear DNA 3 h after administration, showing a markedly uneven distribution in different nuclei. The number of labelled nuclei decreased after 24 h. Adenine-^{14}C (I) was incorporated mainly into RNA (controls with RNase or N HCl treatment). Incorporation increased up to 72 h, being on the average 2-fold higher in nuclei than in cytoplasm, but parallel in both cellular parts. Similar correlations were observed after incubation of isolated glands in solutions containing I. Glands labelled in vivo for 24 h (2 μCi I per g body wt.) lost half of the RNA label during 1 h of subsequent incubation in vitro. Incorporation of glycine-^{14}C (II) and methionine-^{14}C into proteins increased for 24 h in vivo and 2 h in vitro, with incorporation into cytoplasm prevailing. The labelling of medium (350-500 μm diam.) and large (800-900 μm diam.) oocytes of R. temporaria was compared. Incorporation of I into nuclear RNA of both types of cells increased up to 72 h with no further change for 7 d. Nucleoli of the large oocytes showed higher labelling than the nucleoplasm. The label in the cytoplasm of these cells was resistant to RNase or N HCl extraction. In the cytoplasm of medium oocytes, I was found mainly in RNA. II was incorporated more intensively into large oocytes. Labelling of cytoplasmic proteins increased for 48 h, being 10 times higher in the large oocytes. Incorporation of II into nuclear proteins was the same for both cellular types. The results are discussed in detail; the absence of correlation between RNA content and protein synthesis is stressed. (CA 63:1965, 8782 h)

83 Mansingh, A. GLYCINE CATABOLISM IN Blattella germanica (L.) J. Insect Physiol. 11, 7 (1965) 1031-37.

Glycine-U-^{14}C was injected into the body cavity of German roaches and the catabolism of the amino acid was studied. At the end of 5 h, during which $^{14}CO_2$ was collected, the soluble and insoluble fractions of the body were obtained and further separated by column and paper chromatography. The radioactivity was recovered from $^{14}CO_2$, glucose, trehalose, glycogen, organic acids including glyoxylic acid, pyruvic acid, α-ketoglutarate, and oxalacetate; lipids, proteins, glutathione, amino acids, and excretion. The amino acids that incorporated the labelled carbon were: serine, alanine, aspartate, glutamate, glutamine-asparagine, and proline. Roaches administered with unlabelled glycine showed accumulation of uric acid in the fat bodies. The probable pathways of glycine catabolism in the roaches are discussed. It is concluded that the maintenance of the nitrogen-pool and the production of energy via Krebs' TCA cycle are the most important roles of glycine in the insect. (Auth.)

84 Mansingh, A. THE EFFECT OF MALATHION ON THE METABOLISM OF AMINO ACIDS IN THE GERMAN COCKROACH Blattella germanica. J. Insect Physiol. 11, 10 (1965) 1389-400.

The effect of malathion (I) intoxication of the free amino acids of the blood of susceptible and resistant strains of B. germanica was studied. The roaches were poisoned by releasing them for 40 min on a surface treated with (I) (0.46 μl of 95% technical grade/cm^2). The poisoned roaches and the unpoisoned controls of S strain were kept in recovery jars at 30°C and 55% relative humidity. Intoxication with (I) did not affect the levels of most of the free amino acids of the blood, but glycine (II), glutamate (III), proline (IV), and glutamine (V) were depleted in the susceptible strain, and, except for V, were slightly reduced in the resistant strain. There was a direct positive correlation between the degree of intoxication, the external symptoms of

poisoning, and the depletion of these amino acids. While the depletion of IV appeared to be the consequence of increased utilization of III, the level of V was affected by the concentrations of the other three amino acids. Mild poisoning had no effect on the V concentration, but the administration of labelled II glycine-U-^{14}C or III glutamate-U-^{14}C increased the lowered level of V in the lethally intoxicated roaches. Studies with labelled amino acids revealed that depletion of the amino acids, along with glycogen, trehalose, and glucose, was a consequence of the increased activity of the Krebs cycle. The NH_3 liberated by the deamination of the amino acids was utilized in the synthesis of nontoxic metabolites, urea and uric acid. (Essentially CA 63: 1965, 18962 c)

85 Maragoudakis, M.E., King, T.E., Cheldelin, V.H. ACIDIC AMINO ACIDS FROM α-HYDROXY-γ-OXOGLUTARATE-^{14}C IN RAT LIVER AND LARVAE OF THE BLOWFLY, Sarcophaga bullata. Biochim. biophys. Acta 93, 3 (1964) 646-49.

Alpha-hydroxy-γ-oxoglutarate-^{14}C (I) was prepared from oxalomalate-^{14}C by acidifying to pH 3.0 with HCO_2H and evaporating. After purification by adsorption on Dowex-1 (formate) resin, and elution with 6 N HCO_2H, the product was assayed with glutamic dehydrogenase (II). The identity of I was established by chromatography of its 2,4-dinitrophenylhydrazone, by catalytic reduction to γ-hydroxyglutamate (III), and by reductive amination by II. I was incubated with rat liver and blowfly larvae homogenates in the presence of alanine, $(NH_4)_2SO_4$, NADH, $MgCl_2$, and phosphate buffer, pH 7.5, for 3 h at 30°C. The acidic amino acids aspartic, glutamic, and erythro- and threo-hydroxyglutamic were isolated by mear of a Dowex-1 (acetate) column and elution with HOAc. Both threo- and erythro-hydroxyglutamic acids were formed by rat liver, but only the erythro isomer was formed by the blowfly larvae. (CA 62: 1965, 9558 d)

86 Miura, Y., Ito, H., Sunaga, K., Ikeda, K., Moriyama, Y., Hasegawa, S. PROTEIN SYNTHESIS IN SILK GLANDS. V. RELATION OF RIBOSOMES TO ENDOPLASMIC RETICULUM DURING FIBROIN SYNTHESIS. Seikagaku Zasshi (J. Biochem., Tokyo) 55, 6 (1964) 623-28.

By density-gradient centrifugation, homogenates of the posterior silk glands were divided into six groups; their protein, RNA, and lipids were analysed before and after incubating at 37°. During incubation the ribosomes detached from the endoplasmic reticulum and glycine-^{14}C did not react with the secretory protein fraction. (CA 61: 1964, 7422 e)

87 Okada, T., Goto, M. SYNTHESES OF 2-AMINO-4-HYDROXY-6-(HYDROXYMETHYL)PTERIDINE-10-^{14}C AND 2-AMINO-4-HYDROXYPTERIDINE-10-^{14}C AND THEIR METABOLISM IN Drosophila melanogaster. Seikagaku Zasshi (J. Biochem., Tokyo) 58, 5 (1965) 458-62.

When D. melanogaster larvae were grown in a medium containing either 2 mg (1.5 mCi/mM) of labelled 2-amino-4-hydroxy-6-(hydroxymethyl)pteridine or 10 mg (1.5 mCi/mM) of labelled 2-amino-4-hydroxypteridine, the adult flies contained radioactive sepiapterin and isoxanthopterin. This evidence suggested a hypothetical biosynthetic pathway for the formation of pteridines in this organism. (CA 64: 1966, 5513 h)

88(2) Peakall, D.B. RATE OF INCORPORATION OF AMINO ACIDS INTO THE WEB PROTEINS OF THE SPIDER Araneus diadematus Cl. p. 13 of "Proceedings of the 16th International Congress of Zoology, Washington, D.C., 20-27 Aug. 1963, Vol. I". Moore, J.A., Ed. Washington, D.C., 16 International Congress of Zoology, 1963.

The rate of appearance of labelled amino acids in the web proteins of A. diadematus Cl. is measured. The ^{14}C-alanine, ^{14}C-glucose or radioactive web protein were fed orally to the spider. The webs are digested, the number of counts of radioactive disintegrations per minute measured and the total N-content of the web determined. Thus it is possible to calculate the amount of incorporation of the labelled material that has taken place. The same procedure was used for thread that had been pulled from the spider. This method has the advantage that the time scale can be altered at will. Using either method the experiment can be carried out over a long period of time as the spider is not harmed. The effects of drugs such as physostigmine (1 mg/kg given orally) which is known to increase the production of thread and protein blocking drugs such as puromycin (100 mg/kg) were examined. The rate of production of web proteins was also studied at the glandular level. Spiders with active glands (activated by pulling of thread), resting and after being given drugs were examined. By slaughtering after various time

intervals and staining for nucleic acids and proteins it was possible to follow the processes of production and secretion of web proteins. The rate of incorporation of amino acids into the web proteins and the passage of this protein to the spinnerets was studied more specifically by the use of autoradiography.

89 Peakall, D.B. EFFECTS OF CHOLINERGIC AND ANTOCHOLINERGIC DRUGS ON THE SYNTHESIS OF SILK FIBROINS OF SPIDERS. Comp. Biochem. Physiol. 12, 4 (1964) 465-70.

Alanine-^{14}C (I) was administrated orally to spiders (Araneus sericatus) and the radioactivity of the silk threads was determined. The rate of I incorporation into the silk was increased by pulling out the threads from the silk glands and by administration of physostigmine, carbachol (II), and para-oxon. The rate of I incorporation was not affected by atropine (III), homoatropine, or mecamylamine; its stimulation by II, however, was blocked by pretreatment with III. It is suggested that the silk-secreting gland is under cholinergic control. (CA 61: 1964, 9813 b)

90 Peakall, D.B. REGULATION OF THE SYNTHESIS OF SILK FIBROINS OF SPIDERS AT THE GLANDULAR LEVEL. Comp. Biochem. Physiol. 15, 4 (1965) 509-15.

Physostigmine (I) and carbachol (II) increased the rate of uptake of orally administered alanine-^{14}C (III) in the epithelium and lumen of the silk gland of Araneus sericatus, but did not alter the absorption from the hind intestine. III incorporation could be doubled in the isolated gland by I and II, and could be decreased to low levels by atropine (IV). In addition, the isolated gland was stimulated by re-emptying following removal of the cephalothorax; this peripheral regulatory mechanism was not inhibited by IV. (CA 63: 1965, 8783 e)

91 Pickett, C., Friend, W.G. NUTRITIONALLY ESSENTIAL AMINO ACIDS OF Rhodnius prolixus (Stål) DETERMINED WITH GLUCOSE-U-^{14}C. J. Insect Physiol. 11, 12 (1965) 1617-23.

Fifth-instar larvae of R. prolixus can synthesize the carbon chains of alanine, asparagine, cystine, glutamic acid, proline, and serine from glucose-U-^{14}C. The following amino acids contained no detectable radioactivity and are therefore classified as essential: arginine, glycine, histidine, isoleucine, leucine, lysine, phenylalanine, threonine, tryptophan, and valine. Although tyrosine showed no radioactivity it may be considered a non-essential amino acid because its synthesis from phenylalanine has been demonstrated in other insects. It is noteworthy that glycine is an essential amino acid for larvae of R. prolixus since it is non-essential for most other animals that have been tested. Proline was the only free amino acid in the haemolymph that was radioactive 48 h after glucose-U-^{14}C injections. (Auth.)

92 Platova, T.P. REVEALING OF INTERMEDIATE STAGES OF PROTEIN SYNTHESIS IN THE NUCLEI OF Drosophila melanogaster SALIVARY GLAND CELLS. Tsitologiya 7, 3 (1965) 318-25. (In Russian)

Protein synthesis in the salivary gland cells of larvae of D. melanogaster was studied by autoradiographic determination of lysine-^{14}C incorporation. Intermediate stages of protein synthesis (formation of acid-insoluble labile complexes of activated amino acids) were detected in the period of intensive growth and secretion of salivary glands. These labile complexes were detected in cytoplasm in the 2nd- and early 3rd-instar larvae, but not in the late 3rd instar. However, the labile complexes were detected in nuclei in the entire 3rd instar. Evidence of the presence of unstably attached amino acids in giant chromosomes was obtained. It was suggested that synthesis of chromosome proteins might be accomplished directly in the chromosome. (CA 63: 1965, 8784 b)

93 Porter, C.A., Jaworski, E.G. BIOSYNTHESIS OF CHITIN DURING VARIOUS STAGES IN THE METAMORPHOSIS OF Prodenia eridania. J. Insect Physiol. 11, 9 (1965) 1151-60.

The relationship between chitin content and activity of the chitin synthetase enzyme was investigated in final instar larvae and pupae. The chitin synthetase assay reaction mixtures contained 4×10^{-4} M uridine diphospho-N-acetylglucosamine (UDPAG)-^{14}C (5.81×10^{4} dpm), 0.011 M N-acetylglucosamine (AG), 5 mg chitodextrin, and 1 ml of an enzyme preparation in a total volume of 1.25 ml. A correlation was found between changes in chitin concentration and activity of the enzyme. AG-^{14}C is incorporated into chitin when the particulate fraction from

Prodenia larvae is incubated with UDPAG-^{14}C. Radioactive chitodextrins and AG are liberated by partial hydrolysis of the insoluble residue and a portion of the chitodextrins is further digested to AG by chitinase. The liberation of considerably more radioactivity directly from the insoluble residue with chitinase than without chitinase is further evidence that chitin is synthesized during the incubation with UDPAG-^{14}C. The maximum level of chitin and the peak activity of the enzyme occur in the late final larvae. The concentrations of hexosamines and chitodextrins are discussed in relation to their possible significance in chitin biosynthesis.

94 Price, G.M. ASPECTS OF AMINO ACID AND NUCLEIC ACID METABOLISM IN THE LARVA OF THE BLOWFLY, Calliphora erythrocephala. Biochem. J. 95, 3 (1965) 39P-40P.

The distribution of free amino acids between the haemolymph, fat body, cutaneous muscle and cuticle of 4-d-old blowfly larvae was examined. The amino acid present in greatest amount in the fat body was tyrosine, followed by alanine and glutamine, which were the two amino acids present in greatest amounts in the other tissues. Aspartic acid was not discernible in haemolymph and glutamine acid and phenylalanine were present there in only trace amounts. Phenylalanine was absent from the cuticle, present in trace amounts in cutaneous muscle, and was easily discernible in the fat body. These observations regarding tyrosine and phenylalanine suggest that hydroxylation of phenylalanine to tyrosine may take place in the fat body. The large amount of tyrosine in the fat body also suggests that it is being accumulated there prior to its involvement in sclerotization of the larval cuticle. Larvae were injected with [U-^{14}C]valine and left for 1 h after which their tissues were extracted with a series of solvents. In perchloric acid extracts free ^{14}C-labelled alanine, aspartate, glutamate, glutamine and valine were identified. In methanol-chloroform extracts ^{14}C-labelled phospholipids and neutral fats were present and in the HCl hydrolysate of the protein fraction ^{14}C-valine was the only labelled amino acid detectable. The concentration of RNA and DNA was measured in tissues from 4-d-old larvae and in 1-7-d-old whole larvae. The concentration (µg/mg wet wt. of tissue) of RNA-P in fat body, cutaneous muscle and cuticle was 0.72, 0.30 and 0.14, respectively, and 0.16, 0.006 and 0.011 for DNA-P, giving RNA-P: DNA-P ratios much greater than those found in vertebrate tissues. The concentration of RNA-P was greatest in 2-d-old larvae (1.3 µg/mg) falling to 0.3 µg/mg in 4-d-old larvae. The DNA-P concentration was greatest in 1-d-old larvae (0.12 µg/mg) falling to 0.02 µg/mg in 5-d-old larvae. The base ratios in the RNA from fat body were guanine: adenine 0.67, cytosine: adenine 0.66 and uracil: adenine 1.03 and from cutaneous muscle were 0.74, 0.72 and 0.98, respectively.

95 Price, G.M. THE INCORPORATION IN VITRO OF L-VALINE INTO THE FAT BODY PROTEIN OF THE LARVA OF THE BLOWFLY, Calliphora erythrocephala. Biochem. J. 97, 3 (1965) 33P-34P. Abstr. Presented at the "453rd Meeting of the Biochemical Society, Middlesex Hospital Medical School, England, 8 Oct. 1965".

The incorporation at 25°C of [U-^{14}C]valine into isolated fat bodies of C. erythrocephala was studied. Pre-incubation for $\leq$1 h resulted in a 2- to 3-fold decrease in incorporation rate. The rate of incorporation was maximal in fat body from the youngest larvae examined, i.e. 4-d-olds (20 000 cpm/mg of protein), and then decreased rapidly up to 6-d-old larvae (2000), after which there was a much slower decrease in the rate up to the 8-d-old larvae of white prepupae (500). The rate of [U-^{14}C]valine incorporation over 30 min in the presence of 7-d-old haemolymph was only 50% of that obtained with 4-d-old haemolymph. The specific activity of the protein in precipitated fat body ("retained" protein) and in the supernatant ("released" protein) was estimated separately. The specific activity of the "released" protein increased linearly and at a much greater rate than that of the "retained" protein. After a 2 h incorporation period the specific activity of the "released" protein was 2-3 times that of the "retained" protein.

96 Ramamurty, P.S. ON THE CONTRIBUTION OF THE FOLLICLE EPITHELIUM TO THE DEPOSITION OF YOLK IN THE OOCYTE OF Panorpa communis (MECOPTERA). Expl Cell Res. 33 (1964) 601-5.

Blood proteins are transported into oocytes in order to serve as raw materials for yolk protein. The transport of the protein molecules through the peritoneal sheath, the basement membrane and the follicle epithelium was studied by intra-vital staining with trypan blue and simultaneously by autoradiography. ^{3}H-L-histidine was injected into the body cavity of the scorpionfly, P. communis. An incubation time of 8-15 min limited activity to the areas of protein synthesis.

Uniformly distributed labelling occurred in all stages up to nine, with distinctly weaker labelling in the germinal vesicle (none at all in the yolk spheres). Observations based on greatly increased incubation periods following injection indicated the importation of protein labelled elsewhere in the body with subsequent incorporation into the oocyte with the help of the follicle cells, as from 1 h after injection. The semicolloidal vital dye and the blood proteins are transported into the oocyte by the same mechanism and become incorporated into the yolk spheres. The intravital storage of trypan blue appears to be suitable for demonstrating light microscopically those cells incorporating macromolecules.

97 Ritossa, F.M. EXPERIMENTAL ACTIVATION OF SPECIFIC LOCI IN POLYTENE CHROMOSOMES OF Drosophila. Expl Cell Res. 35, 3 (1964) 601-7.

The Pavia strain of D. buskii was used since its chromosomes are particularly favourable for cytological analysis. New puffing patterns can be induced in Drosophila by several methods known or supposed to depress the level of "high energy phosphate bonds" in the cells. They are temperature shock, anaerobiosis, 2,4-dinitrophenol, salicylate, azide, dicumarol. For autoradiography a mixture of equal concentration of activities of ^{3}H amino acids (DL-lysine 307 mCi/mM; L-tryptophan 1.62 Ci/mM; Dl-leucine 576 mCi/mM) was used for detecting incorporation into proteins. ^{3}H-cytidine (4.9 Ci/mM) and uridine (3.0 Ci/mM) were used for detecting RNA synthesis. The new puffs are points of intense RNA synthesis, and the same puffs are inducible in the salivary glands, midgut, and hindgut (all the larval organs at any time during development, in which a cytological analysis at the puff level can be made in Drosophila).

97-a Ritossa, F.M., Spiegelman, S. LOCALIZATION OF DNA COMPLEMENTARY TO RIBOSOMAL RNA IN THE NUCLEOLUS ORGANIZER REGION OF Drosophila melanogaster. Proc. natn. Acad. Sci. U.S.A. 53, 4 (1965) 737-45.

Experiments were designed to see whether DNA complementary to ribosomal RNA was confined to the nucleolar organizer (NO) region. DNA was prepared from four stocks of D. melanogaster carrying 1,2,3, and 4 doses of the "NO" segment and hybridized to (^{3}H-, ^{32}P-)labelled ribosomal RNA. (^{3}H-labelled RNA was incubated with σ DNA. The internal "noise" control was provided by including ^{32}P-ribosomal RNA of Escherichia coli.) The results obtained support the following conclusions. (1) The wild-type genome saturates at 0.27% of the DNA indicating that it contains approximately 200 sites per diploid set for each of the two ribosomal components. (2) The nucleolar organizer regions on the X- and Y-chromosomes contribute equally to the proportion of DNA complementary to ribosomal RNA. (3) The proportions of the DNA found to be complementary to ribosomal RNA in the different stocks correspond to that predicted from the genetic constitution and the assumption that all the DNA complements of ribosomal RNA are confined to the nucleolar organizer locus. (4) By identifying the "NO" segment as the site of the required DNA templates the data support the assertion that the nucleolus is the site of ribosomal RNA synthesis.

98 Rodriguez, J.G., Hampton, R., Chaplin, M. UTILIZATION OF AMINO ACIDS BY THE TWO-SPOTTED MITE, Tetranychus urticae Koch. Bull. ent. Soc. Am. 10, 3 (1964) 166. Abstr.

Glucose-U-^{14}C was utilized to determine nutritionally essential and non-essential amino acids in the mite, T. urticae Koch. The method involved paper chromatography and an amino acid analyser. Amino acids containing large amounts of radioactivity were classified as non-essential and those containing little or no radioactivity as essential.

99 Roth, T.F., Porter, K.R. YOLK PROTEIN UPTAKE IN THE OOCYTE OF THE MOSQUITO Aedes aegypti L. J. Cell Biol. 20, 2 (1964) 313-32.

Yolk proteins are thought to enter certain eggs by a process akin to micropinocytosis but the detailed mechanism has not been previously depicted. In this study the formation of protein yolk was investigated in the mosquito A. aegypti L. Ovaries were fixed in phosphate-buffered OsO_4, for electron microscopy, before and at intervals after a meal of blood. The deposition of protein yolk in the oocyte was correlated with a 15-fold increase in 140 mμ pit-like depressions on the oocyte surface. These pits form by invagination of the oocyte cell membrane. They have a 20 mμ bristle coat on their convex cytoplasmic side. They also show a layer of protein on their con-

cave extracellular side which we propose accumulates by selective adsorption from the extra-oocyte space. The pits, by pinching off from the cell membrane become bristle-coated vesicles which carry the adsorbed protein into the oocyte. These vesicles lose the coat and then fuse to form small crystalline yolk droplets, which subsequently coalesce to form the large proteid yolk bodies of the mature oocyte. In an attempt to determine the pathway by which the proteins, formed after a blood meal, enter the different tissues of the abdomen, mosquitoes were fed on anaesthetized rat made radioactive by an intraperitoneal injection of DL-leucine-^{3}H. Preliminary radioautographs, and certain morphological features of the fat body, ovary, and midgut, suggest that the midgut is the principal site of yolk protein synthesis in the mosquito.

100 Salpeter, M.M., O'Connor, A. ACETYLCHOLINESTERASE IN MOTOR END-PLATES EVALUATED BY ELECTRON MICROSCOPE AUTORADIOGRAPHY. J. Cell Biol. 27, 2 (1965) 93A. Abstr. 184. Presented at the "5th Annual Meeting of the American Society for Cell Biology, Philadelphia, 10-12 Nov. 1965".

The sites at which acetylcholinesterase (AcChase) occurs within the motor end-plate can be demonstrated by electron microscope autoradiography following the binding of ^{3}H-diisopropylfluorophosphate (DFP) to the enzyme. If the section and emulsion thicknesses are controlled, the distribution of enzyme can be evaluated quantitatively. Small fragment of external ocular and sternomastoid muscles of mouse were fixed with glutaraldehyde. Every DFP-sensitive site present was blocked with unlabelled DFP (10^{-3} M). After washing, the fragments were placed in 10^{-3} M pyridine-2-aldoxime (2-PAM), a specific reactivator of DFP-inhibited AcChase. Subsequent incubation with ^{3}H-DFP (10^{-4} M) introduced radioactive DFP on a 1:1 basis only into those sites of AcChase reactivated by the 2-PAM. Non-specific adsorption of ^{3}H-DFP was reduced by a final exchange with unlabelled DFP (10^{-3} M). After postfixation with OsO_4 and embedding in Epon, sections were coated with monolayers of Ilford L4 or Kodak NTE emulsion. End-plates from both muscles showed a highly significant localization of silver grains primarily over the synaptolemma. (From Abstr.)

101 Schaefer, C.H. FREE AMINO ACIDS OF THE VIRGINIA PINE SAWFLY, Neodiprion pratti Dyar: THEIR CHROMATOGRAPHIC DETERMINATION AND BIOSYNTHESIS. J. Insect Physiol. 10, 2 (1964) 363-9.

An aqueous solution of U-^{14}C-glucose was injected into larvae in the 3rd, 4th, and 5th instars and also on prepupae. Fifteen amino acids (lysine, arginine, histidine, serine, glycine, glutamic acid, aspartic acid, glutamine, alanine, proline, valine, tyrosine, leucine, isoleucine, and phenylalanine) and four unknown, ninhydrin-positive compounds were detected in the haemolymph of the larvae. Their occurrence was independent of instar and three host plants indicating a selective accumulation of particular amino amino acids. The metabolic incorporation of ^{14}C into proline, alanine, serine, glycine, and radioactivity were detected in histidine and glutamic acid indicating limited biosynthesis. Altogether seven amino acids and one unknown, ninhydrin-positive substance were synthesized in vivo and are apparently non-essential. The separation and identification of free amino acids with thin-layer chromatography are described; a solvent system for separating leucine and isoleucine is given.

102 Schlossberger-Raecke, I., Karlson, P. ZUM TYROSINSTOFFWECHSEL DER INSEKTEN. XIII. RADIOAUTOGRAPHISCHE LOKALISATION VON TYROSINMETABOLITEN IN DER CUTICULA VON Schistocerca gregaria Forsk. (Tyrosine metabolism of insects. XIII. Autoradiographic localization of tyrosine metabolites in the cuticle of Schistocerca gregaria). J. Insect Physiol. 10, 2 (1964) 261-6. (In German, with English summary)

When tyrosine-U-^{14}C (I) was injected into the abdomens of 4th-instar larvae of S. gregaria, ^{14}C was mainly found in the outer layers of the cuticle after moulting. The amount of ^{14}C was dependent on the degree of sclerotization and on the time interval between the injections and moulting. When I was injected 15-70 h before moulting, the incorporation of ^{14}C into the cuticle was high and there was no difference between the normal and the albino strain of the insect. This suggested that precursors of the sclerotizing substances are formed 15-70 h before moulting, and that the metabolic processes are controlled by the moulting hormone ecdysone. When I was injected 2-10 h prior to moulting, very little ^{14}C was incorporated into the cuticle of the albino mutant while in normally pigmented insects there was selective labelling of the

melanin (II) patches. This indicated that the metabolic processes leading to II as the final product occur much later than the production of the sclerotizing agents. DL-Tryptophan-U-^{14}C metabolites were not incorporated into the cuticle, which proved that it does not participate in sclerotization and pigmentation of the cuticle. (CA 61: 1964, 2230 d)

103 Sekeris, C. E. ACTION OF ECDYSONE ON RNA AND PROTEIN METABOLISM IN THE BLOWFLY, Calliphora erythrocephala. p. 149-67 of "Mechanisms of Hormone Action. A NATO Advanced Study Institute, Meersburg/Bodensee, 20-26 May 1964". Karlson, P., Ed. New York, Academic Press. 1965.

The biochemistry of sclerotization has been investigated in detail in the hopes of finding a suitable system for studying ecdysone. Various studies undertaken by the author and his colleagues are described. The activities of the main enzymes involved in tyrosine metabolism during larval development, tyrosine transaminase, phenoloxidase, DOPA decarboxylase, and transacetylase were followed. A direct dependence of the decarboxylase activity on the ecdysone titer was demonstrated. Only the epidermis contained decarboxylase activity, and may be considered as a target tissue for ecdysone in which a specific enzyme is being induced. By means of certain inhibitors of protein synthesis (streptomycin, erythromycin, chloromycin, puromycin) it could be shown that enzyme induction is due to a de novo synthesis of protein. A simple reaction of hormone and enzyme molecule could not be blocked so uniformly by such different inhibitors. A critical phase of primary action of ecdysone was determined. The effect of ecdysone on RNA metabolism was studied. An early effect on nuclear RNA could be demonstrated (Fig. 12) but no influence within the first 2 h on cytoplasmic RNA. The time sequence of ecdysone effects is as follows: The hormone penetrates the cell within 15-30 min, reaching a max. concentration after 1 h; stimulation of messenger RNA is seen within 1-2 h, increase in labelling of microsomal RNA after 3-4 h, and lastly increase of decarboxylase activity due to synthesis of enzyme protein begins after 6-8 h. The possible causal relationship between these events is discussed.

104 Sekeris, C. E., Lang, N. INDUCTION OF DOPA-DECARBOXYLASE ACTIVITY BY INSECT MESSENGER RNA IN AN IN VITRO AMINO ACID INCORPORATING SYSTEM FROM RAT LIVER. Life Sci. 3 (1964) 625-32.

The study showed that the messenger RNA induced by ecdysone is a specific one carrying the information for the synthesis of DOPA-decarboxylase. Calliphora erythrocephala Meig. larvae (considered induced at the white prepupal stage, or controls when 7-d-old larvae) were used. The rate of in vitro incorporation of ^{14}C-L-leucine was determined in the amino acid incorporating system; the messenger RNA used clearly increased the rate of protein synthesis but did not lead to enzyme synthesis. Only the addition of messenger RNA from hormone induced animals led to the appearance of enzyme activity. In experiments on DOPA-decarboxylase activity, ^{14}C-DL-DOPA was used. The percent transformation of DOPA into dopamine was taken as a measure of enzyme activity. An in vitro system from rat liver was used while the messenger RNA was taken from an insect; nevertheless, a functional enzyme molecule was produced. A de novo synthesis of an insect-DOPA-decarboxylase is indicated. The ability of the microsomes to respond to messenger RNA from a different phylum is in agreement with the concept of the universality of the code transcription.

105 Sekeris, C. E., Lang, N. ZUR PROTEIN-BIOSYNTHESE BEI INSEKTEN. DER IN VITRO EINBAU VON AMINOSÄUREN IN PROTEIN DURCH FRAKTION AUS EPIDERMISZELLEN DER SCHMEISS-FLIEGE Calliphora erythrocephala. (Biosynthesis of proteins in insects. In vitro incorporation of amino acids in proteins through fractions from the epidermal cells of the bluebottle fly, Calliphora erythrocephala). Hoppe-Seyler's Z. physiol. Chem. 342, 1-3 (1965) 161-65. (In German, with English summary)

Microsomes from the epidermis of C. erythrocephala larva incorporated leucine-^{14}C into protein in a linear fashion. The addition of albumin, however, decreased this effect. Chloromycetin, streptomycin, and erythromycin also inhibited protein synthesis. Epidermal microsomes from white prepupae, which were 2 d older than the other larval specimens and which had a higher number of polysomes in the epidermis, incorporated even more label into protein than did those of the younger larvae. In its general properties the system is similar to corresponding systems in mammals and bacteria.

106 Shyamala, M. B., Bhat, J. V. ESSENTIAL AMINO ACID REQUIREMENTS OF THE SILKWORM, Bombyx mori. Indian J. Biochem. 2, 3 (1965) 201-02.

When glucose-U-^{14}C was fed to silkworms, all the amino acids became labeled except leucine, phenylalanine, histidine, and threonine. These four were considered as essential for the silkworm. (CA 64: 1966, 7095 d)

107 Smirnov, V. N., Kullyev, P., Varshavskiĭ, M., Spirin, A. S. PARTICIPATION OF RIBOSOMES IN THE BIOSYNTHESIS OF SILK FIBROIN. Dokl. Akad. Nauk SSSR 156, 5 (1964) 1221-4.

Study of silkworm silk gland tissues after intake of glycine-^{14}C showed that ribosomes take part in the biosynthesis of fibroin polypeptide chains. (CA 61: 1964, 7424 a)

108 Srinivasan, N. G., Corrigan, J. J., Meister, A. BIOSYNTHESIS OF D-SERINE IN THE SILKWORM, Bombyx mori. J. biol. Chem. 240, 2 (1965) 796-800.

The occurrence of D-serine in the silkworm, B. mori was confirmed, and studies on its formation from L-serine-^{14}C and glucose-^{14}C were carried out. When D-serine-^{14}C was injected into feeding larvae or pupae, it disappeared slowly, and evidence was obtained for its conversion to L-serine in pupae. Injection of L-serine-^{14}C into spinning larvae was followed by the appearance of D-serine-^{14}C. Administration of glucose-U-^{14}C and glucose-1-^{14}C gave L-serine-^{14}C and D-serine-^{14}C; with both types of labelled glucose, L-serine became labelled more rapidly than D-serine. Homogenates of spinning larvae and prepupae, but not of feeding larvae, catalyzed conversion of L-serine to D-serine. The available data indicate that D-serine is formed by the tissues (probably mainly by the fat body) of B. mori at about the time of pupation. (CA 62: 1965, 5614 h)

109 Weinmann, H. P. UNTERSUCHUNGEN MIT MARKIERTEN AMINOSÄUREN ZUM PROTEINSTOFFWECHSEL NORMALER UND LETALER GENOTYPEN VON Drosophila melanogaster. (Investigations with labelled amino acids of the protein metabolism of normal and lethal genotypes of Drosophila melanogaster). Z. vergl. Physiol. 48, 4 (1964) 429-61. (In German, with English summary)

Valine-^{14}C and glutamic acid-^{14}C, both uniformly labelled, giving a specific activity of ~5 mCi/mM, were injected into larvae and adults of wild-type D. melanogaster. The total amount of radioactivity after glutamic acid-^{14}C decreased more quickly than after valine-^{14}C, a difference due to a higher rate of respiratory decomposition of glutamic acid. Incorporation speed of the injected valine-^{14}C into the proteins was assessed by measuring the distribution of radioactivity on one-dimensional chromatograms, and the significance with protein synthesis is discussed. Injected animals were dissected and the distribution of radioactivity among some organs was established. Radioactivity was incorporated into the ovary from injected homogenized larval fat body and partly also from implanted whole pieces of fat body. After injecting hot amino acid into a larva, marking of the ovary could be slowed down by injection of the cold amino acid. The speed of protein synthesis was tested in normal larvae and homozygotes for the factors letal-translucida (ltr) or letal-meander (lme). Both homozygotes showed a clearly diminished speed of incorporation. Simultaneous injection of valine-^{14}C and a hydrolysate of casein does not accelerate incorporation of valine into the proteins of lme-larvae. The slowed synthesis of proteins in the mutants is evidently not a direct consequency of a deficiency of amino acids. Respiration experiments show that both lethal larvae (ltr/ltr and lme/lme) decompose valine more slowly that they do glutamic acid. Although the overall respiration rate (mm^3O_2/mg fresh wt.) of the larvae is not diminished, they decompose valine much more slowly than do ltr larvae of normal individuals.

110 Winteringham, F. P. W., Disney, R. W. A RADIOMETRIC STUDY OF CHOLINESTERASE AND ITS INHIBITION. Biochem. J. 91 (1964) 506-14.

A simple radiometric method has been developed for the micro-estimation of acetylcholinesterase activity over a wide range of substrate concentrations (100-0.01 mM). Enzyme and [carboxy-^{14}C] acetylcholine as substrate were incubated for the required time. Enzyme action was halted by the addition of acid and excess of inhibitor to a small sample which was then allowed to dry. Free [^{14}C]acetate was thus completely volatile whereas the ^{14}C-labelled substrate was not. Reference assays in which the enzyme was absent or inactivated were made simultaneously.

The difference in residual ^{14}C activity measured by a suitable counter therefore represents enzymic hydrolysis of the substrate. The method has been used for studying the properties and inhibition of cholinesterase in adult housefly head and mammalian blood preparations. The enzymic activity-substrate concentration relationships of both preparations were in good agreement with those predicted on the basis of Michaelis-Menten theory as modified by Haldane to take into account inhibition by excess of substrate. The effects of sample dilution and changing substrate concentration on the apparent inhibition by an insecticidal carbamate were similar to those predicted on the basis of competitive reversible inhibition. Under certain kinetic conditions these effects are consistent with the carbamate behaving as a poor but competitive substrate, inhibition being due to carbamoylation of the enzyme as suggested by earlier workers. There is evidence that cholinesterase inhibition by insecticidal carbamates may, have been significantly underestimated in earlier studies.

See also:

15 The distribution of sex-linked recessive lethals induced in Drosophila males by tritiated deoxycytidine. (Kaplan, W.D. et al., 1965)

16 The effect of tritiated thymidine and gamma irradiation on the mortality of adult Drosophila melanogaster. (Kent, E., 1965)

17 The effect of tritiated thymidine and gamma irradiation on the mortality of Drosophila melanogaster larvae. (Kent, E., 1964)

18 The effect of tritiated thymidine and gamma irradiation on the mortality of Drosophila melanogaster larvae. (Kent, E., 1964)

37 Données biochimiques et histochimiques sur l'incorporation du sulfate de sodium radioactif, chez Gryllus bimaculatus de Geer (Insecte, Orthoptère). (Martoja, R., 1964)

49 Polysaccharide and glycoprotein formation in the cockroach II. Incorporation of D-glucose-^{14}C into bound carbohydrate. (Lipke, H. et al., 1965)

123 Les "puffs" des chromosomes géants révèlent l'activité de genes que déclenchent une hormone. (Dajoz, R., 1964)

124 Synthetic activities during spermatogenesis in the locust. (Das, N.K. et al., 1965)

136 Meetings. Insect biochemistry. (Levenbook, L., 1965)

139 Cytochemical investigation of silk glands in Antheraea pernyi. (Makarov, P.V., 1965)

142 Protein synthesis in silk glands. VI. RNA metabolism in fifth instar larvae. (Miura, Y., 1965)

151 Fibroin synthesis in posterior silk glands. VI. Metabolic changes in RNA during the fifth instar. (Ogoshi, S., 1965)

154 Glycine-specific transfer ribonucleic acid (t-RNA) on the posterior silk gland of Bombyx mori. (Onodera, K., Komano, T., 1964)

166 On the action of ribonuclease in salivary gland cells of Drosophila. (Ritossa, F.M. et al., 1965)

168 Recent autoradiographic observations on the incorporation of labeled precursors of nucleic acids and proteins in the fatty bodies of Musca domestica. (Russo-Caia, S., 1964)

172 Effect of ecdysone on nucleic of epidermal cells of Calliphora larvae in vitro. (Sekeris, C.E. et al., 1965)

173 The action of ecdysone on nucleic acid metabolism in insects. (Sekeris, C.E. et al., 1965)

174 The mechanism of action of hormones. V. The effect of ecdysone on RNA metabolism in the epidermis of the blowfly, Calliphora erythrocephala. (Sekeris, C.E. et al., 1965)

176 The ribonucleic acid from the silk gland of the silkworm and the amino acid code. (Szafrański, P. et al., 1964)

179 Synthesis and transfer of DNA, RNA, and protein during vitellogenesis in Rhodnius prolixus (Hemiptera). (Vanderberg, J.P., 1964)

191 Incorporation of N-methylaminoethanol and N-dimethylaminoethanol into the phospholipids of the house fly, Musca domestica. (Bridges, R.G., Ricketts, J., 1965)

226 Studies in D-serine and D-2,3-diaminipropionic acid in Bombyx mori. (Corrigan, J.J., 1965)

235 Carbohydrate-amino acid conversions during cuticle synthesis in Periplaneta americana. (Lipke, H. et al., 1965)

236 Molt and intermolt activities in the epidermal cells of an insect. (Locke, M. et al., 1965)

239 Autoradiographic investigations on the function of the egg follicles and the nurse cells during yolk formation and protein synthesis in the fly ovary. (Bier, K., 1963)

242 Analytical and histological study of the head and thorax glands in the honeybee Apis mellifica. (Hanser, G., Rembold, H., 1965)

233 Neurosecretory control of ovarian development in the desert locust. (Highnam, K.C., 1961)

245 Neurosecretory control of ovarian development in the desert locust. (Highnam, K.C., 1962)

246 Intermediary metabolism and the insect fat body. (Kilby, B.A., 1965)

254 The metabolism of acetylcholine in the intact central nervous system of an insect (Periplaneta americana). (Treherne, J.E., Smith, D.S., 1965)

260 Metabolism of choline in Periplaneta americana. (Kumar, S.S., Hodgson, E., 1964)

265 The endocrine control of adult reproductive diapause in the chrysomelid beetle, Galeruca tanaceti (L.) III. (Siew, Y.C., 1965)

408 The effect of malathion on the catabolism of labelled glucose in Blattella germanica (L.) (Mansingh, A., 1964)

5. Nucleic Acids. Nucleotides

111 Antonov, A.S., Grigor'eva, S.P., Ivanova, P.V., Belozerskiĭ, A.N. NUCLEOTIDE COMPOSITION OF RAPIDLY TAGGED RIBONUCLEIC ACID IN SILK GLAND OF Bombyx mori. Dokl. Akad. Nauk SSSR 154, 1 (1964) 216-9.

Ribonucleic acid (RNA) rapidly acquired the tracer from $Na_2H^{32}PO_4$ fed to the caterpillars of B. mori. This RNA contained the nucleotides in the proportion of (cytidine + guanine)/(adenine + uridine) = 0.65-0.66 in the fibroin and ceresin parts of the gland; this corresponded to the nucleotide proportions in the deoxyribonucleic acid of the gland. Thus, the matrix RNA of the gland had a different nucleotide proportion from that of soluble RNA and ribosomal RNA of this organ. No information about the biochemical paths of synthesis of silk protein could be deduced from this information. (CA 60:1964, 11098b)

112 Arnold, G. AN AUTORADIOGRAPHIC STUDY OF RNA SYNTHESIS IN ISOLATED SALIVARY GLANDS OF Drosophila hydei. I. AUTORADIOGRAPHIC STUDIES. J. Morph. 116, 1 (1965) 65-87.

The dry mass of cellular structures in isolated Drosophila salivary glands was determined by interference microscopy; a correction which compensates for self-absorption of β-particles, and consequent lowered grain counts, is discussed. The correction factors are 12.0 for nucleolus, 5.0 for nucleoplasm and 8.8 for cytoplasm. After 15 s in uridine-^{3}H, label was localized over the nucleolus; after 1 min, nucleoplasm RNA became labelled also. In situ synthesis of some nucleolar RNA is indicated. Comparisons of uridine-^{3}H and cytidine-^{3}H incorporation were made in glands exposed briefly to isotope, followed by transfer to unlabelled nucleoside solutions. The data suggest two RNA fractions in nucleoli. Rapid turnover and higher uridine incorporation characterized one fraction, which resembled RNA of nucleoplasm metabolically. The second nucleolar RNA incorporated less uridine, remained longer in the nucleolus, and resembled cytoplasmic RNA in precursor incorporation pattern. Preincubation in Actinomycin D before uridine-^{3}H labelling resulted in 80% inhibition of RNA synthesis in both nucleolus and nucleoplasm. Longer isotope exposures produced some increase in labelling. Actinomycin treatment delayed appearance of label in cytoplasmic RNA. After HCl extraction of uridine-^{3}H-labelled RNA, some activity, presumed to be incorporated in DNA, remained. This non-extractable label appeared earliest over nucleoli, and subsequently over chromatin. Actinomycin treatment abolished incorporation of non-extractable label into nucleoli. (From auth.)

113 Barth, R.H., Jr., Bunyard, P.P., Hamilton, T.H. RNA METABOLISM IN PUPAE OF THE OAK SILKWORM, Antheraea pernyi: THE EFFECTS OF DIAPAUSE, DEVELOPMENT, AND INJURY. Proc. natn. Acad. Sci. USA 52, 6 (1964) 1572-80.

RNA was extracted from the wing hypodermis and the fat body of the silkworm and fractionated by sucrose gradient centrifugation. Relative rates of synthesis of RNA were determined by labelled

uridine incorporation. In diapausing pupae there were two peaks of ribosomal RNA (16 and 28S) with a large amount of transfer RNA (4-8S). Uridine incorporation was very slight. Dramatic changes in RNA resulted following injury, with large increases in 28S, 16S, and 12S (probably messenger RNA), and in uridine incorporation, indicating rapid synthesis of RNA. In developing pupae the same changes occurred in RNA metabolism, but less profoundly. Injection of actinomycin prior to the isotope blocked incorporation of uridine into RNA in the injured and developing pupae. (CA 62:1965, 10893b)

114 Beermann, W., Pelling, C. ^{3}H-THYMIDIN-MARKIERUNG EINZELNER CHROMATIDEN IN RIESENCHROMOSOMEN. (The labelling of individual chromatids of giant chromosomes with ^{3}H-thymidine). Chromosoma 16, 1 (1965) 1-21. (In German, with English summary)

^{3}H-thymidine was administered to fertilized eggs of Chironomus tentans at the time of oviposition. Larvae hatching from these eggs were raised to the end of the 4th instar when they were dissected and their salivary glands squashed. Good autoradiographs of the giant chromosomes were obtained after two years' exposure. Three principal patterns of labelling were observed: 1) "single-strand labelling", where one or two chromosome pairs/nucleus show one single helical track of silver grains typically running from one end of the chromosome to the other; 2) "two- or four-strand labelling", where all chromosome pairs of a nucleus show two or four densely labelled tracks; and 3) "diffuse strand labelling" where the level of labelling is generally low and the number of labelled strands per chromosome pair seems to be >8. Approximately half the nuclei remained unlabelled. In 9 out of 70 chromosome pairs with single strand labelling the labelled strand begins at one end of the chromosome but ends interstitially. The labelled single strands must be intact mitotic half-chromatids (or their crossover products) which received their label during DNA synthesis early in embryonic development, probably before blastoderm formation. A model of cell lineage involving selection against labelled nuclei accounts for the observed distribution of labelled single strands. The occurrence of 2- and 4-strand labelling points to a smaller number of mitotic divisions preceding the formation of some portions of the salivary glands. The results are in line with the classical concept of polyteny.(From auth. summary)

115 Berlowitz, L. CORRELATION OF GENETIC ACTIVITY, HETEROCHROMATIZATION, AND RNA METABOLISM. Proc. natn. Acad. Sci. U.S.A. 53, 1 (1965) 68-73.

A comparison of RNA synthesis of heterochromatin and euchromatin in larval tissues of the mealy bug was made by determining uridine-^{3}H uptake in testes and wing-bud tissues. Mealy bug heterochromatin was largely discontinued RNA synthesis. (CA 62:1965, 12212b)

116 Bier, K. GERICHTETER RIBONUKLEINSÄURETRANSPORT DURCH DAS CYTOPLASMA. (Directed RNA transfer through the cytoplasm). Naturwissenschaften 51, 17 (1964) 418. (In German)

The oocyte nucleus does not take part in RNA synthesis in Musca domestica and Calliphora erythrocephala. Results obtained with double injections of tritiated RNA-precursors at 20-30 min intervals and an incubation period of 40-60 min indicated a directed RNA transfer from the nurse cells to the oocyte. RNA synthesized in the polyploid nuclei of nurse cells reaches the oocyte via intercellular cytoplasmic bridges, the fusomes. ^{3}H-labelled uridine and cytidine were used.

117 Bier, K. ÜBER DEN TRANSPORT ZELLEIGENER MAKROMOLEKÜLE DURCH DIE KERNMEMBRAN. I. RNS-SYNTHESE AND RNS-TRANSPORT UNTER SAUERSTOFFMANGEL UND BEI HERABGESETZTER TEMPERATUR. (Study on the transport of macromolecules of the cell across the nuclear membrane. I. RNA synthesis and transfer under conditions of oxygen deficiency or reduced temperature). Chromosoma 16, 1 (1965) 58-69. (In German, with English summary)

The effect of O_2-deprivation and temperature reduction on the incorporation of RNA precursors, ^{3}H-uridine and ^{3}H-cytidine, was investigated in various larval tissues and in adult ovaries of Musca domestica L. Whereas RNA synthesis in most tissues was markedly reduced under anaerobic conditions, moderate synthesis continued in muscle cell and nurse cell nuclei. RNA macromolecules (mRNA and rRNA), however, do not migrate into the cytoplasm. RNA synthesis within the cell nucleus was affected to a lesser degree by a sudden reduction temperature than the passage of RNA through the nuclear membrane, which dropped to a very low level. Macromolecular RNA does not, therefore, diffuse into the cytoplasm but is transported actively through the nuclear membrane. The malformations caused by anaerobiosis during embryogenesis are linked with active RNA transfer through the nuclear membrane and a disruption in the transfer and synthesis sequence.

118 Bier, K. DIE KERN-PLASMA-RELATION UND DAS RIESENWACHSTUM DER EIZELLEN. (The nucleus-plasma relationship and its bearings on the giant growth of the egg cell). Zool. Anz., Suppl. 27 (1964) 84-91. (In German)

Oocyte nuclei which are in meiotic prophase remain tetraploid up to the end of the growth period. The volumes of such egg cells exceed those of cells in a similar nuclear phase by a factor of 10 000 or 100 000. To a considerable extent, this increase is due to an increase in protein content, partly in the ooplasm, partly as yolk proteins. Protein synthesis takes place only in the presence of RNA. Oocyte nuclei should therefore be foci of extreme RNA synthesis. This did not, however, prove to be the case. Polytrophic ovaries (Panorpa communis) showed only very slight RNA synthesis with ^{3}H-uridine, and this absence of synthesis was even more pronounced in Calliphora erythrocephala, Musca domestica and Drosophila. The same was shown by the author to be true of the telotrophic type of ovary (Oncopeltus fasciatus (Dallas)). During its growth period the oocyte nucleus therefore synthesizes insufficient or no RNA. The oocyte grows very slowly initially, and the proteins are used up even more slowly. The oocyte synthesizes some protein from RNA synthesized by other cell nuclei, and the oocyte grows by taking up protein molecules from other cells. The tremendous increase in volume cannot be explained on the basis of the RNA metabolism of the oocyte.

119 Birnstiel, M.L., Sirlin, J.L., Jacob, J. NUCLEOLUS: A SITE OF TRANSFER RIBONUCLEIC ACID SYNTHESIS. Biochem. J. 94, 1 (1965) 10P-11P.

Nucleolar RNA from the salivary glands of Smittia was labelled with uridine-^{14}C in the presence of 5,6-dichloro-1-(β-D-ribofuranosyl)benzimidazole (I) and the 4, 5, 6-trichloro derivative (II). If the glands were incubated in the absence of the I and II, both the nucleolus and chromosomes were heavily labelled and the cytoplasm only slightly labelled. The labelled RNA was heterogeneous, including fractions >28S and fractions between 8S and 28S. Inclusion of I and II (which inhibit chromosomal and cytoplasmic RNA synthesis) gave a small amount of labelled 28S RNA and a high concentration of labelled RNA with the sedimentation characteristics of transfer RNA. Transmethylation in the presence of methionine-methyl-^{14}C and puromycin as the inhibitor of protein synthesis showed that incorporation into the cytoplasm was 4-fold that of the nucleolus. The cytoplasmic label was unaffected by RNase, while 87% of the nucleolar activity could be removed by the enzyme. Transmethylation was confined to 4S RNA. Transfer RNA was apparently a product of nucleolar RNA synthesis. (CA 62:1965, 16546d)

120 Bowers, B., Williams, C.M. PHYSIOLOGY OF INSECT DIAPAUSE. XIII. DNA (DEOXYRIBONULEIC ACID) SYNTHESIS DURING THE METAMORPHOSIS OF THE CECROPIA SILKWORM. Biol. Bull. 126, 2 (1964) 205-19.

DNA synthesis at stages in the life-cycle of the cecropia (Hyalophora cecropia) and Samia cynthia was examined by radioautographic survey of the incorporation of ^{3}H-thymidine. In sections of pupae previously injected with ^{3}H-thymidine, incorporation of the nucleotide into DNA, as well as cell division, was observed in several tissues as late as one week after pupation. In diapausing pupae, incorporation of tymidine occurred in spermatogonia, haemocytes, a few midgut regenerative cells, and a few cells of the testicular walls. Neither incorporation nor mitotic figures were observed in diapausing epidermal tissues. Large epidermal injury increased DNA synthesis in the blood cells of diapausing pupae and induced incorporation in a few epidermal cells in the immediate vicinity of the wound. Epidermal cells outside the wound periphery did not incorporate thymidine after injury. A generalized incorporation of thymidine was observed in synchrony with the termination of pupal diapause. The first cells to show increased incorporation were the regenerative cells of the midgut, followed by cells of the epidermis, muscles, nerves, tracheoblasts, and, ultimately, the fat body. The incorporation in the epidermis precedes and then accompanies the extensive cell division associated with adult differentiation. Lack of DNA synthesis in the epidermal tissues of injured diapausing pupae appears to be the first biochemical or metabolic criterion so far recognized that permits one to distinguish between an injured pupa and a developing adult. (CA 61:1964, 6101h)

121 Cannon, G.B. PUFF DEVELOPMENT AND DNA SYNTHESIS IN Sciara SALIVARY GLAND CHROMOSOMES IN TISSUE CULTURE. J. cell. comp. Physiol. 65, 2 (1965) 163-81.

The salivary glands of S. coprophila were cultured for 24 h in a chemically defined medium. Chromosome development with puff formation and condensation occurred. DNA synthesis proceeded in normal fashion in six different stages in the 4th larval instar as shown by incorporation of ^{3}H-thymidine.

122 Clever, U. PUFFING CHANGES IN INCUBATED AND IN ECDYSONE TREATED Chironomus tentans SALIVARY GLANDS. Chromosoma 17, 4 (1965) 309-22.

Incubation of salivary glands of last instar C. tentans in a variety of media led to more or less drastic changes in puffing patterns. Degree and pattern of these changes varied with concentration and composition of the media. In most of the media tested ecdysone had the same effects as in vivo, i.e. it induced puffs I-18-C and IV-2-B. Among the media tested was a 0.6% NaCl solution which did not contain any K ions. An addition of K ions did not influence the result. After incubations for longer periods (>20 h) the chromosomes lost their ability to respond to ecdysone though they still incorporated ^{3}H-uridine in a normal fashion. Ecdysone does not appear to influence puffing via a change in intracellular K^+/Na^+ ratio.

123 Dajoz, R. LES "PUFFS" DES CHROMOSOMES GEANTS REVELENT L'ACTIVITE DE GENES QUE DECLENCHENT UNE HORMONE. Nature, Paris 3350 (1964) 218-25.

Revue. Une interprétation biochimique, génétique, et endocrinologique est proposée, basée sur les données obtenues surtout sur les insectes. L'auteur considère le rapport entre les "puffs" des chromosomes géants avec l'action de l'enzyme ecdysone. On cite dans le texte des travaux utilisant des radioisotopes sans pourtant fournissant des références entières.

124 Das, N.K., Siegel, [illegible], Alfert, M. SYNTHETIC ACTIVITIES DURING SPERMATOGENESIS IN THE LOCUST. J. Cell Biol. 25, 2(1965) 387-95.

In isolated testes of the locust Schistocerca gregaria, DNA synthesis is completed prior to initiation of meiosis. Protein synthesis continues throughout the whole meiotic cycle as well as during spermatid development. All spermatocytes, except those in 1st or 2nd metaphase, anaphase, and early telophase are labelled after exposure to uridine-^{3}H (I) for 3-30 min or to cytidine-^{3}H (II) for 1-2 h. Nucleolar labelling is detected only after exposure of the emulsion for a relatively longer time. In tubules exposed to I or II for 3-120 min, early spermatid nuclei are found to be labelled. The condensing and elongating spermatids are inactive with respect to uptake of RNA precursors. Depression of RNA synthesis, however, is not always accompanied by cytologically detectable condensation of chromatin, since very little or no RNA is synthesized in spermatids in which chromatin condensation has barely begun. Protein synthesis decreases slightly in metaphase, anaphase, and early telophase. In the absence of new RNA synthesis, protein synthesis continues at a reduced rate, as the developments of spermatids progress. Almost all of the RNA synthesized in meiotic nuclei, in contrast to mitotic nuclei, generally is of chromosomal origin. (CA 63:1965, 6060 gh)

125(2) Gay, H. Carnegie Inst. Washington Yr Book 62 (1963) 503-11.

Puffing phenomena in giant chromosomes of dipteran salivary glands are discussed and pulse labelling.

126 Gay, H. NEW EVIDENCE ON CHROMOSOME STRUCTURE AND FUNCTION. Science, N.Y. 146 (1964) 425.

"Pulse-labelling" revealed integrated functional responses of numerous "paired" chromonematic strands in salivary-gland chromosomes of Drosophila melanogaster. Incorporation of ^{3}H-thymidine was initiated at some of the many sites along the chromosomes but was similar in the two homologues. In hybrids of D. melanogaster and D. simulans occasional differences in pattern of incorporation are detectable in "homologues", which reveal functional as well as structural differences at the chromosomal level. With respect to RNA synthesis, a 30-s pulse with ^{3}H-uridine produced labelling throughout the length of the chromosomes, as if all gene loci were actively engaged in synthesis.

127 Grell, R.F., Chandley, A.C. EVIDENCE BEARING ON THE COINCIDENCE OF EXCHANGE AND DNA REPLICATION IN THE OOCYTE OF Drosophila melanogaster. Proc. natn. Acad. Sci. U.S.A. 53, 6 (1965) 1340-46.

Incorporation of thymidine-^{3}H was used as a cytological marker for the replication time of DNA, and increase in crossing-over induced by elevated temperature as a genetic marker in D. melanogaster oocytes. The interval between the occurrence of the two processes and the mature oocyte averaged 8-9 d. Both events occurred roughly at the same time, in the early 16-cell cysts located mainly in the middle germarium, and perhaps in the final firemeiotic interphase stage. (CA 63:1965, 8788g)

128 Grell, R.F., Chandley, A.C. CORRESPONDENCE BETWEEN THE TIMES OF DNA REPLICATION AND CROSSING-OVER IN THE OOCYTE OF Drosophila melanogaster. p.62 of "Biology Division Semiannual Progress Report for the Period Ending February 15, 1965". ORNL-3768, Oak Ridge National Lab., Tenn. May 1965, 205p.

When ^{3}H-thymidine is injected into females, it is incorporated into the DNA of the oocyte at the time of the last replication and remains undiluted by further replication. The results indicate that DNA replication and crossing-over are roughly coincident and suggest that both processes occur in the early 16-cell cyst in a stage which may correspond to the last premeiotic interphase.

129 Henderson, S.A. RNA SYNTHESIS DURING MALE MEIOSIS AND SPERMIOGENESIS. Chromosoma 15, 4 (1964) 345-66.

Using ^{3}H-uridine, the course of RNA synthesis has been followed autoradiographically during all stages of male meiosis and spermiogenesis in the locusts Schistocerca gregaria and Cyrtacanthacris tartarica and the grasshopper Chorthippus brunneus. Using ^{3}H-thymidine, premeiotic DNA synthesis was followed in C. tartarica. RNA synthesis is actively carried out by all autosomes throughout first meiotic prophase, up to and including diakinesis, and at second prophase. No RNA synthesis occurs at the contracted stages of first or second metaphase or first or second anaphase. RNA is again synthesized by young spermatids, but such synthesis ceases by the time that differentiation begins. No label was detected in the nuclei of differentiating spermatids, even after 8 h incubation with ^{3}H-uridine. Morphological and functional comparisons suggest that orthopteran prophase chromosomes at male meiosis, and proably all prophase chromosomes, are lampbrush in nature, though to varying degrees. The X univalent, allocyclic in its appearance and staining properties, is apparently completely inactive throughout the whole of meiosis. No RNA or DNA precursor could be successfully demonstrated to be incorporated by the X at any stage of male meiosis. Nucleoli are present at interphase and early prophase but are usually absent during later prophase stages in this material. They do not label heavily in advance of or at the same time as, the commencement of the labelling of the rest of the chromatin: they only accumulate greater densities of label after several hours' incubation with the labelled precursor. No independent cytoplasmic synthesis of RNA could be detected after up to 2 h in vitro incubation in labelled saline at 30°C, though nuclei are heavily labelled after only ½ h. It is some 2-4 h before nuclear synthesized RNA appears to pass to the cytoplasm in detectable amounts. (Auth. summary)

II/320 Hosoda, J., Shigematsu, H., Mizuno, S., Takahashi, H., Maruo, B. RIBONUCLEIC ACID METABOLISM IN THE POSTERIOR SILKGLAND OF SILKWORM, Bombyx mori, DURING THE FIFTH INSTAR. Biochim. biophys. Acta 72 (1963) 544-54*

RNA metabolism in the posterior silkgland of the silkworm, B.mori L.during the 5th instar has been studied. The base composition of the bulk RNA did not change significantly during the instar. ^{32}P-pulse labelling during the earlier stage of the instar indicated the synthesis of a rapidly turning-over RNA having a base composition different from that of ribosomal RNA and resembling that of DNA. Sedimentation analysis of RNA at this stage revealed the presence of components having different sedimentation constants from those of the ribosomal and s-RNA. At a later stage of the instar, there was no evidence for the occurrence of a rapidly turning-over RNA having a base composition different from that of ribosomal RNA. The role of RNA in silk fibroin synthesis is discussed. (Auth.)

* Cited by title (Previews) only in Vol.II.

130 Jacob, J., Sirlin, J.L. SYNTHESIS OF RNA (RIBONUCLEIC ACID) IN VITRO STIMULATED IN DIPTERAN SALIVARY GLANDS BY 1,1,3-TRICYANO-2-AMINO-1-PROPENE. Science, N.Y. 144 (1964) 1011-12.

The uptake of ^{3}H-uridine (and to somewhat lesser extent guanosine) by cells from larval salivary glands of Smittia parthenogenetica was considerably enhanced in the presence of 1,1,3-tricyano-2-amino-1-propene and this uptake was not suppressed by Actinomycin D or dichlororibofuranosyl-benzimidazole, substances which suppress RNA and deoxyribonuleic acids, respectively. The enhanced uptake appeared in RNA in the nucleolus. (CA 61:1964, 3461b)

131 Kullyev, P. CONTENT OF NUCLEIC ACIDS IN SILK GLANDS OF SILKWORM VARIETIES DIFFERING BY THEIR PRODUCTIVITY. Izv. Akad. Nauk turkmen. SSR, Ser. Biol. 1 (1965) 70-74. (In Russian)

The relation was followed between the silk gland size, its nucleic acid content, and silk productivity in three silkworm (Bombyx mori) varieties. During the last larval instar the silk gland weight increased 5-17-fold without changes in the cell number. The concentration of DNA decreased, but its amount per cell increased. Labelled thymidine incorporated intensively into DNA of the silk glands. The glands contained a high concentration of RNA and its amount per cell increased during the last instar. A linear dependence was found between the amount of RNA per cell and silk productivity. (CA 63:1965, 2160f)

132 Kullyev, P., Zbarskiĭ, I.B., Ramenskaya, G.P., Samarina, O.P. RNA (RIBONUCLEIC ACID) BIOSYNTHESIS IN THE SILK GLAND OF THE SILKWORM. Biokhimiya 29, 3 (1964) 470-76. (In Russian). English Translation: Biochemistry 29, 3 (1964) 407-12.

Intensive synthesis of RNA takes place only in the 1st half of the 5th instar and is accomplished substantially before the beginning of the synthesis of active fibroin. RNA remains comparatively stable in the period of active fibroin synthesis; slight incorporation of adenine is evidently not related to the synthesis of new molecules on the RNA template and can be explained better by the exchange of end nucleotides of soluble RNA and a non-specific radioactivity background. Investigation of adenine-^{14}C incorporation by radiography showed that primary incorporation in the period of RNA synthesis takes place in nucleus structures, where evidently the RNA synthesis is localized. Fractionation of the gland by heat processing with phenol yielded fractions with higher metabolic activities. Contrary to mammalian tissues, specific activity of these fractions kept increasing for a long time. ^{32}P in the form of $Na_2H^{32}PO_4$ and adenine-8-^{14}C, with specific activity 5 mCi/mg, were introduced into silkworms in vivo, or were incubated with gland in vitro. Adenine-8-^{14}C in doses from 0.3 to 3 mCi/g was used in the autoradiographic part of the work. (Ca 61:1964, 6095a)

133 Lara, F.J.S., Lopes, C.R., Foresti, L. SEDIMENTATION CHARACTERISTICS OF RAPIDLY LABELED RNA FROM THE SALIVARY GLAND CELLS OF Rhynchosciara angelae. Life Sci. 4, 5 (1965) 579-82.

Sedimentation studies of RNA from salivary glands of R. angelae larvae show four distinct absorption peaks corresponding to particles with sedimentation constants of 45S, 28S, 16S, and 4S. The incorporation of uridine-^3H into RNA in vivo was greatest in the heavier fractions; this incorporation was inhibited by pretreatment with actinomycin D. (CA 63:1965, 2034c)

134 Leach, W.M. SOME FACTORS INFLUENCING THE UTILIZATION OF TRITIATED THYMIDINE IN GRASSHOPPER EMBRYOS. Diss. Abstr. 26 (1965) 1232.

The following were examined in neuroblasts of the grasshopper Chortophaga viridifasciata (De Geer) (1) the thymidine "pool" during mitosis, (2) the effects of excess unlabelled thymidine and of 5-fluorodeoxyuridine (FUdR) on the "pool" and (3) the effects of unlabelled thymidine and FUdR on mitosis. For exposure of neuroblasts, dissected embryos were placed in culture medium containing ^3H-thymidine (^3HTdR), ^3H-uridine (^3HU), unlabelled thymidine, FUdR, or combinations of these compounds. Neuroblasts were examined in hanging drop cultures with bright field microscopy. Uptake of radioactivity was assayed either with autoradiograms or with a windowless Geiger tube gas flow counter. Retention of ^3HTdR and its derivatives, other than DNA, was less in neuroblasts exposed during prometaphase and metaphase than during prophase or early telophase. No dilution of intracellularly retained ^3HTdR was produced by exposure to excess unlabelled thymidine with the experimental conditions employed. Conversion of ^3HU derivatives to precursors utilized in the synthesis of an RNase resistant material is reduced by the presence of FUdR. The reduction of cold acid soluble ^3HTdR in the presence of FUdR may be ascribed to the proportionally greater intracellular availability of ^3HTdR than of the thymidine derivatives synthesized in vivo. Incorporation of ^3HTdR into DNA, however, is nearly negligible in the presence of FUdR. Both excess thymidine and FUdR affect the neuroblast cell cycle during DNA synthesis. Incorporation of ^3HTdR into DNA is negligible in neuroblasts blocked in middle telophase. The mitotic ratio of neuroblasts exposed continuously to FUdR is reduced by about 4 h of exposure. Continuous exposure to FUdR either blocks or retards neuroblasts in a stage which appears to be interphase. Posttreatment with thymidine does not restore the normal mitotic rate. Nucleoli in neuroblasts exposed to either excess

thymidine or FUdR remain prominent and refractile for long periods of time. In FUdR-treated neuroblasts nucleoli persist into midmitosis.

135 Leach, W.M. RETENTION OF TRITIATED THYMIDINE IN GRASSHOPPER NEUROBLASTS. Expl Cell Res. 35, 1 (1964) 201-4.

In order to determine whether ^{3}H-thymidine is retained in the neuroblasts during a period of no DNA synthesis embryos (~ 13-to 14-d-old) of Chortophaga viridifasciata (De Geer) were incubated at 26°C in culture medium containing ^{3}H-thymidine at 1-10 µCi/ml. It was found that ^{3}H-thymidine which enters cells during a period of no DNA synthesis may be incorporated into DNA during a subsequent period of DNA synthesis. Solutions containing excess unlabelled thymidine proved ineffective in removing all incorporated ^{3}H-thymidine derivatives from neuroblasts.

136 Levenbook, L. MEETINGS. INSECT BIOCHEMISTRY. Science, N.Y. 150 (1965) 643-4.

The symposium on "Insect Biochemistry, Chiba, Japan, 20 Jun.-3 Jul.1965" was reviewed by Levenbook who also presented a paper. The following comments are taken from his report, and refer to papers relevant to this bibliography.
(a) Miura, Y. discussed the incorporation of ^{14}C-orotate into silk gland cellular particulates. The pattern of labelling depended upon the age of the 5th stage larvae, nuclear RNA being most radioactive at earlier periods. In more mature larvae three types of labelled RNA-low-molecular-weight, ribosomal, and DNA-like-were obtained from large (14 000 g) subcellular particles. The DNA-like RNA, which was isolated in fibrous form, had a low turnover of ^{14}C-orotate.
(b) Shigematsu, H. also considered a DNA-like RNA synthesized by the silk gland in the early 5th instar. However, in his experiments with ^{32}P neither this nor any other RNA fraction had the properties of true messenger RNA. Employing fibroin antibody as a specific test for fibroin, Shigematsu found fibroin synthesized in vitro to be predominantly in the microsomal and soluble fractions. He also reported that blood concentrations of glycine and tyrosine, but not serine or alanine, could regulate the rate of fibroin formation in vivo.
(c) Levenbook, L. described the profiles of individual free amino acids throughout metamorphosis of the blowfly Phormia regina. The analytical picture was supplemented by kinetic data on the rates of oxidation, turnover, and incorporation into protein of labelled alanine and lysine during metamorphosis. The turnover and oxidation of alanine were much more rapid than those of lysine, but the two amino acids were incorporated into protein at about the same rate during metamorphosis.
(d) Corrigan, J.J. considered the occurrence of free D-amino acids in various insects. Young larvae of Bombyx mori contain little or no D-serine. However, at the time of spinning or in the pupa, D-serine, which occurs in most Lepidoptera, accounts for 15-70% of the total. The derivation of the blood D-enantiomorph from D(-)-2,3-diamino propionic acid (DAPA), isolated from silkworm digestive fluid by S.Wada and T. Toyota, was considered a most likely possibility. Preliminary experiments suggested that DAPA itself might be formed from glucose.
(e) Hirano, C. and Tojo, S. presented some recent studies on the distribution and metabolism of an insect purine. In the diapausing rice stem borer (Chilo suppressalis), urate, located primarily in the fat body, was synthesized very slowly; the rate increased markedly in the postdiapause period of development as measured by the degree of incorporation of ^{14}C-glycine into uric acid. In both C. suppressalis and B. mori labelled guanine and alanine were converted to uric acid, and a marked transport of the purine into the developing pupal ovary of B. mori was observed.
(f) Clayton, R.B., working in the field of insect steroids employed the roach Eurycotis floridana as the experimental subject. The roach was raised aseptically on a doubly labelled diet (^{3}H-cholestanol and ^{14}C-cholesterol); analyses for labelled cholesterol, cholestanol, and Δ^{7}-cholestanol revealed three types of functional spaces of different structural specificity among the insect tissues. Together with studies on sterol distribution in subcellular fraction of individual tissues, the data supported the idea of a tissue-specific recurring, repeating structural unit common to all subcellular membranes.
(g) Ikekawa, N. and Saito-Suzuki, M. applied modern analytical techniques to the silkworm. Throughout development the major steroid component is cholesterol, followed by β-sitosterol and campesterol. Larvae were much more active than pupae in converting ^{3}H-β-sitosterol to cholesterol, while esterification of injected ^{14}C-cholesterol was considerably depressed in brainless "dauer" pupae as compared with normal pupae.
(h) Chefurka, W. discussed the difficulties and pitfalls in evaluating the relative importance of the pentose shunt and glycolytic pathways of glucose catabolism in insects. The extent to which

glucose was catabolized by these alternative routes was influenced by numerous variables, for example, site of injection of labelled glucose, sex, species, stage of development, and O_2 tension.

137 Lu, C.-H., Ku, C.-J., Wang, P.-Y., Chu, Y.-S. METABOLISM OF RIBONUCLEIC ACID (RNA) IN THE SILK GLAND OF Samia ricini. K'o Hsueh T'ung Pao (Scientia) 4 (1964) 340-2. (In Chinese)

^{32}P (5 μCi) was injected into the back of the 5th-stage silkworm. Silk glands were isolated at 0.5, 1, and 2 h after injection, macerated, and centrifuged; the supernatant was then extracted with 90% aqueous PhOH to give phenol-soluble RNA (I). In the aqueous phase, RNA soluble in Et_2O-2M NaCl was called low-mol.wt. RNA (II), and the precipitate was high-mol.wt. RNA (III). Radioactivity in RNA was highest in II, lowest in I. Total RNA-P (mg/gland) from the 1st- to 6th-d was: 39.02, 162.00, 400.64, 711.00, 378.84, and 271.74. The percent of I increased, III decreased, and II stayed constant during the 3rd-to 6th-d. Base composition in RNA as determined by electrophoresis and paper chromatography showed both II and III to be standard G-C types, with (guanine + cytosine)/(adenine + uracil) ratio 1.51 and 1.31, respectively. But I has a base ratio of 1.08, and that of silk gland is 0.64. The activity of RNA was determined by radioactivity measurement after incubating glands in Robinson medium containing glycine-^{14}C at 30° for 60 min and interrupting the reaction with 0.7N $HClO_4$. I had a distinct effect in protein formation, II was slightly active, and III was inactive. I and II together were more active than each alone, and the combination of all three was more effective than I and II. The sensitivity of gland to ribonuclease was variable, but less sensitive in later developing stages. The presence of I in silk-protein formation is essential, I is probably the RNA in the chromosome. (CA 61:1964, 13666b)

138 Lu, C.-H., Ku, C.-J., Wang, P.-Y., Chu, Y.-S. RIBONUCLEIC ACID IN THE SILK GLAND OF SILKWORM (Attacus ricini). Shih Yen Sheng Wu Hsueh Pao (Acta Biol. exp.sin.) 9, 3 (1964) 300-10. (In Chinese)

A. ricini at 5th instar were employed. $Na_2H^{32}PO_4$ was introduced into the body cavity. Various types of RNA of the posterior silk gland were isolated with phenol and Na dodecyl sulphate, and their specific radioactivities were measured. The nucleotide compositions of RNA and DNA were analysed by paper electrophoresis and column chromatography. When the effect of RNA was studied, RNA was added to Robinson's buffered medium in which the silk glands were incubated in the presence of glycine-^{14}C and the incorporation rate into silk protein was compared with that in the absence of added RNA. There were found three types of RNA in the posterior silk glands: high-mol.wt. RNA (H-RNA), low-mol.wt. RNA (L-RNA), and phenol not-liberated RNA (P-RNA). The relative amount of each varied with growth of the silk gland. At the first few days of 5th instar H-RNA was the most abundant but decreased abruptly after 4th day. L-RNA changed slightly in percentage, while P-RNA was the least in amount at beginning, then increased with growth of the worm and finally almost dominated at the later stage, when fibroin synthesis became the most active. When ^{32}P was injected, it incorporated into RNA with highest efficiency at 4th day of 5th instar. P-RNA appeared the most metabolically active. After 4th day of the 5th instar, total RNA in the silk gland was rapidly decreased and the incorporation of ^{32}P was also reduced. L-RNA and H-RNA are typically guanine-cytosine type, with a (guanine + cytosine)/(adenine + uridine) ratio of 1.51 and 1.81, respectively. However, P-RNA has a different composition which tends to approach that of DNA with decreased guanine and cytosine, and increased adenine and uridine. P-RNA but not H-RNA stimulated fibroin synthesis. Combination of 3 RNAs exerted the highest promoting effect. Incorporation of glycine was reduced to less than 40% of the control after treatment of the silk glands of 4th day with RNase, but with similar treatment of the silk glands of 6th day, the inhibition was only a little more than 10%. The effect of RNase became weaker when P-RNA in the silk gland was higher. Inhibition of fibroin synthesis could be partly reversed by addition of P-RNA or mixture of 3 RNAs. P-RNA may contain some parts of messenger RNA. (CA 62:1965, 6847d)

139 Makarov, P.V. CYTOCHEMICAL INVESTIGATION OF SILK GLANDS IN Antheraea pernyi. Tsitologiya 7, 5 (1965) 616-21. (In Russian)

The silk gland of A. pernyi was studied for the content of nucleic acids, acid and basic proteins, and polysaccharides. Autography was carried out after introduction of thymidine-^{3}H, adenine-^{14}C, glycine-^{14}C, and methionine-^{14}C. The nuclei of silk gland cells were rich in DNA and acid proteins, deficient in histones. The amount of acid proteins increased in the last period of the caterpillar life. Migration of DNA into the cytoplasm was observed only in the presence of the jaundice virus in the cell. The volume of the cells of the silk gland increased at the peak of the synthesis of

fibroin. The amount of RNA in the nuclei increased up to the beginning of the cocoon stage. The cytoplasm was rich in acid proteins and also contained basic proteins, acid mucopolysaccharides, and glycogen. The fibroin contained methionine (contrary to the mulberry silkworm, in whose fibroin no methionine or cystine is found). The silk of A. pernyi contained almost no diamino acids (1%), but was rich in tyrosine, tryptophan, histidine, and SH groups (the mulberry silkworm fibroin does not contain any S-containing amino acids). The synthesis of fibroin from its precursor at the peak of silk secretion was very rapid. The ^{14}C from glycine-^{14}C was detected 30 min after its introduction, not only in the gland cells, but also in the silk (the corresponding time in the mulberry silkworm was 2 h). (CA 64: 1966, 2466f)

140 Mead, C.G. A DEOXYRIBONUCLEIC ACID-ASSOCIATED RIBONUCLEIC ACID FROM Drosophila melanogaster. J. biol. Chem. 239, 2 (1964) 550-4.

A deoxyribonucleic acid-associated ribonucleic acid has been isolated from D. melanogaster. Several of the properties of this RNA are consistent with those postulated for an RNA serving as an intermediate in the transfer of genetic information. The ratio of DNA to RNA in the complex was 2:1 on a molar nucleotide basis. The molar nucleotide composition of the RNA was similar to that of the DNA (equating uridine with thymidine) and distinct from that of the microsomal RNA or soluble RNA. Treatment with ribonuclease, deoxyribonuclease, or heat altered the sedimentation properties of the DNA-RNA complex. The T_m of the DNA, however, was only slightly increased (2°) after removal of the RNA with ribonuclease. The RNA associated with the DNA of 3rd instar larvae was found to be metabolically active as measured by ^{32}P incorporation. When the resulting progeny were to be uniformly labelled with ^{32}P, the phosphoric acid was omitted from the medium and 5-10 μCi of ^{32}P-orthophosphate were added per ml of medium. Two types of RNA, both of which were associated with the DNA of larvae, were distinguished by their relative metabolic stabilities.

141 Michaels, G., Blumberg, B. STUDY ON RNA FROM 80S RIBOSOMES FROM Drosophila virilis LARVAE. J. Cell Biol. 27, 2 (1965) 65A. Abstr. 127. Presented at the "5th Annual Meeting of the American Society for Cell Biology, Philadelphia, 10-12 Nov. 1965".

Ribosomes with $s_{20,w}$ of 80S have been isolated from 3rd instar larvae of D. virilis both by differential centrifugation and by sucrose density gradient separation (SDG); the RNA (rRNA) was extracted by adjusting to 1% sodium dodecyl sulphate, phenol treatment, and ethanol precipitation. The sedimentation profile of the rRNA has been characterized by 15-30% SDG analysis recorded on a Gilford model 2000 automatic recording spectrophotometer, and showed two peaks as expected, the heavier one occurring in larger yields. Determination of the sedimentation coefficient, however, gave unexpected results in terms of the usual ~28S and ~18S obtained as values for the rRNA of other 80S particles. The values have been calculated by simultaneously running ^{32}P-labelled Escherichia coli rRNA and determining the relative placement of the O.D. and the cpm curves. Sedimentation coefficients calculated by this method, assuming the E. coli peaks were 23S and 16S, were 19.5S and 12.5S. The larval findings were corroborated by concurrent runs using rRNA from P. paladium and E. coli; the calculated values were 20.5S and 12S. Base analyses were performed using Dowex-50 resin after the method of Katz and Comb (J. Biol. Chem. 238:1963, 3015), determining the yield spectrophotometrically. Reproducible results on the total RNA from isolated 80S gave 26.6 ± 0.5% U; 23.7 ± 2% G; 25.7 ± 0.5% A; and 20.9 ± 1.4% C. Analysis of the separated peaks has been performed and showed distinct differences in base composition. Comparing the values of the total rRNA with those reported for a variety of other 80S rRNA's (Petermann, The Physical and Chemical Properties of the Ribosomes, 1964, p.106) indicated that the D. virilis had considerably higher A and U and lower G and C. The values were similar, however, to those reported by Mead for D. melanogaster microsomal RNA (J. Biol. Chem. 239:1963, 550). In comparison with the rRNA of 80S RNP particles of other plants and animals, differences have been found here both in the sedimentation coefficient and in the base composition, although the sedimentation coefficients of the parent particles are similar. (From abstr.)

142 Miura, Y., Ito, H., Sunaga, K., Ogoshi, S. PROTEIN SYNTHESIS IN SILK GLANDS. VI. RNA METABOLISM IN FIFTH INSTAR LARVAE. Seikagaku Zasshi (J. Biochem., Tokyo) 58, 3 (1965) 293-99.

When silkworms (Attacus ricini) were fed with ^{14}C-labelled orotate (I) during the early 5th instar stage, or when the posterior silkglands of the silkworm (Bombyx mori) were incubated during the

same stage with I, only the nuclear RNA in the silk glands showed a high radioactivity. In the later 5th-instar stage, a fairly active incorporation was observed in the RNA of large particles, both in vitro and in vivo. The large particles contained three kinds of RNA: low-mol.wt. fibrous, and ribosomal RNA, with the base ratio of the fibrous type being different from the other two. The fibrous RNA was obtained in the fibrous form, and was eluted with saline similarly to DNA from a chromatographic column containing methylated albumin.(CA 63:1965, 16842a)

143 Muckenthaler, F.A. AUTORADIOGRAPHIC STUDY OF NUCLEIC ACID SYNTHESIS DURING SPERMATOGENESIS IN THE GRASSHOPPER, Melanoplus differentialis. Diss. Abstr. 25, 4 (1964) 2673-4.

Both squash preparations and sections were made of testes at measured time intervals after the animals had been injected with ^{3}H-labelled precurcors of the nucleic acids. Rate of incorporation was determined by a study of autoradiograms made with Kodak NTB-2 liquid emulsion. Incorporation of thymidine and adenine into DNA and adenine and uridine into RNA was used to determine the rate and time of synthesis of the nucleic acids. The length of the spermatogonial cell cycle is 28 h; DNA synthesis occupies 12 h of this. These figures are derived from the data on percentages of cells in mitotic metaphase which are labelled at different time intervals after injection of thymidine. A study of thymidine incorporation into cells in the premeiotic and meiotic stages indicates that DNA synthesis immediately prior to meiosis precedes the growth period of the spermatocytes and represents final synthesis of DNA in spermatogenesis. Since the spermatogonial cell cycle is approximately 28 h and the number of divisions is seven, these divisions should take about 8-9d. Meiosis takes 9-10 d and spermiogenesis 10 d as is indicated by labelling of recognizable stages of meiotic division and mature sperm respectively. The total time for the whole of spermatogenesis can then be computed to be approximately 28 d. The labelling pattern indicates that adenine is incorporated into an intermediate precursor of DNA, a low mol.wt. RNA being suggested as the most likely possibility. The synthesis of RNA was studied by comparing autoradiograms of unextracted preparations with those from which the RNA was extracted with ribonuclease. Labelling in the nucleus of the apical cell after adenine and uridine incorporation indicates a high rate of RNA synthesis in this cell. RNA synthesis in the spermatogonial cells occurs during the entire cell cycle except during the time corresponding to the middle stages of division. Considerable RNA synthesis occurs in prophase of meiosis and ceases during diakinesis. Synthesis of RNA then resumes after the second meiotic division and continues for a short time in the early spermatid until condensation of chromatin occurs. It is concluded that RNA synthesis depends on the physical state of the chromosomes since a consistent pattern in different types of cells shows that it occurs at all times except when the chromosomes are in a highly condensed state. (From abstr.)

144 Muckenthaler, F.A. AUTORADIOGRAPHIC STUDY OF NUCLEIC ACID SYNTHESIS DURING SPERMATOGENESIS IN THE GRASSHOPPER, Melanoplus differentialis. Expl Cell Res. 35, 3 (1964) 531-47.

For abstract, see ref. 143

145 Mukherjee, A.B. PATTERN OF DNA SYNTHESIS IN MOSQUITO CHROMOSOMES. Bull. ent. Soc. Am. 11, 3 (1965) 159. Abstr.102. Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov. - 2 Dec.1965".

Fourth instar larvae of Aedes cataphylla Dyar where treated with thymidine-^{3}H (specific activity 1900 mCi/mM) for 2 h. Chromosome preparations were made from brain tissues following 2, 6, and 8 h of treatment. Autoradiographs were made using Kodak NTB$_3$ emulsion. All the three pairs of chromosomes were heavily labelled indicating synchronous replication of chromosomal DNA. 75% of the prophase nuclei were labelled (Abstr.)

146 Mukherjee, A.S., Beermann, W. SYNTHESIS OF RIBONUCLEIC ACID BY THE X-CHROMOSOMES OF Drosophila melanogaster AND THE PROBLEM OF DOSAGE COMPENSATION. Nature, Lond. 207 (1965) 785-6.

Experiments were designed to determine whether RNA synthesis by the X-chromosomes of male and female salivary glands operates at recognizably different levels, and if so, whether it is possible to evaluate the results in terms of repressing effect in females or an enhancing effect in males. For this purpose, short-pulse labelling with ^{3}H-uridine was used. The dissected salivary glands from

the 3rd instar larvae of wild-type D. melanogaster ("Oregon R") were incubated in ^{3}H-uridine (2 μCi) in 10 μl of Drosophila Ringer for 5 min. The usual procedure of staining, squashing, and covering with stripping film, etc. was followed. Only chromosomes with similar puffing patterns were compared. The results showed that at the level of chromosomal RNA synthesis the single X-chromosome in males works with an efficiency close to that of the two X's in females. This suggests that dosage compensation operates at the level of information transfer from DNA to RNA. No conclusion can be drawn as to whether dosage compensation is a phenomenon involving repression or activation, i.e. works in the female or in the male.

147 Nash, D., Plaut, W., ON THE PRESENCE OF DNA IN LARVAL SALIVARY GLAND NUCLEOLI IN Drosophila melanogaster. J. Cell Biol. 27, 3 (1965) 682-6.

Fluorescent dyes and isotopic labelling were used to study nucleolar DNA. Isolated glands of mature 3rd instar larvae were incubated in modified Ringer with ^{3}H-thymidine (6000-16 000 μCi/mM) at a concentration of 5-15 μCi/ml) for 5-25 min. Squashed and fixed preparations were stained with aceto-orcein to facilitate good photographic recording. DNAse and RNAse were used. Nucleolar labelling was observed but the structural relationship between nucleolar DNA and chromosomal DNA is obscure.

148 Nicklas, R.B., Jaqua, R.A. X CHROMOSOME DNA REPLICATION, DEVELOPMENTAL SHIFT FROM SYNCHRONY TO ASYNCHRONY. Science, N.Y. 147, 3661 (1965) 1041-3.

Male grasshoppers (Melanoplus differentialis) were injected with thymidine-^{3}H and the testes were fixed, stained by the Feulgen reaction, squashed, and radioautographs prepared. The X-chromosome was negatively heteropycnotic in early spermatogonial cell generations and positively heteropycnotic in the final premeiotic interphase. Autoradiography showed that this condensation was paralleled by a delay in the time of DNA replication in the X-chromosome relative to that in the autosomes. (CA 62:1965, 13566a)

149 Nigon, V., Gillot, S. L'INCORPORATION DE LA THYMIDINE AU COURS DE L'OVOGENESE ET DU DEVELOPPEMENT EMBRYONNAIRE CHEZ LA DROSOPHILE. Expl Cell Res. 33 (1964) 29-38.

Une première série d'observations a montré que, dans l'ovogenèse de la Drosophile, la thymidine tritiée, fournie par injection, s'incorpore dans l'ADN nucléaire mais aussi dans des structures cytoplasmiques dont les unes sont sensibles à la ribonucléase, tandis que d'autres sont détruites par la désoxyribonucléase. Un jour après l'injection, l'intensité des marquages cytoplasmiques l'emporte largement sur celle des marquages nucléaires. Ces premières observations n'ont pu être retrouvées au cours de nombreuses expériences ultérieures utilisant des thymidines d'origines diverses marquées par le tritium ou par ^{14}C. Dans tous les cas, le marquage se localise essentiellement au niveau de l'ADN nucléaire. Il existe toutefois un certain marquage cytoplasmique qui résiste à l'action des nucléases. Dans les œufs en cours de développement, la thymidine libre s'incorpore dans l'ADN des noyaux en formation. En revanche, les substances cytoplasmiques marquées à la suite de l'injection de thymidine ne semblent pas participer à la synthèse de l'ADN. Diverses hypothèses sont émises pour expliquer la contradiction entre les résultats des deux ensembles d'observations effectuées. L'une des explications les plus vraisemblables se réfère à la possibilité de différences dans la constitution de thymidines tritiées appartenant à des lots différents. (Rés.)

150 Oberlander, H., Berry, S.J., Krishnakumuran, A., Schneiderman, H.A. RNA AND DNA SYNTHESIS DURING ACTIVATION AND SECRETION OF THE PROTHORACIC GLANDS OF SATURNIID MOTHS. J. expl Zool. 159 (1965) 15-31.

The mechanism of activation of the prothoracic glands in larvae and pupae of saturniid moths (Samia cynthia ricini and Antheraea polyphemus) was analysed, and changes examined which occur in the prothoracic glands during the larval-pupal and pupal-adult transformation. ^{3}H-thymidine and ^{3}H-uridine were used, and the techniques of injection (10 μCi/g and 5 or 10 μCi/g of body weight, respectively) and autoradiography are described. The glands in both moths synthesize DNA in the 4th instar, to a lesser extent in the 5th and in prepupae, and not at all in diapausing pupae or developing adults. The prothoracic glands appear to lose their ability to synthesize DNA during the larval-pupal transformation. The prothoracic glands of Samia synthesized RNA at a high rate throughout the 4th larval instar. The rate of synthesis RNA in A. polyphemus in developing adults was several times greater than the rate of RNA synthesis in diapausing pupae. Injection of juvenile

hormone caused a marked increase in the rate of RNA synthesis. Changes in the rate of RNA synthesis were correlated with cytological changes in developing adults and in pupae injected with juvenile hormone extract. Prothoracic gland cells were found in adult Samia. Some of the cells were degenerating while the others appeared inactive. The relationship of RNA synthesis to activation and secretion, and the significance and control of DNA synthesis in the prothoracic glands are considered. Preliminary work on protein synthesis in the glands and their activation in vitro is evaluated.

151 Ogoshi, S. FIBROIN SYNTHESIS IN POSTERIOR SILK GLANDS. VI. METABOLIC CHANGES IN RNA DURING THE FIFTH INSTAR. Seikagaku Zasshi (J. Biochem., Tokyo) 57 (1965) 209-16.

By isotopic experiment with orotic-^{14}C acid incorporation using posterior silk glands at the 5th instar stage, max. ^{14}C incorporation was observed in the large particles of the microsome fractions. In the posterior silk glands at the 5th instar, DNA-like RNA was present, as demonstrated by the fractionation in a methylated albumin column, and the base composition of this particular RNA was different from that of ribosomal RNA (CA 63:1965, 13744g)

152 Olivieri, G., Olivieri, A. AUTORADIOGRAPHIC STUDY OF NUCLEIC ACID SYNTHESIS DURING SPERMATOGENESIS IN Drosophila melanogaster. Mutation Res. 2,4 (1965) 366-80.

The incorporation of ^{3}H-uridine and ^{3}H-thymidine in the D. melanogaster testes was studied autoradiographically. RNA synthesis was observed in spermatogonia and young spermatocytes. At 30 min after ^{3}H-uridine injection only the nucleus and nucleolus appeared labelled; at 2-4 h post injection (p.i.), labelling was also observed in the cytoplasm. At 8 h p.i. labelling was very heavy in the cytoplasm and lighter in the nucleolus, while it disappeared altogether in the nucleus. At 4 d p.i., labelling was transmitted to the cytoplasm of spermatids and at 6 d to sperm; it disappeared in the final stages of maturation, when these cells were no longer arranged in bundles. In the post-meiotic stages no RNA synthesis was observed. The non-germ line cells showing RNA synthesis were: testis coat cells, cyst cells, terminal epithelium cells and seminal vesicle wall cells. Direct RNA synthesis was not observed in nutritive cells. DNA synthesis was observed in spermatogonia as early as 30 min after ^{3}H-thymidine injection. By contrast, ^{3}H-thymidine labelling in spermatocytes was rarely observed, even at 8 h after injection, and then only in the very young spermatocytes. An analysis of the data from several other organisms on RNA metabolism in the course of meiosis has shown that RNA synthesis always occurs in the primary spermatocytes; by contrast, RNA synthesis does not always occur in post-meiotic stages and thus does not seem to be an essential step during spermiogenesis. (Auth.)

153 Onodera, K., Komano, T., Kurosawa, S., Yamamoto, K. PRESENCE OF A DIFFERENT SEQUENCE IN THE TERMINAL REGION OF GLYCINE-SPECIFIC (TRANSFER RNA). Agric.biol.Chem., Tokyo 29, 7 (1965) 693-95.

The title RNA (I) was isolated from the posterior silk gland of Bombyx mori. I and glycyl-tRNA synthetase were incubated with uniformly labelled L-^{14}C-glycine in a suitable medium. The separated product was digested with RNase, the digest chromatographed on DEAE-cellulose, and eluted with the linear gradient 0.01-0.6 M $HCOONH_4$ at pH 6.5. Counts of eluate fractions showed two radioactive peaks (II, III) issuing, respectively, at 0.025 and 0.035 M, initially and on rerun with 0.01-0.04 M gradient. On high-voltage paper electrophoresis, III moved ahead of II; u.v. absorptions and scanner peaks approximately coincided. I has a heterogeneous nucleotide sequence between the terminal nucleotides and the first guanylic acid in the chain. (CA 63:1965, 10190g)

154 Onodera, K., Komano, T. GLYCINE-SPECIFIC TRANSFER RIBONUCLEIC ACID (t-RNA) IN THE POSTERIOR SILK GLAND OF Bombyx mori. Biochim. biophys. Acta 87, 2 (1964) 338-40. (In English)

^{14}C-labelled amino acids and t-RNA prepared from the posterior silk gland of B. mori were studied in relation to the isolation of glycine-specific t-RNA. ^{14}C-glycine and ^{14}C-alanine were predominantly incorporated into t-RNA under the conditions investigated, while ^{14}C-serine, aspartic ^{14}C-acid and glutamic ^{14}C-acid were incorporated to a lesser extent. (CA 61:1964, 7422c)

155 Painter, R.R., Kilgore, W.W. INCORPORATION OF GLYCINE-2-C-14 INTO UNTREATED AND CHEMOSTERILANT TREATED HOUSE FLIES. Bull. ent. Soc. Am. 11, 3 (1965) 178. Absr. 479 Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov.-2 Dec. 1965".

The RNA of the eggs oviposited by normal house flies fed labelled glycine contained ^{14}C primarily in adenylic and guanylic acids. Thiotepa-sterilized house flies oviposited eggs with less ^{14}C incorporated into the RNA. (Absr.)

156 Pavan, C., NUCLEIC ACID METABOLISM IN POLYTENE CHROMOSOMES AND THE PROBLEM OF DIFFERENTIATION. p.222-41 of "Genetic Control of Differentiation. Brookhaven Symposia in Biology No.18, 7-9 Jun.1965". BNL-931 (C-44), Brookhaven National Lab., Upton, N.Y. 1965, 270p.

Data on polytene chromosomes obtained for cells of different tissues in the same or different stages of development and the information provided on the patterns of gene action during differentiation are reviewed. The chemical changes occurring during the swelling of certain chromosome regions which are related to the synthesis and accumulation of DNA, RNA, and protein in specific loci at certain times of development were analysed by injecting labelled precursors (^3H-thymidine, ^3H-uridine, ^3H-cytidine) into the larva. Data from a comparative study of (polytene chromosome) nucleic acid metabolism of different organs (salivary gland, Malpighian tubules, some cells of the median intestine, and several other glands) of Rhynchosciara angelae, under normal as well as some abnormal conditions are discussed. The syntheses of RNA and DNA are evidently discontinuous. The interval in the cycle of RNA synthesis appears to be much shorter. The existence of metabolic DNA is discussed. The main process occurring in most polytene chromosome puffs is RNA synthesis; the extra synthesis of DNA in specific loci of the chromosomes is, however, well documented for at least R. angelae and Sciara coprophila.

157 Pavan, C. SYNTHESIS. p.335-42 if "Genetics Today. Proceedings of the 11th International Congress of Genetics, The Hague, Netherlands, Sep.1963, Vol.2". Geerts, S.J., Ed. Oxford, Pergamon Press. 1965.

Summary of several papers. Some data are presented on polytene chromosomes of Rhynchosciara angelae obtained with tritiated precursors of RNA and DNA, and the significance of the results to interphase chromosomes generally is discussed.

158 Pelling, C. RIBONUKLEINSÄURE-SYNTHESE DER RIESENCHROMOSOMEN VON Chironomus tentans. (RNA synthesis by the giant chromosomes of Chironomus tentans). Chromosoma 15, 1 (1964) 71-122. (In German, with English summary)

This investigation was carried out on the salivary gland nuclei of the 4th instar larvae of C. (Camptochironomus) tentans and led to the identification of 277 RNA-containing structures which were specified in the revised chromsome map. Up to two thirds of these bands appear together at any one time within a nucleus. The average amount of RNA in strongly expanded structures (e.g. Balbiani rings and big puffs) is greater than that of the weakly puffed bands. RNA of the puffed regions is synthesized in situ. ^3H-uridine injection showed these bands to be specifically labelled. The label as well as the metachromatic coloration of the toluidine blue stain is sensitive to RNase. Alterations of the puff pattern, i.e., changes in the degree of puffing of a band are accompanied by differences in incorporation. A general relationship exists between the rate of synthesis and the size of a puff. RNA production increases with the size of these structures. The phenomenon of puffing should therefore be understood as a mechanism regulating the amount of RNA produced by a locus. Each of the three large chromosomes: I, II, and III (including up to 90 active bands each) synthesizes as much RNA as one of the two big Balbiani rings in full development or as much as each of the two nucleolar organizers. Nucleolar incorporation mostly starts from the area attached to the chromosome and then extends to the periphery. This observation supports the view that the DNA-rich portions of the nucleolus, the nucleolus organizer proper, are concerned with the synthesis of the nucleolar RNA. Despite considerable individual flutuations, (average) uridine incorporation increases with time, possibly reflecting changes in the rate of RNA synthesis.

159 (z) Peters, G. EINFLUSS DES METAMORPHOSEHORMONS ECDYSON AUF DEN NUCLEINSÄURESTOFF-WECHSEL VON Calliphora LARVEN. (The effect of ecdyson, the hormone of metamorphosis on nucleic acid metabolism in Calliphora larvae). Thesis. Naturwissenschaftliche Fakultät, Ludwig-Maximilians-Universität. Munich 1963, 70p. (In German)

Existing techniques for isolating nucleic acids were adapted for blowfly (C. erythrocephala) tissue and the results obtained evaluated critically. Incorporation of ^{32}P (from phosphate) in RNA was increased from 50-80% by ecdysone. This effect reached a max. 4-7 h after injection. Data were obtained indicating a negative influence of ecdysone on the storing of certain substances. The distribution of activity in individual nucleotides is different according to whether ecdysone is present or not. Results confirm the hypothesis of the action mechanism of the hormone according to which the genetic material is first activated; subsequently, in a second phase, specific nucleic acids are produced.

160 Plaut, W., Nash, D. LOCALIZED DNA SYNTHESIS IN POLYTENE CHROMOSOMES AND ITS IMPLICATIONS. p.113-35 of "The Role of Chromosomes in Development. Proceedings of the 23rd Symposium of the Society for the Study of Development and Growth, Amherst, Mass., June 1964". Locke, M., Ed. New York, Academic Press, 1964, 290p.

Incubation of salivary glands of Drosphila melanogaster with ^{3}H-thymidine is reported to result in labelling of interband regions.

161 Pollister, A.W. AN AUTORADIOGRAPHIC STUDY OF RNA SYNTHESIS IN ISOLATED SALIVARY GLANDS OF Drosophila hydei. II. INTERFEROMETRIC STUDIES. J. Morph. 116, 1 (1965) 89-98.

Interferometric measurements were made on sections of salivary glands mounted in oils of refractive indices 1.410, 1.460, and 1.500, estimating optical path differences as fringe displacement with a Leitz double-beam interferometer microscope. From these data the mean concentrations (in $mg/cm^2/\mu m$) of 55 cells of three glands were computed as follows: karyoplasm, 0.027 ± 0.0026; cytoplasm, 0.048 ± 0.0024; nucleolus, 0.066 ± 0.0041. From these concentrations it was computed, according to Maurer and Primbsch (Expl Cell Res. 33; 1964, 8) that the correction factors for four micron sections were: karyoplasm, 0.203; cytoplasm, 0.114; nucleolus, 0.083. The reciprocals of these fractions (5.0, 8.8, and 12.0) are the correction factors of Arnold (ibid, 65) by which measured silver grain densities on autoradiographs are multiplied to give corrected (i.e. potential) densities. (Auth.)

162(2) Ramamurty, P.S. ÜBER DIE HERKUNFT DER RIBONUKLEINSÄURE IN DEN WACHSENDEN EIZELLEN DER SKORPIONSFLIEGE Panorpa communis (INSECTA, MECOPTERA). (On the origin of the RNA in the growing egg cells of Panorpa communis (Insecta, Mecoptera)). Naturwissenschaften 50, 10 (1963) 383-4.

On the basis of experiments with ^{3}H-uridine it was possible to demonstrate that the major source of RNA-synthesis is the cell-nucleus of the egg-nutrition cells (3 nutrition cells + 1 oocyte = an egg-nutrition unit) from which it passes through the nutrition-cell cytoplasm into the oocyte via fusomes. Some RNA is formed by the oocyte nucleus during the later stages of the maturation process, while the follicle epithelium in which the egg is embedded is a third source. (Ba 45: 164, 35543)

163 Ramenskaya, G.P. THE INCORPORATION OF URIDINE-^{3}H INTO THE CELLULAR STRUCTURES OF THE SILK GLAND AND THE EFFECT ON THIS PROCESS OF ACTINOMYCIN D. Tsitologiya 7, 1 (1965) 88-90. (In Russian)

Silkworms at 2 and 7 d of the 5th growth cycle received 12.5 γ actinomycin D/worm (approximate weight 2 g), and 15 min later, uridine-^{3}H at a dose of 4 μCi/worm. Control worms received the uridine-^{3}H only. The incorporation of uridine-^{3}H into RNA was studied on sections of the fibroin part of the silk gland by the usual staining techniques and autoradiography. In the first series, the incorporation of the RNA precursor into the cell nuclei occurred in the control silkworms within 15 min after its introduction. After 18 h, the radioactivity in the nucleus decreased and appeared in the cytoplasm. There was no incorporation of uridine-^{3}H in worms receiving actinomycin D. In the second series, there was no incorporation in either the test or the control silkworms. Thus, the synthesis of RNA takes place in the silk gland during the 1st half of the 5th growth cycle, when it accumulates in the nucleus. Subsequently, the RNA is transferred into the cytoplasm. Actinomycin D completely inhibits the synthesis of RNA (CA 63:1965, 2166d)

164 Ritossa, F.M. BEHAVIOUR OF RNA AND DNA SYNTHESIS AT THE PUFF LEVEL IN SALIVARY GLAND CHROMOSOMES OF Drosophila. Expl Cell Res. 36, 3 (1964) 515-23.

Synthetic activities at the puff level in salivary gland chromosomes of Drosophila buskii were studied by autoradiographic methods. The analyses were carried out both on normally occurring and on experimentally induced puffs. All the puffs in this material appear to be sites of intense RNA synthesis (high incorporation of ^{3}H-uridine and ^{3}H-cytidine, an almost complete loss of this radioactivity after RNase digestion, and a loss of label (^{3}H-cytidine) after puff regression). On pulse labelling with ^{3}H-thymidine to test DNA synthesis in the salivary gland cells, some chromosomes appear continuously labelled along their length, while others are discontinuously labelled. The discontinuously labelled chromosomes are shown to be a phase in DNA duplication. DNA and RNA synthesis are certainly not mutually exclusive within the entire nucleus and probably not within an individual puff.

165 Ritossa, F.M., Borstel, R.C. von, Swift, H. THE ACTION OF RIBONUCLEASE ON SALIVARY GLAND CELLS OF Drosophila. Genetics 50 (1964) 279.

Ribonuclease induces up to 40 new puffs in polytene chromosomes after a 5 h exposure of excised glands in a solution containing the enzyme; only remnants of the nucleolus remain after this treatment. In the course of isotopic labelling experiments, three principal observations were made: (1) after ribonuclease action in vivo, a certain amount of uridine labelling still remains in very active, normally occurring puffs (although much less than when ribonuclease is absent) and in the puffs induced by ribonuclease itself; (2) the nucleolus organizer region and nucleolar remnants are labelled; and (3) ribonuclease inhibits amino acid incorporation into protein after 2 h of incubation. Paradoxically, ribonuclease-induced puffs stained metachromatically with azure B are much more intense in colouration than are the untreated, normal puffs in control glands. We know that entry of uridine into the cell is not hindered by ribonuclease, therefore we conclude that ribonuclease breaks down cellular RNA, which adds to the nucleotide pool, effectively diluting the added, labelled uridine. From the observation of inhibition of amino acid incorporation by ribonuclease after a 2 h treatment and the observation that puffs are induced by ribonuclease by 5 h of treatment, it can be firmly concluded that the protein of the puffs pre-exists and is not formed during the process of puff production.

166 Ritossa, F.M., Pulitzer, J.F., Swift, H., Borstel, R.C. von. ON THE ACTION OF RIBONUCLEASE IN SALIVARY GLAND CELLS OF Drosophila. Chromosoma 16, 2 (1965) 144-51.

Third instar larvae of Drosophila buskii were used throughout. Ribonuclease was shown to degrade the nucleolus in actively metabolizing cells. It does this without inhibiting RNA synthesis in the puffs and the nucleolus organizer. DNA synthesis still continues before or after puff formation, while amino acid incorporation is inhibited before the puffs are formed, indicating pre-existence of proteins involved in the process of puff formation. The effect of ribonuclease in RNA and RNA synthesis was studied by using ^{3}H-uridine (specific activity 4 Ci/mM); the effects of RNAse on amino acid incorporation were studied by means of tritiated L-histidine (specific activity 1.1 Ci/mM), L-lysine (0.4 Ci/mM), L-phenylalanine (1.65 Ci/mM), L-leucine (0.5 Ci/mM), and DL-tryptophan (0.6 Ci/mM); and on DNA synthesis, using ^{3}H-thymidine (6 Ci/mM).

167 Robert, M., Kroeger, H. LOKALISATION ZUSÄTZLICHER RNS-SYNTHESE IN TRYPSIN-BEHANDELTEN RIESENCHROMOSOMEN VON Chironomus thummi. (Localization of the additional RNA synthesis in trypsin-treated giant chromosomes of Tendipes thummi). Experientia 21, 6 (1965) 326-7. (In German, with English summary)

After injection of buffered trypsin into nuclei of salivary gland cells of T. thummi the existing puffs in the giant chromosomes are enlarged. Autoradiography shows an increase in RNA synthesis in the puffs, which is about threefold. ^{3}H-uridine was used. The presence of histone may normally block RNA synthesis but in the puffed segments the histone is in a form which does not block and, at the same time, is particularly susceptible to trypsin digestion.

168 Russo-Caia, S. RECENT AUTORADIOGRAPHIC OBSERVATIONS ON THE INCORPORATION OF LABELED PRECURSORS OF NUCLEIC ACIDS AND PROTEINS IN THE FATTY BODIES OF Musca domestica. Atti. Accad. naz. Lincei Rc. Classe di scienze fisiche, matematiche e naturali 37, 6 (1964) 518-20. (In Italian)

Previous autoradiographic studies on the incorporation of ^{14}C-labelled adenine and orotic acid into the trophocytes of the larval fatty bodies of M. domestica are extended to the in vitro incorporation

of tritiated precursors of nucleic acids and proteins. Fatty bodies isolated from stage III larvae were maintained in Case's physiological solution for Diptera (Lockwood, CA 55, 14554c) containing ^{3}H-uridine (I), ^{3}H-cytidine (II) or ^{3}H-orotic acid (III) as nucleic acid precursors, or phenylalanine-^{3}H (IV) as protein precursor. These substances were added to a concentration of 5 or 10 μCi/ml, and their incorporation examined after 10-15 min, 60 min, and 7-8 h when fragments were fixed in Bouin's fluid, embedded, and sectioned 6-7 μm thick. The sections were exposed for 7-15 d on plates coated with Ilford L4 emulsion as described by Russo-Caia (CA 60, 16255e) and were finally stained with methyl greenpyronine. With I, II, and III the trophocyte nuclei were faintly marked after 15 min, more so after 1 h when some cytoplasmic granules were also marked, and strongly after 7-8 h (in some cases completely covered by granules), the cytoplasm also showing a uniform distribution of radioactivity. There was no significant difference in intensity between I, II, and III. Incorporation of IV was chiefly in the cytoplasm after 15 min, increasing with time so that after 7-8 h marked granules were present in the nuclear area. These results show an active metabolism of the RNA synthesized in the nucleus and passed to the cytoplasm in the larval fatty body cells and this metabolism is accompanied by protein synthesis, demonstrated by incorporation of IV. These materials elaborated in and by the larval fatty bodies serve during metamorphosis for the formation of the imago. (CA 63:1965,6067ac)

169 Schiff, S.O. RIBONUCLEIC ACID SYNTHESIS IN NEUROBLASTS OF THE GRASSHOPPER Chortophaga viridifasciata. Diss. Abstr. 25, 9 (1965) 5459.

Experiments were designed to study various aspects of RNA synthesis, particularly in relation to the mitotic cycle in grasshopper neuroblasts. Living cells were observed in hanging drop preparations, and part of these were carefully mapped as to their location in the embryo, so that they could be reidentified in fixed and stained sections. In this way the progress of individual cells through mitotic stages could be ascertained with precision, and the effects of exposure to a labelled riboside observed. Autoradiography was employed, using ^{3}H-uridine as a precursor of RNA, and the distribution and density of silver grains in emulsion over cells was studied. Analysis of 763 cells lead to the following conclusions: (1) ^{3}H-uridine is incorporated into RNA molecules which are extractable by RNase digestion; (2) RNA synthesis begins in middle telophase, 9 min after appearance of nucleoli, and continues to approximately the middle part of middle prophase; (3) RNA synthesis begins simultaneously in chromosomes and nucleoli, and nuclear RNA synthesis precedes the appearance of label in the cytoplasm; (4) during those stages in which nuclear RNA synthesis takes place, most of the cellular label is associated with chromosomes and nucleoli; (5) the structures most densely labelled are the nucleoli; (6) cytoplasmic labelling is observed only in cells fixed in very late prophase, mid-mitotic stages, and early telophase, after 40 or more min of exposure to ^{3}H-uridine; (7) label moves from nucleus to cytoplasm beginning in very late prophase, and some of it probably returns to the nucleus during middle telophase; (8) from middle to late anaphase most of the cytoplasmic label lies in the spindle between separating chromosomes; (9) the grain density over cells, which reflects the amount of ^{3}H-uridine incorporated, is decreased by increasing the tonicity of the culture medium. (DA)

170 Schiff, S.O. RIBONUCLEIC ACID SYNTHESIS IN NEUROBLASTS OF Chortophaga viridifasciata (De Geer), AS DETERMINED BY OBSERVATIONS OF INDIVIDUAL CELLS IN THE MITOTIC CYCLE. Expl Cell Res. 40, 2 (1965) 264-76.

All embryos except controls were exposed to 40 μCi/ml of ^{3}H-uridine with a specific activity of 2.77 Ci/mM. Embryos were incubated at 38°C in hanging drops for 10-40 min in medium containing ^{3}H-uridine, and fixed immediately. Analysis of 783 mapped and unmapped neuroblasts leads to the following conclusions: ^{3}H-uridine is incorporated into RNA molecules which are extractable by RNase digestion. RNA synthesis begins in the middle of middle telophase, 9 min after appearance of nucleoli, and continues to approximately the middle part of middle prophase. RNA synthesis begins simultaneously in chromosomes and nucleoli, and nuclear RNA synthesis precedes the appearance of label in the cytoplasm During those stages in which nuclear RNA synthesis takes place, most of the cellular label is associated with chromosomes and nucleoli. The nucleoli are the most densely labelled structures in the neuroblast. Cytoplasmic labelling is prominent only in cells fixed in very late prophase and mid-mitotic stages, after an exposure to ^{3}H-uridine of more than 20 min. The uptake of ^{3}H-uridine is decreased by incubating neuroblasts in hypertonic culture medium.

171 Schneiderman, H.A., Gilbert, L.I. CONTROL OF GROWTH AND DEVELOPMENT IN INSECTS. Several growth hormones appear to be isoprenoid derivatives, and some may act upon the cell nucleus. Science, N.Y. 143 (1964) 325-33.

Article reviews recent results. Findings from numerous studies are discussed, among them some results obtained autoradiographically (including some unpublished work, as also table 3 on the rate of uptake of ^{3}H-uridine into pupae of Hyalophora cecropia). They suggest (1) ecdysone, juvenile hormone, gonadotropic hormone, and perhaps the brain hormone may be related chemically; (2) these substances may all be polyisoprenoid derivatives; (3) the juvenile hormone and the brain hormone may act directly on many tissues to cause growth without ecdysone; and (4) the possibility remains that the mechanism whereby the juvenile hormone activates the prothoracic glands is totally different from the mechanism whereby the brain hormone activates the prothoracic glands; and the brain hormone may turn out to resemble the more conventional neurosecretory polypeptides (e.g. oxytocin and vasopressin).

172 Sekeris, C.E., Dukes, P.P., Schmid, W. WIRKUNG VON ECDYSON AUF EPIDERMISZELLKERNE VON Calliphora-LARVEN IN VITRO. (Effect of ecdysone on nuclei of epidermal cells of Calliphora larvae in vitro). Hoppe Seyler's Z. physiol. Chem. 341, 1-3 (1965) 152-4. (In German, with English summary)

Epidermis nuclei isolated from 7-d-old larvae of C. erythrocephala incorporate [2-^{14}C]uracil into RNA. Addition of the insect hormone ecdysone to the incubation mixture leads, within 15 min, to a considerably increased incorporation of uracil into RNA over that of controls. (Auth. summary)

173 Sekeris, C.E., Dukes, P.P., Schmid, W. THE ACTION OF ECDYSONE ON NUCLEIC ACID METABOLISM IN INSECTS. Biochem. J. 97, 3 (1965) 23P-24P. Abstr. Presented at the "453rd Meeting of the Biochemical Society, Middlesex Hospital, Medical School, England, 8 Oct. 1965".

Recent studies on the structure and role of ecdysone, a C_{27}-7(8)-en-6-oxo-steroid, and the latest results are cited. Radioisotopes were used in a number of studies. RNA synthesis in the epidermis of Calliphora erythrocephala larvae was studied under the influence of ecdysone. Using the method of Georgiev & Mantieva (Biochim. biophys. Acta 6:1962,153) two nuclear fractions were obtained, one at 0°-50°C corresponding mainly to ribosomal and transfer RNA, and one at 65°C possessing the characteristics of messenger RNA. Incorporation of labelled precursors into RNA and template activity of the isolated RNA were taken as criteria to judge the effects of the hormone. The stimulation of ^{32}P-incorporation into both nuclear RNA fractions within 1 h of ecdysone administration, and into cytoplasmic RNA within 3-4 h could be demonstrated. The response of isolated epidermis nuclei to ecdysone was studied by means of [2-^{14}C]uracil incorporation into RNA. Template activity of the RNA was also stimulated in the presence of ecdysone.

174 Sekeris, C.E., Lang, N., Karlson, P. ZUM WIRKUNGSMECHANISMUS DER HORMONE. V: DER EINFLUSS VON ECDYSON AUF DEN RNA-STOFFWECHSEL IN DER EPIDERMIS DER SCHMEISSFLIEGE Calliphora erythrocephala. (The mechanism of action of hormones. V. The effect of ecdysone on RNA metabolism in the epidermis of the blowfly, Calliphora erythrocephala). Hoppe-Seyler's Z. physiol. Chem. 341, 1-3 (1965) 36-43. (In German, with English summary)

The turnover of nucleic acids in the epidermis of C. erythrocephala is increased by the insect hormone ecdysone; the incorporation of $H^{32}PO_4^{2-}$ into ribosomal and messenger RNA of the cell nucleus is increased. The m-RNA fraction from hormone-treated animals has a higher messenger activity than that from controls, measured by the stimulation of protein synthesis in an in vitro system. In connection with the earlier finding of the hormone-dependent synthesis of the messenger RNA for Dopa decarboxylase, it is concluded that ecdysone stimulates enzyme production by stimulating the DNA-dependent RNA synthesis. (Auth. summary)

175 Smirnov, V.N., Spirin, A.S., Kullyev, P., Zbarskiĭ, I.B. RIBONUCLEIC ACID SYNTHESIS OF SILK-SECRETING GLAND OF Bombyx mori. Dokl. Akad. Nauk SSSR 155, 4 (1964) 957-60.

Centrifugal examination of RNA of the silk gland with ^{32}P showed that a large component of ribosomal RNA, a small component of ribosomal RNA, and a small component of soluble RNA make up the tagged RNA isolated from the organ, as shown by spectrophotometry; radiographic

study showed four peaks, which failed to coincide with the spectrophotometric peaks. The period of max. synthesis of fibroin coincides with the period of almost total lack of RNA synthesis by the organism. Rapidly-tagged RNA exists mainly at the start of the fifth period of development, i.e. during the synthesis of most of RNA. This indicates that this form of RNA is not the short-lived messenger RNA but a precursor of the stable RNA which accumulates in the cells during this growth period (CA 61: 1964, 1010d)

176 Szafrański, P., Lutowicz, J., Puzyńska, L. THE RIBONUCLEIC ACID FROM THE SILK GLAND OF THE SILKWORM AND THE AMINO ACID CODE. Acta biochim. pol. 11, 1 (1964) 71-81. (Polish summary)

^{32}P-labelled RNA was isolated by the phenol method; from ECTEOLA-cellulose column three and two fractions of RNA were obtained from the posterior and the middle part of the gland, respectively. The nucleotide composition of each fraction was compared with the composition of mRNA calculated from the amino acid content of silk protein by doublet, triplet and mixed codes. The composition of mRNA for sericin (doublet code) is similar to that of RNA from the middle part of the gland. In a cell-free preparation from E. coli, RNA from the middle part stimulated the incorporation into protein of the ^{14}C-labelled amino acids specific for sericin, i.e. serine, glycine and glutamic acid. (Auth.)

177 Taylor, J.H. DISTRIBUTION OF TRITIUM-LABELED DNA AMONG CHROMOSOMES DURING MEIOSIS. I. SPERMATOGENESIS IN THE GRASSHOPPER. J. Cell Biol. 25, 2, Pt.2 (1965) 57-67.

Thymidine-H^3 of high specific activity was used to study the distribution of labelled chromatids during meiotic divisions in spermatocytes of Romalea microptera (Beauvoir), a species of grasshopper (Orthoptera). The distribution is regularly semiconservative as has been shown previously for mitosis, i.e., all chromatids are labelled after incorporation of thymidine-H^3 into DNA at premeiotic interphase. If incorporation occurs at the interphase preceding this one, the chromosomes arrive at meiotic divisions with the equivalent of one chromatid of each homologue labelled. Chromatid exchanges occur at a frequency which is very nearly that predicted on the assumption that each chiasma represents an exchange between homologous chromatids. However, the exchanges are randomly distributed among chromosomes in a size group, whereas chiasmata are not. A quantitative analysis of the frequency and pattern of exchanges indicates that most of these result from breakage and reciprocal exchange between homologous chromatids. Sister chromatid exchanges are much less frequent and may be limited to premeiotic stages. (Essentially auth.)

178 Urbani, E., Russo-Caia, S. CYTOCHEMICAL AND AUTORADIOGRAPHIC OBSERVATION OF NUCLEIC ACID METABOLISM IN THE OOGENESIS OF Dytiscus marginalis. Rend. Ist. Sci Univ. Camerino 5, 1 (1964) 19-50. (In Italian, with English summary)

Ovary slices of D. marginalis were fixed with EtOH, mounted with gelatin, dehydrated with increasing concentrations of EtOH, and placed 2 h in concentrated solutions of thymidine, uridine, or phenylalanine. Emulsions were added and developed. Cytochemical determinations were made by fluorescent microscopy. Thymidine-^{3}H, thymidine-^{14}C, uridine-^{3}H, and phenylalanine-^{3}H were injected at different times to study nucleic acid metabolism. A cytochemical and morphological study of an extrachromosomal body which is included only in the oocyte, and not in the nurse cells, was made. The incorporation of uridine-^{3}H revealed that while ribonucleic acid metabolism was simultaneous in all nurse cells, DNA synthesis occurred at different rates in each cell. (CA 61: 1964, 8676f)

179 Vanderberg, J.P. SYNTHESIS AND TRANSFER OF DNA, RNA, AND PROTEIN DURING VITELLOGENESIS IN Rhodnius prolixus (HEMIPTERA). Biol. Bull. 125 (1964) 556-75.

Histochemical and autoradiographic techniques demonstrated that DNA was synthesized in the nuclei of the ovary, fat body, and midgut. The autoradiographic localization of sites of incorporation of ^{3}H-labelled precursors into DNA, RNA, and protein was analysed by injection 5 μCi ^{3}H-thymidine (1900 mCi/mM) for determining DNA-, 5μCi ^{3}H-uridine (3280 mCi/mM) for RNA-, or 10 μCi DL-leucine-4,5-^{3}H (3570 mCi/mM) for determining protein-synthesis. The dilution of the radioactive solutions was such that each insect received 0.01 ml/injection. There appeared to be a transfer of some of the DNA in a partially depolymerized form from the ovarian trophic tissues

to the growing oocyte. RNA was synthesized in the nuclei of the ovary, fat body, and midgut, and then was transferred to the cytoplasm. Some of the RNA passed from the ovarian trophic tissues to the growing oocyte. Protein was synthesized most actively in the ovarian follicular epithelium, and in the fat body. Newly synthesized protein was transferred from the follicular epithelium to the oocyte. Synthesis of yolk protein by the oocyte itself appeared to be neglible. (Auth.)

180 Ward, D.N. MEETINGS. CANCER RESEARCH. The "19th Annual Symposium on Fundamental Cancer Research, Houston, Tex., 4-6 Mar. 1965", * is summarized by the author. Science, N.Y. 150 (1965) 1063-75.

H. Laufer discussed relationships between chromosomal puffing and cellular function during insect development. The insect Chironomus thummi was studied during the larval-pupal transformation. Several enzymes were studied in the differentiating salivary glands. Although some of the enzyme changes correlated with puffing in the Balbiani rings of the chromosomes in the salivary gland, tracer studies and immunochemical isolations led Laufer to conclude that tissue specificity of the enzymes was not great enough to account for the specificity of the puffing. To circumvent this dilemma, Laufer proposes that the activity of the Balbiani ring correlates with the production of a transport system in the salivary gland, which in turn moves enzymes from other parts of the insect circulation and into the secreted product of the gland.

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* Full text of papers is being published as a monograph "Developmental and Metabolic Control Mechanisms and Neoplasia".

181 Watkins, M.J. EVIDENCE FOR A LAMPBRUSH TYPE STRUCTURE IN GRASSHOPPER SPERMATOCYTE CHROMOSOMES. Expl Cell Res. 36, 1, (1964) 14-18.

Prophase chromosomes in spermatocytes of the grasshopper, Melanoplus differentialis, resemble the lampbrush chromosomes of amphibian oocytes in being long, thin and extremely diffuse. Previous microinterferometric measurements of the dry mass of these chromosomes showed an apparent increase in mass during diakinesis to the expected value at metaphase. The measured dry mass is the same for chromosomes in prophase, metaphase and anaphase of mitosis. It is suggested that the apparent increase in mass during diakinesis is due to the regression of loops or strands of chromosome material which cause the diffuse appearance in diplotene chromosomes. Autoradiographic studies show that chromosomes in grasshopper spermatocytes further resemble lampbrush chromosomes in the incorporation of ^{3}H-uridine around the chromosomes while they are in the diffuse state. The technique used is described in detail. The ^{3}H-uridine (specific activity 0.68 Ci/mM) and DL-phenylalanine-^{3}H (specific activity 33.2 mCi/mM) were used at a concentration of 500 μCi/ml.

182 Wyatt, G.R., Linzen, B. THE METABOLISM OF RIBONUCLEIC ACID IN CECROPIA SILKMOTH PUPAE IN DIAPAUSE, DURING DEVELOPMENT AND AFTER INJURY. Biochim. biophys. Acta 103, 4 (1965) 588-600.

RNA metabolism in tissues of Hyalophora cecropia was studied by injecting ^{32}P and the amount of RNA, its total base composition, the rate of incorporation, and the content of ^{32}P in the four ribonucleotides was estimated. In wing tissue, incorporation of phosphate into RNA was elevated during the first week of development towards the adult, but by day 13, when protein synthesis is still highly active, RNA synthesis had returned to the diapause rate (see Table I). After injection of ecdysone into brainless pupae, RNA synthesis was stimulated somewhat at 4 h and strongly at 24 h. Integumentary injury also accelerated RNA synthesis (Table II). In fat body incubated in vitro, phosphate incorporation into RNA appeared elevated at the earliest stages of adult development (Table III). After injury, incorporation was maximal after 1 d and declined whereas the rate of protein synthesis continued to rise for a week. In both tissues the composition of rapidly synthesized RNA, estimated from pulse incorporation of ^{32}P in the nucleotides, was different from the bulk RNA and distincly DNA-like, suggesting template RNA. No change in either bulk or new RNA composition was detected in development or after injury. DNA was prepared from Cecropia wing tissue and found to have an A+T/G+C ratio of 1.8.

16 The effect of tritiated thymidine and gamma irradiation on the mortality of adult Drosophila melanogaster. (Kent, E., 1965)
19 Some physiochemical indexes of gaseous exchange in the housefly Musca domestica and of DNA nucleotide composition of first-generation larvae, following internal β-irradiation by phosphorus-32. (Kharlamov, V.P., 1964)
22 Mutagenic effect on mature Drosophila spermatozoa of ^{32}P incorporated into DNA. (Lee, W.R. et al., 1965)
23 The mutagenic effect of tritiated uridine in Drosophila spermatocytes. (Olivieri, G., Olivieri, A., 1965)
56 Structure and function of interphase chromosomes. (Beermann, W., 1965)
57 Cytoplasmic synthesis of nuclear histone during spermiogenesis in the grasshopper Chortophaga viridifasciata (de Geer). (Bloch, D.P., Brack, S.D., 1964)
61 Actinomycin and puromycin: effects on sequential gene activation by ecdysone. (Clever, U., 1964)
82 Autoradiographic study of protein-producing cells. (Makarov, P.V., 1965)
94 Aspects of amino acid and nucleic acid metabolism in the larva of the blowfly, Calliphora erythrocephala. (Price, G.M., 1965)
97 Experimental activation of specific loci in polytene chromosomes of Drosophila. (Ritossa, F.M., 1964)
103 Action of ecdysone on RNA and protein metabolism in the blowfly, Calliphora erythrocephala. (Sekeris, C.E., 1965)
104 Induction of dopa-decarboxylase activity by insect messenger RNA in an in vitro amino acid incorporating system from rat liver. (Sekeris, C.E., Lang, N., 1964)
228 Giant chromosomes. (Beermann, W., 1962)
229 Hormone-controlled gene activity in the giant chromosomes of Acricotopus lucidus. (Panitz, R., 1964)
230 Salivary gland function and chromosomal puffing patterns in Drosophila hydei. (Berendes, H.D., 1965)
231 Cytological and autoradiographic studies in Sciara coprophila salivary gland chromosomes. (Gabrusewycz-Garcia, N., 1964)
232 Studies of nuclear RNA in the salivary gland of Sciara coprophila. (Gabrusewycz-Garcia, N., 1965)
233 Electron microscope autoradiography of the nucleolus of insect salivary gland cells. (Jacob, J., Sirlin, J.L., 1964)
236 Molt and intermolt activities in the epidermal cells of an insect. (Locke, M. et al., 1965
237 Incorporation of labelled thymidine into the silk gland of the silkworm. (Akai, H., Kobayashi, M., 1965)
238 Effect of the molting hormone on the synthesis of nucleic acids in the imaginal disks of Calliphora erythrocephala. (Berreur, P., 1965)
239 Autoradiographic investigations on the function of the egg follicles and the nurse cells during yolk formation and protein synthesis in the fly ovary. (Bier, K., 1963)
241 Mitotic activity in the hemocytes of Oncopeltus fasciatus (Dall). (Feir, D., O'Connor, G.M., Jr., 1965)
520 Cell stages refractory to thymidine incorporation induced by x-rays. (McGrath, R.A. et al., 1965)
522 Effects of radiation on the synthesis of nucleic acids in polytene chromosomes. (Pavan, C., Basile, R., 1963)
523 Localization of DNA complementary to ribosomal RNA in the nucleolus organizer region of Drosophila melanogaster. (Ritossa, F.M., Spiegelman, S., 1965)
568 Drosophila Cytology and genetics. (Oak Ridge National Laboratory, 1964)

6. Lipids and Fatty Acids. Sterol and Steroid Metabolism

183 Bergmann, E. D. INSECT STEROIDS. Bull. Soc. Chim. France 10 (1965) 2787-91. (In French)

A review with 65 references.

184 Bloch, K. BIOSYNTHESIS OF CHOLESTEROL. Angew. Chem. 77, 21 (1965) 944-54. (In German)

185 Clayton, R. B. BIOSYNTHESIS OF STEROLS, STEROIDS, AND TERPENOIDS. I. BIOGENESIS OF CHOLESTEROL AND THE FUNDAMENTAL STEPS IN TERPENOID BIOSYNTHESIS. Q. Rev., Lond. 19, 2 (1965) 168-200.

A review with 156 references. Extensive use of radioisotopes is reported. (The work done on insects is not emphasized.) The article deals with the major features of the pathway of cholesterol biosynthesis, intermediate reactions between acetate and squalene, the conversion of acetate into mevalonate, and in turn into isopentenyl pyrophosphate, farnesyl pyrophosphate, and squalene, and the stereochemistry of squalene biosynthesis. The biological conversion of squalene into lanosterol, and of lanosterol into cholesterol, and the final steps in cholesterol biosynthesis are discussed.

186 Chino, H., Gilbert, L. I. LIPID RELEASE AND TRANSPORT IN INSECTS. Biochim. biophys. Acta 98 (1965) 94-110.

When isolated fat body of the silkmoth, cockroach or grasshopper was incubated with [carboxy-^{14}C]palmitate, the ^{14}C-labelled fatty acid was rapidly incorporated into the neutral lipids of the fat body. When this "prelabelled fat body" was reincubated with insect haemolymph, a rapid release of ^{14}C-labelled diglyceride took place from the fat body into the haemolymph, whereas no significant release of triglyceride occurred. This diglyceride release was specific for insect haemolymph. No significant release of diglyceride occurred into a solution of bovine serum albumin, egg albumin or rat plasma. In contrast, free fatty acid was released not only into the insect haemolymph but also into synthetic media. Diglyceride release was markedly inhibited by cyanide, 2,4-dinitrophenol and azide, whereas the release of free fatty acid was accelerated by these chemicals. The greatest rate of release of diglyceride was observed from adult silkmoth fat body, and the lowest from diapausing pupal fat body. Electrophoretic analysis of the haemolymph showed that the diglyceride released into the haemolymph was complexed to one of the haemolymph proteins. This diglyceride-protein complex seems to be the most likely form by which long-chain fatty acids are transported in the insects studied. (Auth.)

187 Clayton, R. B. THE UTILIZATION OF STEROLS BY INSECTS. J. Lipid Res. 5, 1 (1964) 3-19.

The review is divided into nutritional studies (quantitative requirements; utilization of sterols other than cholesterol; saturated sterols; sparing of the dietary requirement for cholesterol by other sterols; sterol and analogues), metabolic studies (sterol biosynthesis in insects; intestinal absorption of sterols; distribution of sterols in insect tissues; sterol ester formation), transformations of the sterol molecule (excretion of sterols and sterol metabolites; cholesterol as a precursor of an insect hormone, ecdysone and brain hormone being discussed; desaturation of the sterol nucleus; metabolism of phytosterols), the functions of sterols in insects, and some comparative aspects.

188 Gilby, A. R. LIPIDS AND THEIR METABOLISM IN INSECTS. A. Rev. Ent. 10 (1965) 141-60.

Review article. Mention is made of radioisotopes used in studies on the mechanism of sterol metabolism (p. 150) and on the biosynthesis of lipids (fatty acids and triglycerides: p. 151-2; phospholipids: p. 152; sterols and isoprenoids, and other aliphatic compounds: p. 153). An extensive bibliography (160 references) contains numerous references to radioisotope studies.

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189 Agarwal, H. C., Houx, N. W. H. γ-BUTYROBETAINE DERIVATIVE IN PHOSPHOLIPIDS OF Phormia. Biochim. biophys. Acta 84, 3 (1964) 353-5.

Larvae of the blowfly, P. regina, were fed diets containing γ-butyrobetaine-methyl-^{14}C and lacking choline or carnitine. Phospholipids were fractionated chromatographically and assayed for P,

radioactivity, and nature of phospholipid. The results indicated that during post-embryonic development of P. regina, no carnitine was incorporated into the phospholipids. They also provided definite proof that β-methylcholine, incorporated into the phospholipids, was derived from γ-butyrobetaine in the larval diet. (CA 61: 1964, 6088h)

190 Bade, M.L. BIOSYNTHESIS OF FATTY ACIDS IN THE ROACH Eurycotis floridana. J. Insect Physiol. 10, 2 (1964) 333-41.

After ingestion of [1-^{14}C] acetate, fatty acids of the roach, E. floridana show a labelling pattern consistent with biosynthesis by condensation of C_2 units. Oleic acid is efficiently synthesized by direct conversion of stearic acid. Synthesis of a C_{18} dienoic acid may occur at a very low rate. Oleic acid constitutes about half of the total fatty acid content, and palmitic is the most abundant saturated acid. There is only a trace of fatty acids of chain length greater than C_{18}; arachidonic acid is entirely absent. (Auth.)

191 Bridges, R.G., Ricketts, J. INCORPORATION OF N-METHYLAMINOETHANOL AND N-DIMETHYLAMINOETHANOL INTO THE PHOSPHOLIPIDS OF THE HOUSEFLY, Musca domestica. Biochem. J. 95, 3 (1965) 41P.

In the present experiments, larvae allowed to develop on a medium containing no added choline grew more slowly than when choline was present. The phospholipids of such larvae contained little phosphatidylcholine (1-2% of total lipid phosphorus compared with 14-18% found in larvae fed on a choline-containing medium) and the phosphatidylethanolamine content increased correspondingly. Larvae fed on diets containing MAE or DMAE in place of choline contained an amount of phosphatidylcholine similar to that found in larvae grown in the absence of choline. Also, when larvae were fed on a choline-free medium to which [$^{14}C_3$]L-serine had been added, no significant amount of ^{14}C-radioactivity was associated with the lipid-bound choline although labelling of ethanolamine had occurred. These findings suggest that house fly larvae are unable to synthesize choline from ethanolamine in a manner similar to that which has been demonstrated in rat liver (by Bremer et al., in Biochim. biophys. Acta 43: 1960, 477). Changes in the percentage distribution of the bases incorporated into the phospholipid fraction of the larvae fed on diets containing various combinations of ethanolamine, MAE, DMAE and choline suggest that competition can occur between ethanolamine and MAE as a substrate for the enzyme system synthesizing phosphatidylethanolamine. A similar competition occurs between DMAE and choline for the enzyme system involved in lecithin synthesis. There also appears to be an inverse relationship between the amounts of phosphatidyl-MAE and phosphatidylcholine synthesized.

192 Chino, H., Gilbert, L.I. DIGLYCERIDE RELEASE FROM INSECT FAT BODY: A POSSIBLE MEANS OF LIPID TRANSPORT. Science, N.Y. 143 (1964) 359-61.

Following injection of palmitic acid-1-^{14}C (I) into Hyalophora cecropia pupae, the specific activity of neutral fat (II) in the haemolymph was > 120-fold that in the fat body. Column chromatography revealed high radioactivity in diglyceride (III) and very low radioactivity in the triglycerides (IV). Incorporation of I into isolated fat body was very rapid, 80% of labelled II being III, although 98% of total II was IV. The specific activity of the III was almost 200-fold higher than that of the IV, suggesting that first fat body incorporates I into III then releases most of III into haemolymph. A 1.5 g fat body was incubated with I, rinsed free of I, and incubated with cell-free haemolymph. A chromatography of the neutral fat extract of haemolymph revealed rapid release of labelled III but not of labelled IV. Since a sterol (V) emerges from the column between III and IV, contaminating V was precipitated from the III fractions as the digitonide. All radioactivity remained with III. Radioassay of the eluate of a thinlayer chromatogram of the supernate showed almost all activity in a spot of mobility identical to known as well as synthetic dipalmitin-^{14}C. Following saponification of the supernate, its chromatographic mobility and almost all radioactivity corresponded to I. Identical experiments with cecropia adults give similar results except that III release was much greater. Also, in Melanoplus differentialis, II is released as III. By polyacrylamide-gel electrophoresis of haemolymph, at least two distinct proteins of cecropia pupae were found to be lipoproteins. It was demonstrated, following EtOH-Et_2O release of the lipid moiety from the lipoprotein bands, that a major portion of labelled III in haemolymph was in these bands. (CA 60: 1964, 11104c)

193(z) Clayton, R.B., Edwards, A.M. A NOVEL BIOLOGICAL DESATURATION OF THE STEROID NUCLEUS: CONVERSION OF CHOLESTANOL TO Δ^7-CHOLESTENOL IN COCKROACHES. Fedn Proc. Fedn Am. Socs exp. Biol. 21 (1962) 297. Abstr. 217.

Two species of roaches, Eurycotis floridana and Blattella germanica, were reared aseptically on synthetic diets containing 0.1% 7α-H^3-cholestanol and 0.005% 4-C^{14} cholesterol. At maturity approximately 45% of the total H^3 content of the tissues was found to be present in Δ^7-cholestenol. A number of different tissues contained H^3-Δ^7-cholestenol in about the same concentration. The identity of the H^3-Δ^7-cholestenol was revealed by gas-liquid chromatography of the sterol methyl ethers and was confirmed by hydrogenation which converted it to cholestanol under acidic conditions with a platinum catalyst but left it unchanged under neutral conditions in the presence of Raney Nickel. Contrary to the findings of other workers, using non-sterile roaches, no conversion of C^{14}-cholesterol to any other 3-hydroxy sterol could be demonstrated in these experiments. (Abstr.)

194 Clayton, R.B. THE UTILIZATION OF STEROLS IN INSECTS: A NOVEL APPROACH TO THE STUDY OF CELL-MEMBRANE STRUCTURE. Biochem. J. 96, 2 (1965) 17P.

Quantitative data support the view that the three sterols: cholesterol, cholestanol and Δ^7-cholestanol, can be considered as tracers for three types of functional spaces of different structural specificity which occur in different combinations in the different tissues of the insect. The subcellular distribution of these sterols was therefore studied in order to determine whether the different subcellular fractions showed different or similar patterns of incorporation. Muscle, fat, salivary gland, nerve and midgut tissues were dissected from the insect, homogenized with 0.32M-sucrose and fractionated by differential centrifugation to yield nuclear, mitochondrial, microsomal and supernatant fractions. In all cases the adequacy of the fractionation was confirmed by analyses of the fractions for DNA, RNA, succinic dehydrogenase and protein. The lipid extracts of the fractions were chromatographed on alumina to separate non-esterified sterols from the sterol ester and these were assayed for C^{14} and H^3. The same ratio C^{14}:H^3 was found to be present in the free sterol fraction of all subcellular particulate components of each individual tissue, though different ratios were found in different tissues. The ratios of the individual sterols or all the various particulate fractions, were essentially constant within any one tissue, but varied considerably from one tissue to another. The results are consistent with the incorporation of the sterols into a repeating unit of membrane structure which is common to all of the subcellular membrane systems of a particular tissue or cell type, but is different in different tissues.

195(2) Clayton, R.B., Edwards, A.M. CONVERSION OF 5α-CHOLESTAN-3β-OL TO Δ^7-5α-CHOLESTEN-3β-OL IN COCKROACHES. J. biol. Chem. 238 (1963) 1966-72.

In the course of the isolation and analysis of sterols the following substances were used in studies on Eurycotis floridana and Blattella germanica: cholestanol-7α-H^3, cholestanol-7β-H^3, cholestanol-4-C^{14}, cholestanol-4-C^{14}-7β-H^3, cholesterol-4-C^{14}, cholesterol-7α-H^3, cholesterol-7β-H^3, Δ^7-cholestenol-4-C^{14}, 5α-cholestane-3β,7α-diol-7β-H^3, and 5α-cholestane-3β,7β-diol-7α-H^3. The conversion of cholestanol to Δ^7-cholestenol was demonstrated. The transformation involves the loss of the 7β- and 8β-hydrogen atoms. The 3β,7α- and 3β,7β-dihydroxycholestanes do not behave as intermediates in the process. The conversion takes place slowly and apparently irreversibly in the intact animal and results in the distribution of the Δ^7-stenol in comparable concentrations throughout the body tissues. This desaturation is discussed in the light of present knowledge of other biological desaturations of the steroid nucleus, and some observations concerning its probable site of occurrence in the insect and its possible physiological significance are briefly considered.

196 Clayton, R.B., Lasser, N.L. THE INTRACELLULAR DISTRIBUTION OF STEROLS IN THE TISSUES OF THE COCKROACH, Eurycotis floridana. Fedn Proc. Fedn Am. Socs exp. Biol. 23, 2, Pt.1 (1964) 275. Abstr. 1045. Presented at the "48th Annual Meeting, Chicago, 12-17 Apr. 1964".

The roach, E. floridana, was reared on a diet containing minimal cholesterol-C^{14} (0.005%) and cholestanol-7α-H^3 (0.1%). Various tissues of the insects were separated by differential centrifugation into nuclear, mitochondrial, microsomal and soluble fractions. The distribution of C^{14} and H^3 in esterified and non-esterified sterols and more polar steroids, between the various subcellular fractions was determined. The distribution of H^3 between cholestanol and Δ^7-cholestenol (a metabolite of cholestanol) was also determined. Most of the free sterol was found in the particulate cell fractions, and the ratios of the different free sterols were closely similar in both mitochondria and microsomes of a given tissue, though they were different for different tissues. The results are consistent with the incorporation of the non-esterified sterols into a repeating unit of membrane structure common to mitochondria, endoplasmic reticulum and cell membranes of a given tissue. (Abstr.)

197 Crone, H. D. PHOSPHOLIPID COMPOSITION OF FLIGHT MUSCLE SARCOSOMES FROM THE HOUSEFLY, Musca domestica. J. Insect Physiol. 10, 3 (1964) 499-507.

The title sarcosomes (flight muscle mitochondria) were examined for lipid (I) and phospholipid (II) content. The proportions of various compounds (expressed as P as % of total I P) were phosphatidylethanolamine (III) 69, phosphatidylcholine (IV) 9, polyglycerolphosphatide (V) 6, and alkali-stable II 3%. Data are tabulated on the IV and V content of the head, thorax, and abdomen, as well as the distribution of IV and V between different thorax fractions obtained in the isolation of the sarcosomes. Most of the V of the flies occurred in the thorax. The most distinctive feature of sarcosome II composition was the low proportion of IV compared with the results for the whole body. This result was of particular interest for the flies in which the proportion of IV to III in the whole body was much reduced in comparison with the proportion found in mammalian extracts. The P of IV in the sarcosomes attained a higher specific activity than that of the III when sarcosomes were isolated 24 h after injecting ^{32}P as inorganic phosphate. The difference was considerably more marked than that found in similarly treated whole flies given ^{32}P in the larval stage, with sarcosomes isolated 8 d after emergence. The proportion of IV in sarcosomes appeared to be dependent on the diet. A dietary supply of choline increased this proportion in whole adult flied, but milk feeding had no similar effect. (CA 61: 1964, 6091g)

198 Domroese, K. A. SOME ASPECTS OF LIPID CATABOLISM IN SATURNIID MOTHS. Diss. Abstr. 25, 1 (1964) 706.

The role of lipid as an energy source in adult development and flight muscle metabolism in the giant American silkworm, Hyalophora cecropia L., was investigated. Extraction of lipid and carbohydrate and oxidation of ^{14}C-labelled substrates shows that lipid is the available substrate as well as the preferred substrate in male flight muscle metabolism. Flight muscle homogenates show greater oxidative activity with fatty acids and citric acid cycle intermediates than with glucose and glycolytic intermediates. This suggests that carbohydrate pathways are not prominent in flight muscle. The intense utilization of lipid as the fuel of flight in Cecropia moths does not involve specialized metabolic pathways but proceeds along pathways commonly found in fatty acid oxidation in other organisms. It appears however, that Cecropia flight muscle differs from that of other insects in that carbodydrate pathways are not prominent.

199 Domroese, K. A., Gilbert, L. I. THE ROLE OF LIPID IN ADULT DEVELOPMENT AND FLIGHT MUSCLE METABOLISM IN Hyalophora cecropia. J. exp. Biol. 41 (1964) 573-90.

Changes in total lipid and respiratory quotient show that female pupae of H. cecropia begin to catabolize lipid early in adult development. In males there is a conservation of lipid during adult development resulting in the male moth having about three times the lipid content of the female. In the adult moth both sexes utilize lipid as the major energy source. Lipid is the available substrate as well as the preferred substrate in flight-muscle metabolism in male moths. Data on substrate preference were obtained using ^{14}C-labelled compounds. Flight-muscle homogenates show greater oxidative activity with fatty acids and citric acid cycle intermediates than with glucose or glycolytic intermediates, indicating that carbohydrate pathways are not prominent. A fatty acid oxidizing system has been identified in flight muscle which requires ATP, magnesium and a citric acid cycle intermediate for optimum activity. Experiments with radiotracers (Na-butyrate-1-^{14}C and Na-butyrate-2-^{14}C) and metabolic inhibitors reveal that fatty acid oxidation in flight muscle proceeds via the citric acid cycle and the cytochrome chain. Active fatty acid activating enzymes are present in flight muscle, and fatty acid oxidation in H. cecropia is discussed in relation to vertebrate and other invertebrate systems.

200 Earle, N. W. STEROL UTILIZATION IN THE BOLL WEEVIL. Bull. ent. Soc. Am. 10, 3 (1964) 164. Abstr.

Adult boll weevils, Anthonomus grandis Boheman, required 20 mg of cholesterol per 100 g of diet for sustained egg production and normal longevity. Without sterol in the diet, weevils laid practically no eggs and died within two weeks. Radiotracer experiments indicated a high rate of turnover of cholesterol.

201 Gilbert, L. I., Chino, H., Domroese, K. A. LIPOLYTIC ACTIVITY OF INSECT TISSUES AND ITS SIGNIFICANCE IN LIPID TRANSPORT. J. Insect Physiol. 11, 8 (1965) 1057-70.

Manometric techniques allowed the study of esterase activity in several tissues from Hyalophora cecropia and Periplaneta americana when triacetin or tributyrin were employed as substrates. These techniques were too insensitive to detect true lipase activity (hydrolysis of long-chain fatty acid glycerides). A new lipase radioassay using triolein uniformly labelled in the carboxyl position and mixed with non-radioactive carrier as substrate uncovered lipase activity in the fat body and flight muscle of the moth and in the muscle, midgut, and fat body of the cockroach. ^{14}C-diolein was obtained from emulsified triolein partially hydrolysed by incubation with pancreatic lipase. The hydrolysis of triolein and diolein by certain insect tissues was radioassayed in Tris buffer, pH 7.2 at 30°C, the substrate being actually a mixture of labelled glyceride plus unlabelled glyceride. The enzyme source was the middle layer from a centrifuged homogenate. The digestive lipase exhibited dual pH optima while a single pH optimum was found for fat body. The fact that flight-muscle lipase hydrolyses diglycerides at a rate 5 times that of triglycerides suggests that lipid transported from the fat body, in the form of protein-bound diglyceride, enters the flight muscle as diglyceride where the lipase makes the fatty acids available for sarcosomal oxidation.

202(1) Horning, M. G. p. 60C of "Meeting of the American Chemical Society, 7 Apr. 1958".

"... found that 30% of the label of cholesterol-26-^{14}C was lost by enzymic oxidation when the sterol was incubated with an acetone powder of larvae of the sawfly, Neodiprion pratti pratti, but both the physiological significance and the nature of the products of this reaction are unknown". (p. 13 of Clayton's review on the "Utilization of Sterols by Insects" in J. Lipid Res. 5: 1964, 3, ref. 187.)

203 Kaplanis, J. N., Robbins, W. E., Monroe, R. E., Shortino, T. J., Thompson, M. J. THE UTILIZATION AND FATE OF β-SITOSTEROL IN THE LARVA OF THE HOUSEFLY, Musca domestica L. J. Insect Physiol. 11 (1965) 251-8.

Using ^{3}H-β-sitosterol, gas-liquid chromatographic analysis, and a semi-defined diet with aseptic rearing techniques, it was demonstrated that larvae of the house fly, M. domestica, do not dealkylate β-sitosterol to form cholesterol. Furthermore, the major sterol (> 99%) isolated from insects reared in the above manner on a diet containing pure unlabelled β-sitosterol (100% by GLC) was identified as unchanged β-sitosterol. Beta-sitosterol, campesterol, and cholesterol were also compared in nutritional tests in which each of these three sterols served as a sole source of sterol in both the adult and larval diets. Beta-sitosterol was only approximately one-fourth as effective as either cholesterol or campesterol in supporting larval growth and development. In addition, only 1.4% of the organisms from the diet containing β-sitosterol emerged as adults and these failed to produce viable eggs. These results demonstrate conclusively that β-sitosterol is not converted to cholesterol in the house fly and that this sterol will not fulfil in entirety the sterol requirement of this insect. (Auth.)

204 Lambremont, E. N. DISTRIBUTION OF NEWLY SYNTHESIZED FATTY ACIDS TO THE PRINCIPAL LIPID FRACTIONS OF THE BOLL WEEVIL. Bull. ent. Soc. Am. 10, 3 (1964) 164. Abstr. 99.

Fatty acids newly synthesized from injected ^{14}C-1-acetate are deposited mainly in the phospholipids of unfed adults. After the adult feeds, the distribution changes somewhat, and the neutral glycerides incorporate higher amounts of labelled fatty acid. Incorporation rates appear to correlate closely with the predominating lipid fraction. (Abstr.)

205 Lambremont, E. N. BIOSYNTHESIS OF FATTY ACIDS IN ASEPTICALLY REARED INSECTS. Comp. Biochem. Physiol. 14, 3 (1965) 419-24.

Both aseptic and non-aseptic adult boll weevils (Anthonomus grandis) synthesize long-chain fatty acids from injected acetate-1-^{14}C. Equivalent synthesis rates and patterns of fatty acid labelling also were found when acetate-2-^{14}C was the precursor. Most radioactivity was in the C_{16} and C_{18} saturated and monounsaturated fatty acids. This insect synthesized some linolenic but no linoleic acid. (CA 62: 1965, 13559c)

206 Lambremont, E. N., Stein, C. I. METABOLIC INTERCONVERSIONS OF DIETARY FATTY ACIDS IN THE BOLL WEEVIL. Bull. ent. Soc. Am. 10, 3 (1964) 164. Abstr.

Boll weevils were reared in sterile larvae diet containing isotopically-labelled fatty acids. Gas chromatography and radioassay of the body fat of unfed adults indicated desaturation of stearic and

palmitic to oleic and palmitoleic acids, respectively. The nutritionally important linoleic acid was not formed from either stearic or oleic acid. (Abstr.)

207 Lambremont, E. N., Stein, C. I., Bennett, A. F. SYNTHESIS AND METABOLIC CONVERSION OF FATTY ACIDS BY THE LARVAL BOLL WEEVIL. Comp. Biochem. Physiol. 16, 3 (1965) 289-302.

Larval Anthonomus grandis synthesized long-chain fatty acids from labelled NaOAc in the larval diet. Larvae, pupae, and newly moulted unfed adults had an identical labelling pattern. Oleic acid possessed 60% of the incorporated radioactivity. The weevil also desaturated dietary palmitic acid and stearic acid to palmitoleic acid and oleic acid. Some dietary palmitic acid underwent chain elongation to stearic acid which was desaturated subsequently. Dietary oleic acid was not hydrogenated. The weevil was unable to form linoleic acid from acetate and could not convert closely related long-chain fatty acids into linoleic acid. The direct desaturation pathway may be in operation on all dietary long-chain fatty acids and on fatty acids synthesized from acetate. (CA 64: 1966, 3997e)

208 Mehendale, H. M., Hodgson, E. METABOLISM OF CARNITINE IN THE BLOW FLY, Phormia regina. Bull. ent. Soc. Am. 11, 3 (1965) 159. Abstr. 100. Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov.-2 Dec. 1965".

Carnitine labelled with ^{14}C in either the methyl groups or the carboxyl group has been used to study the metabolism of this compound in Phormia larvae, with particular reference to the pathway leading to phosphatidyl β-methylcholine. The relation between phospholipid metabolism and dietary replacements for choline will be discussed. (Abstr.)

209 Miura, K., Vonk, H. J., Zandee, D. I., Houx, N. W. H. BIOSYNTHESIS OF UNSATURATED AND SATURATED FATTY ACIDS IN ASEPTICALLY REARED LARVAE OF Calliphora erythrocephala. Archs Int. Physiol. Biochim. 73, 1 (1965) 65-72.

Synthesis of fatty acids by blue-bottle larvae was studied by addition of acetate-1-^{14}C to the food of aseptically reared specimens. Labelling of unsaturated fatty acids was twice as high as that of saturated acids. The fatty acid composition of 3-d-old larvae, determined by gas-liquid chromatography, showed the major acids to be palmitoleic (I), 39.8%, oleic (II), 34.5%, and palmitic (III), 18.3%, whereas in 7-d-old specimens the figures were II, 33.4%, III, 27.5%, and I, 26.0%; stearic was ~3% at both ages. (CA 63: 1965, 10890h)

210 Monroe, R. E. METABOLISM AND UTILIZATION OF CHOLESTEROL-4-^{14}C FOR GROWTH AND REPRODUCTION OF ASEPTICALLY-REARED HOUSE FLIES, Musca domestica L. Diss. Abstr. 25, 3 (1964) 1539.

Flies were reared on an aseptic synthetic diet containing cholesterol-4-^{14}C and the metabolism and utilization of this sterol were studied in 2-d- and 4-d-old larvae, pupae, puparia, male and female adults, eggs oviposited by flies fed a sterol-free synthetic diet, and the utilized larval media. The larvae accumulated cholesterol-4-^{14}C at a higher rate than body weight increased, indicating a strict sterol economy and larval storage of sterols. Only a trace of radiolabelled sterol was found in the puparia. The importance of sterol for sustained viable egg production was evident. The majority of the radiolabelled compounds in the larvae and pupae were free sterols, while 15.1% of the sterols in the males and 19.3% in the female flies were esterified. After eight egg collections the adults contained fewer sterol esters than at the beginning of egg laying. Free sterols proved important for embryo growth and development, while the sterol esters were probably utilized mainly in transport and storage. The free and esterified sterol fractions were mainly composed of a Δ^5-sterol in the larvae, pupae, and male and female flies with only a trace of $\Delta^{5,7}$-sterol in the pupae and male and female flies. However, during egg production the female flies converted nearly 16% of their cholesterol-4-^{14}C to a $\Delta^{5,7}$-sterol. The first two egg collections contained ~16% $\Delta^{5,7}$-sterols, collections seven and eight nearly 36% (free sterol fraction). The highest concentration in the esterified sterol fraction (27.3%) was found in collections five and six. The increased conversion of cholesterol-4-^{14}C to a $\Delta^{5,7}$-sterol during progressive egg collections would indicate that a $\Delta^{5,7}$-sterol played an important role in embryo development. Ultraviolet spectroscopy, gas-liquid chromatography employing three different liquid phases (SE-30, QF-1, and NGS), and reverse isotope dilution demonstrated that the Δ^5-sterol was unchanged cholesterol and the $\Delta^{5,7}$-sterol 7-dehydrocholesterol. These sterols were probably used structurally per se and as precursors for more biologically active metabolites in the house fly for growth and development and viable egg production. (From Diss. Abstr. 25: 1964, 1539)

211[a] Piek, T. OVER DE VORMING VAN WAS BIJ DE HONINGBIJ. (Apis mellifera L.) (Synthesis of wax in the honeybee, Apis mellifera L.). Thesis. Utrecht Rijkuniversiteit. (Netherlands). Jun. 1962, 65p. (In Dutch, with English summary)

Newly emerged bees were fed, for one or two weeks, on a sugar paste containing either heavy water, D-labelled sodium acetate, sodium acetate-1-^{14}C or uniformly labelled glucose-^{14}C. The various lipid fractions were isolated in order to investigate the origin of the components of the secreted wax. Changes in respiratory quotient as a function of age of the imagines were determined in order to ascertain the onset of wax synthesis. Following feeding with labelled acetate, isolated hydrocarbons and free wax acids were heavily labelled whereas esters and their constituent acids and alcohols were labelled lightly. Heavy water or glucose each gave the same relative labelling of the various lipid fractions of the wax. Autoradiography showed oenocytes to be 30% more radioactive than fat cells after feeding acetate-1-^{14}C. No pronounced differences were found after feeding glucose-^{14}C. It is proposed that the oenocytes synthesize wax acids and hydrocarbons from acetate originating from glycolysis in fat cells, and that the fat cells themselves synthesize the esters as well as the necessary acids and alcohols from acetate originating from the glycolysis in these cells. Oenocytes are suggested to take up acetate directly, in contrast to fat cells.

212 Piek, T. SYNTHESIS OF WAX IN THE HONEYBEE (Apis mellifera L.). J. Insect Physiol. 10, 4 (1964) 563-72.

Newly emerged honeybee workers were fed during 1 or 2 weeks with sucrose containing either heavy water, sodium acetate with deuterium, sodium acetate-1-^{14}C, or uniformly labelled glucose-^{14}C. The various lipid fractions were isolated in order to investigate the origin of the secreted wax components. In feeding acetate with deuterium or ^{14}C the isolated hydrocarbons and free wax acids were heavily labelled, but not the esters or their component acids and alcohols. Feeding uniformly labelled glucose or heavy water caused no extreme differences in the labelling of different lipid fractions. Radioactivity of the oenocytes was 30% higher than that of the fat cells (micro-autoradiographic assays) after feeding acetate-1-^{14}C, but no distinct difference was found after feeding uniformly labelled glucose-^{14}C. In order to interpret these facts the oenocytes were assumed to take up directly the acetate fed to the animals, but not so the fat cells. A proposed hypothesis supposes that oenocytes synthesize wax acids and hydrocarbons from acetate originating from the glycolysis in the fat cells, and that fat cells synthesize the esters as well as their component acids and alcohols from acetate originating from the glycolysis in these cells. (From auth.)

213 Schaefer, C. H. FATTY ACIDS OF THE VIRGINIA PINE SAWFLY, Neodiprion pratti Dyar. Can. Ent. 97, 9 (1965) 941-4.

The incorporation into fatty acids of uniformly labelled glucose (12.0 mCi/mM), [1-^{14}C]sodium acetate (11.4 mCi/mM) and [2-^{14}C] mevalonate (1.37 mCi/mM), injected into 4th- and 5th-instar larvae, is tabulated (Table 3). Glucose incorporation was relatively low, [1-^{14}C] acetate relatively high. Most of the radioactivity incorporated into the total lipids from [2-^{14}C] mevalonate was lost after saponification. Lipids account for approx. 8% of the wet weight of N. pratti larvae. Fatty acids comprise 80% of the total lipids. Approximately 75% of the fatty acids are unsaturated and > 70% have 18 carbons. Four unknowns were characterized as being polyunsaturates of 16 and 18 carbons.

214 Schaefer, C. H., Kaplanis, J. N., Robbins, W. E. THE RELATIONSHIP OF THE STEROLS OF THE VIRGINIA PINE SAWFLY, Neodiprion pratti Dyar, TO THOSE OF TWO HOST PLANTS, Pinus virginiana Mill AND Pinus rigida Mill. J. Insect Physiol. 11, 7 (1965) 1013-21.

Approximately 0.1% of the wet weight of N. pratti larvae is composed of sterols of which 73% is cholesterol, 6% is 7-dehydrocholesterol, 4% is campesterol, and 17% β-sitosterol. The sterol composition of the foliage of two host plants was as follows: P. virginiana — β-sitosterol (92%), campesterol (7%), and 'cholesterol' (< 1%), and P. rigida — β-sitosterol (94%) and campesterol (6%). The following ^{14}C-substrates were injected: 1-^{14}C-sodium acetate (122 650 cpm/μg), 2-^{14}C-mevalonic acid-N,N'-dibenzylethylenediamine salt (5000 cpm/μg based on free mevalonic acid), and ^{14}C-uniformly labelled glucose (114 700 cpm/μg). No larval biosynthesis of sterols from these substrates was apparent. The dealkylation of ^{3}H-β-sitosterol to ^{3}H-cholesterol by sawfly larvae was studied. Data of a gas-liquid chromatographic analysis of ^{3}H-sterols from flies fed ^{3}H-β-sitosterol and results of an analysis of the ^{3}H-sterols from sawflies by reverse isotope dilution with authentic

211(2) Piek, T. OVER DE VORMING VAN WAS BIJ DE HONINGBIJ. (Apis mellifera L.) (Synthesis of wax in the honeybee, Apis mellifera L.). Thesis. Utrecht Rijkuniversiteit. (Netherlands). Jun. 1962, 65p. (In Dutch, with English summary)

Newly emerged bees were fed, for one or two weeks, on a sugar paste containing either heavy water, D-labelled sodium acetate, sodium acetate-1-^{14}C or uniformly labelled glucose-^{14}C. The various lipid fractions were isolated in order to investigate the origin of the components of the secreted wax. Changes in respiratory quotient as a function of age of the imagines were determined in order to ascertain the onset of wax synthesis. Following feeding with labelled acetate, isolated hydrocarbons and free wax acids were heavily labelled whereas esters and their constituent acids and alcohols were labelled lightly. Heavy water or glucose each gave the same relative labelling of the various lipid fractions of the wax. Autoradiography showed oenocytes to be 30% more radioactive than fat cells after feeding acetate-1-^{14}C. No pronounced differences were found after feeding glucose-^{14}C. It is proposed that the oenocytes synthesize wax acids and hydrocarbons from acetate originating from glycolysis in fat cells, and that the fat cells themselves synthesize the esters as well as the necessary acids and alcohols from acetate originating from the glycolysis in these cells. Oenocytes are suggested to take up acetate directly, in contrast to fat cells.

212 Piek, T. SYNTHESIS OF WAX IN THE HONEYBEE (Apis mellifera L.). J. Insect Physiol. 10, 4 (1964) 563-72.

Newly emerged honeybee workers were fed during 1 or 2 weeks with sucrose containing either heavy water, sodium acetate with deuterium, sodium acetate-1-^{14}C, or uniformly labelled glucose-^{14}C. The various lipid fractions were isolated in order to investigate the origin of the secreted wax components. In feeding acetate with deuterium or ^{14}C the isolated hydrocarbons and free wax acids were heavily labelled, but not the esters or their component acids and alcohols. Feeding uniformly labelled glucose or heavy water caused no extreme differences in the labelling of different lipid fractions. Radioactivity of the oenocytes was 30% higher than that of the fat cells (micro-autoradiographic assays) after feeding acetate-1-^{14}C, but no distinct difference was found after feeding uniformly labelled glucose-^{14}C. In order to interpret these facts the oenocytes were assumed to take up directly the acetate fed to the animals, but not so the fat cells. A proposed hypothesis supposes that oenocytes synthesize wax acids and hydrocarbons from acetate originating from the glycolysis in the fat cells, and that fat cells synthesize the esters as well as their component acids and alcohols from acetate originating from the glycolysis in these cells. (From auth.)

213 Schaefer, C.H. FATTY ACIDS OF THE VIRGINIA PINE SAWFLY, Neodiprion pratti Dyar. Can. Ent. 97, 9 (1965) 941-4.

The incorporation into fatty acids of uniformly labelled glucose (12.0 mCi/mM), [1-^{14}C]sodium acetate (11.4 mCi/mM) and [2-^{14}C] mevalonate (1.37 mCi/mM), injected into 4th- and 5th-instar larvae, is tabulated (Table 3). Glucose incorporation was relatively low, [1-^{14}C] acetate relatively high. Most of the radioactivity incorporated into the total lipids from [2-^{14}C] mevalonate was lost after saponification. Lipids account for approx. 8% of the wet weight of N. pratti larvae. Fatty acids comprise 80% of the total lipids. Approximately 75% of the fatty acids are unsaturated and > 70% have 18 carbons. Four unknowns were characterized as being polyunsaturates of 16 and 18 carbons.

214 Schaefer, C.H., Kaplanis, J.N., Robbins, W.E. THE RELATIONSHIP OF THE STEROLS OF THE VIRGINIA PINE SAWFLY, Neodiprion pratti Dyar, TO THOSE OF TWO HOST PLANTS, Pinus virginiana Mill AND Pinus rigida Mill. J. Insect Physiol. 11, 7 (1965) 1013-21.

Approximately 0.1% of the wet weight of N. pratti larvae is composed of sterols of which 73% is cholesterol, 6% is 7-dehydrocholesterol, 4% is campesterol, and 17% β-sitosterol. The sterol composition of the foliage of two host plants was as follows: P. virginiana — β-sitosterol (92%), campesterol (7%), and 'cholesterol' (< 1%), and P. rigida — β-sitosterol (94%) and campesterol (6%). The following ^{14}C-substrates were injected: 1-^{14}C-sodium acetate (122 650 cpm/μg), 2-^{14}C-mevalonic acid-N,N'-dibenzylethylenediamine salt (5000 cpm/μg based on free mevalonic acid), and ^{14}C-uniformly labelled glucose (114 700 cpm/μg). No larval biosynthesis of sterols from these substrates was apparent. The dealkylation of ^{3}H-β-sitosterol to ^{3}H-cholesterol by sawfly larvae was studied. Data of a gas-liquid chromatographic analysis of ^{3}H-sterols from flies fed ^{3}H-β-sitosterol and results of an analysis of the ^{3}H-sterols from sawflies by reverse isotope dilution with authentic

cholesterol and purification through dibromide recrystallization are tabulated (Table III and IV). The sawfly dealkylates the phytosterols to cholesterol and presumably obtains its required cholesteral in this manner.

215 Sridhara, S., Bhat, J.V. INCORPORATION OF [1-^{14}C] ACETATE INTO THE LIPIDS OF THE SILKWORM Bombyx mori L. Biochem. J. 91, 1 (1964) 120-3.

Silkworm larvae and pupae have been shown to incorporate ^{14}C into lipid at a high rate after the injection or ingestion of [1-^{14}C]acetate. The saponifiable fraction of the lipid recovered from the insect contained two or more times the radioactivity of the unsaponifiable fraction. The sterol fraction did not contain any radioactivity. Most of the radioactivity in the saponifiable fraction was present in palmitic acid, stearic acid and oleic acid, and the polyunsaturated acids were non-radioactive. The amount of radioactivity incorporated was higher in the male than in the female pupae. (Auth. summary)

216 Sridhara, S., Bhat, J.V. FURTHER INVESTIGATIONS OF THE INCORPORATION OF [1-^{14}C]ACETATE INTO THE LIPIDS OF THE SILKWORM Bombyx mori L. Biochem. J. 94, 3 (1965) 700-4.

After the injection of sodium [1-^{14}C]acetate, the highest incorporation of ^{14}C into the lipids of the silkworm was observed after 24 h. The specific radioactivity of the palmitic acid fraction was greater and increased more rapidly than that of the stearic acid fraction, which was consistent with the precursor-product relationship to be expected on the basis of current concepts of fatty acid synthesis in vivo. The results indicate the probability of synthesis of lipid components in tissues other than the fat body. Fractionation studies indicate considerable differences in the rate of incorporation of [1-^{14}C]acetate into neutral lipids and phospholipids between larvae and pupae as well as among tissues of larvae. The rate of incorporation of [1-^{14}C]acetate remains constant throughout pupal development. (Auth.)

217 Sridhara, S., Bhat, J.V. INCORPORATION OF MEVALONATE-2-^{14}C INTO THE LIPIDS OF THE SILKWORM Bombyx mori. Life Sci. 4, 2 (1965) 167-71.

After administration of mevalonic-2-^{14}C acid to silkworms, maximum incorporation of radioactivity into lipids was 11.8% which occurred at 4 h. Approximately 47% of lipid radioactivity was in a saponified fraction and 3% was unsaponified. Approximately 75% of the ^{14}C in the saponified fraction could be identified as palmitic, stearic, and oleic acids, while 80-90% of the ^{14}C in the unsaponified fraction was isolated as hydrocarbons (10-11%), ubiquinone (14-17%), ubichromenol (20-22%), sterols (3-4%), and highly unsaturated alcohols (34-40%). (CA 62:1965, 15129c)

218 Svoboda, J.A. DEALKYLATION OF H^3-γ-SITOSTEROL IN AMERICAN COCKROACHES AND TOBACCO HORNWORMS. Bull. ent. Soc. Am. 11, 3 (1965) 159. Abstr. 97. Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov.-2 Dec. 1965".

The metabolism of ^{3}H-β-sitosterol in the American cockroach and tobacco hornworm was investigated. The free and ester sterol fractions in certain tissues and organs were examined for the presence of ^{3}H-β-sitosterol and its dealkylation product (^{3}H-cholesterol) in an attempt to define the sites and possible transport routes involved in dealkylation. (Abstr.)

219 Taylor, J.F., Hodgson, E. THE ORIGIN OF PHOSPHOLIPID ETHANOLAMINE IN THE BLOWFLY, Phormia regina (Meig.). J. Insect Physiol. 11 (1965) 281-5.

The predominant phospholipids of P. regina are those containing ethanolamine. The origin of this ethanolamine has been investigated by feeding possible precursors labelled with ^{14}C to larvae raised under axenic conditions on a chemically defined diet free of ethanolamine or serine. The phospholipids were extracted, chromatographed on silicic acid columns, and the nature of the radioactive fragments in acid hydrolysates determined. ^{14}C-labelled ethanolamine was isolated from the phospholipids of larvae raised on media containing 15.0 μCi 1,3-^{14}C-ethanolamine, 4.8 μCi uniform-^{14}C-serine; 4.8 μCi uniform-^{14}C-glycine; or 30 μCi labelled sodium formate.

220(2) Tietz, A. FAT SYNTHESIS IN CELL-FREE PREPARATIONS OF LOCUST FAT-BODY. p. 85-89 of "Biosynthesis of Lipids. Proceedings of the 5th International Congress of Biochemistry, Moscow, 10-16 Aug. 1961, Vol. 7". Popják, G., Ed. Oxford, Pergamon Press. 1963.

Fat-body tissue from ♂ and ♀ migratory locust, Locusta migratoria, (7-14 d after last moult) were used as tissue homogenates. They were able to synthesize fatty acids from ^{14}C-acetate when supplemented with ATP, $MgCl_2$, glutathione, $KHCO_3$ and malonate. Addition of CoA (coenzyme A) and TPN (triphosphopyridine nucleotides) further stimulated synthesis. Malonate could not be replaced by any intermediate of the glycolytic or Krebs cycle. However, the addition of some of these intermediates in the presence of malonate caused further stimulation. The best results were obtained with α-ketoglutarate. Tabulated data are presented on the components required for fatty acid synthesis (Table I), on the composition of glyceride-fatty acids (Table II), and on the metabolism of acetate-1-^{14}C and of malonate-1-^{14}C studied in the homogenate, supernatant, and particles (Table III).

221 Vroman, H. E., Kaplanis, J. N., Robbins, W. E. EFFECT OF ALLATECTOMY ON LIPID BIOSYNTHESIS AND TURNOVER IN THE FEMALE AMERICAN COCKROACH, Periplaneta americana (L.) J. Insect Physiol. 11, 7 (1965) 897-904.

The control of the corpora allata over lipid biosynthesis and turnover was studied in the American cockroach, P. americana (L.), by using 1-^{14}C-acetate as a precursor. The labelled acetate was injected into allatectomized and control roaches and the time-curve of the appearance of label in lipid fractions was determined. It was found that the greatest effect was in the triglyceride fraction, which was more than twice as much per roach in the operated insects, whereas no obvious effect was noted on the hydrocarbon fraction. Allatectomy noticeably slowed the turnover of both triglyceride and phospholipids. (Auth.)

222 Vroman, H. E., Kaplanis, J. N., Robbins, W. E. CHOLESTEROL TURNOVER IN THE AMERICAN COCKROACH, Periplaneta americana. J. Lipid Res. 5, 3 (1964) 418-21.

Turnover of cholesterol (I) in P. americana is slow relative to that in mammals, as determined by feeding I-4-^{14}C in the diet. At least 40% of carcass I is exchangeable with dietary I. (CA 61:1964, 7422g)

223(2) Weaver, N., Law, J. H. HETEROGENEITY OF FATTY ACIDS FROM ROYAL JELLY. Nature, Lond. 188 (1960) 938-9.

Sodium acetate-1-^{14}C and sodium stearate-1-^{14}C were fed to worker bees and also included in an incubation medium with excised mandibular glands. In both cases considerable radioactivity was detected in lipid extracts of the mandibular glands, but the hydroxy fatty acid fraction did not become labelled.

224 Wiens, A. W., Gilbert, L. I. REGULATION OF COCKROACH FAT-BODY METABOLISM BY THE CORPUS CARDIACUM IN VITRO. Science, N. Y. 150 (1965) 615-6.

Incubation in vitro of young, adult, male Leucophaea maderae fat body with extracts of corpora cardiaca or intact corpora cardiaca results in stimulation of oxygen consumption but reduction in CO_2 evolved from carbohydrate. The $^{14}CO_2$ resulting from the oxidation of uniformly labelled glucose-^{14}C was only about 70% of the controls. In the experiments on oxidation, the incubation medium contained 3 ml of Ringer solution and 2×10^6 cpm of sodium acetate-1-^{14}C or sodium palmitate-1-^{14}C. The carbohydrate is preferentially used for trehalose synthesis, and the endogenous metabolism of the fat body appears to be supported by increased lipid utilization. A hormone from the corpus cardiacum is most likely responsible for these effects and may act at two points, at least, in the glycolytic pathway.

See also:

43-a Biosynthesis of royal jelly fatty acid from sucrose. (Brown, W. H. et al., 1962)
46 Studies on the interconversion of carbohydrate and fatty acid in Hyalophora cecropia. (Chino, H., Gilbert, L. I., 1965)
48 The metabolism of glucose and its conversion into long-chain fatty acids by the boll weevil. (Lambremont, E. N., 1965)
51 Interconversion of carbohydrate and fat in the silkworm Bombyx mori L. (Sridhara, S., Bhat, J. V., 1965)
80 The chemistry and physiology of the brain hormone. (Kobayashi, M., 1963)

136 Meetings. Insect biochemistry. (Levenbook, L., 1965)

246 Intermediary metabolism and the insect fat body. (Kilby, B.A., 1965)

261 $C^{14}O_2$ production in the boll weevil, Anthonomus grandis, after injection of ^{14}C-1-acetate. (Lambremont, E. N., Stein, C. I., 1965)

7. Organic Acids

225 Brenner-Holzach, O., Leuthardt, F. ORIGIN OF THE C-2 AND C-8 ATOMS IN URIC ACID IN Drosophila melanogaster. Helv. chim. Acta 48, 5 (1965) 1147-51. (In German)

When D. melanogaster were fed with glucose-1-^{14}C and glucose-6-^{14}C, more ^{14}C was incorporated in C-2 and C-8 of uric acid from glucose-6-^{14}C. The ^{14}C from serine-3-^{14}C was also incorporated into C-2 and C-8 of uric acid. In homogenates of Drosophila larvae, more $^{14}CO_2$ came from glucose-1-^{14}C than from glucose-6-^{14}C. Thus, glucose was oxidized by glycolytic and glucose phosphate shunt pathways in Drosophila. Most of the active formate used to synthesize purines was derived from C-3 of serine. (CA 63: 1965, 8783f)

226 Corrigan, J. J. STUDIES IN D-SERINE AND D-2, 3-DIAMINIPROPIONIC ACID IN Bombyx mori. Bull. ent. Soc. Am. 11, 3(1965) 159. Abstr. 93. Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov.-2 Dec. 1965".

The origin of D-2, 3-diaminipropionic acid (DAPA) in gastro-intestinal fluid of Bombyx larvae and its possible relationship to D-serine, were investigated. Glucose-^{14}C was incorporated by larvae into a compound with properties of D-DAPA. That tent caterpillars lack both D-serine and DAPA may be pertinent. (Abstr.)

227 Hitchcock, M., Smith, J. N. COMPARATIVE DETOXICATION. XIII. DETOXICATION OF AROMATIC ACIDS IN ARACHNIDS; ARGININE, GLUTAMIC ACID, AND GLUTAMINE CONJUGATIONS. Biochem. J. 93, 2 (1964) 392-400.

Conjugation of p-nitrobenzoic acid, p-aminobenzoic acid, and benzoic acid-^{14}C has been studied in representatives of three arachnid orders. N^2-Aroylarginines were formed in each species. In Boophilus, Tegenaria, Agelena, and Epeira aroylglutamic acids were also found. In Tegenaria, Epeira, Agelena, Mitopus, and Phalangium, N^2-aroylglutamines were found. (CA 61: 1964, 13669c)

8. Antimetabolites

See:

134 Some factors influencing the utilization of tritiated thymidine in grasshopper embryos. (Leach, W.M., 1965)

9. Cell. Tissue. Organ

228(2) Beermann, W. RIESENCHROMOSOMEN. (Giant chromosomes). Protoplasmatologia 6 (1962) 1-161. (In German)

Review.

229 Panitz, R. HORMONKONTROLLIERTE GENAKTIVITÄTEN IN DEN RIESENCHROMOSOMEN VON Acricotopus lucidus. (Hormone-controlled gene activity in the giant chromosomes of Acricotopus lucidus). Biol. Zbl. 83 (1964) 197-230. (In German, with English summary)

In each lobe of the tripartite midge salivary gland, the chromosomes show a characteristic pattern of puffs. Numerous studies are cited throughout in which radioisotopes had been used to study puffs and puff formation. In the anterior lobe, Balbiani rings at loci BR-3 and BR-4 regress during the prepupal stage.

Experiments have been performed to determine the cause of temporal variation. Transplantation from the larva into the prepupa of Acricotopus or other Diptera inactivate the two puffs as does cultivation in prepupal haemolymph or in larval haemolymph to which pupal brain complex has been added. There is no effect upon transplantation into other larvae or larval haemolymph. The inactivating factor seems to originate from a part of the ring gland responsible for the production of ecdysome. Temperature as well as hormone concentration influences the process. Loci I/H-18 and II/Q-32 also undergo alterations in similar experiments.

230 Berendes, H. D. SALIVARY GLAND FUNCTION AND CHROMOSOMAL PUFFING PATTERNS IN Drosophila hydei. Chromosoma 17, 1 (1965) 35-77.

The relation between a specific cell function and the puffing pattern was studied in the salivary gland of D. hydei, which shows two different types of cell during the late 3rd instar. An attempt was made to elucidate the factors which might be involved in the differentiation of these two types of cell and the changes in activity or regulation of the puffs involved. The first signs of these differences first appear as an increase in the cellular and nuclear volume in the distal cells of the gland, starting at 103 h after oviposition. Subsequent changes and probable secretory function are described. Determination of nuclear diameter and DNA in nuclei of both parts of the gland revealed a correlation between a particular DNA content and the function of the cell. Distal cells show higher nuclear diameters than proximal cells after the onset of granule production. The first differences in nuclear diameter can be seen at 103 h. The total puffing pattern during late larval and early pupal development was studied, details of the techniques being given (light-, phase- and electron microscopy were used). Puffing patterns were determined at several time intervals during the 3rd instar, prepupal and early pupal stages. Puff activities were determined by comparing the diameter of the puffed regions with that of the neighbouring non-puffed regions. A total number of 148 puffs were present during some period of the 3rd instar, prepupal, and early pupal stages. The activity of 110 puffs was evaluated during a series of successive time intervals. Changes in the puffing pattern during puparium formation were compared with those observed during pupation. Proximal and distal nuclei differ in the activity level of a number of puffs, but only puff 47 B is restricted in activity to the distal cells. This puff becomes active at 119 h and disappears 4 h before puparium formation (156 h). For autoradiography, dissected glands were incubated for 30 min in a Ringer solution containing 10 µCi/ml ^{3}H-uridine (specific activity 1.29 Ci/mM). An exposure time of 3 weeks was required.

231 Gabrusewycz-Garcia, N. CYTOLOGICAL AND AUTORADIOGRAPHIC STUDIES IN Sciara coprophila SALIVARY GLAND CHROMOSOMES. Chromosoma 15, 3 (1964) 312-44.

Morphological and metabolic changes on the salivary chromosomes of S. coprophila were followed during the later half of the 4th larval instar. Cytological maps were prepared for five successive stages from mid 4th instar to the prepupal stage, which summarized the cytological findings and were the basis for studies on DNA replication of these chromosomes. In the autoradiographic experiments use was made of ^{3}H-thymidine as DNA precursor. Marked differences in the relative rates of uptake of ^{3}H-thymidine of a number of bands in a certain proportion of chromosomes were observed, while others with uniform incorporation were found more frequently. The period of uniform labelling must therefore comprise a greater part of the replication cycle than the periods of localized labelling. To assess the validity and constancy of the observed patterns of unequal incorporation, a semi-quantitative analysis was carried out. It showed that the bands with localized uptake may be separated into two broad groups, one of them containing the centromere regions and certain chromosomal ends, which are presumably heterochromatic, the other most of the puff sites and bulbs. Since late replication is characteristic of heterochromatin, bands of the first group (C) were assumed to replicate late in the cycle, puffs and bulbs to start early, and the period of equal labelling to be intermediate. Other intermediate labelling patterns were observed and are described. It is known that in the 4th instar from two to three DNA replications occur in the salivary gland nuclei, the last of which coincides with puffing. Several stages may be distinguished in the puffing process based on morphology and rates of isotope uptake of the puffs. The first sign of puffing is a very high rate of incorporation at puffs. It is maintained throughout this last period of DNA synthesis and only declines when all other chromosomal regions have ceased to replicate. A pattern of high and exclusive uptake at the heterochromatic sites (pattern C) was never observed in this replication; instead puffs are the last regions to terminate DNA synthesis. The results are discussed in relation to asynchronous DNA replication, the problem of "metabolic DNA", and the conept of the heterochromatic state.

232 Gabrusewycz-Garcia, N. STUDIES OF NUCLEAR RNA IN THE SALIVARY GLAND OF Sciara coprophila. J. Cell. Biol. 27, 2 (1965) 31A-32A. Abstr. 58. Paper presented at the "5th Annual Meeting of the American Society for Cell Biology, 10-12 Nov. 1965, Philadelphia".

Staining techniques (azure A and toluidine blue at pH 4.0) combined with ribonuclease digestion were used, as well as autoradiography with ^{3}H-uridine. A striking characteristic of these nuclei is the extensive fluctuation in the rate of RNA synthesis in glands from different larvae. There is also variation in the proportion of extrachromosomal to puff RNA, probably related to metabolic events preceding metamorphosis. A typical nucleolar organizer is present in these nuclei, associated with a large cluster of micronucleoli. This conclusion was reached after examination of sectioned material and smear preparations of salivary, midgut, and Malpighian tubule nuclei. The nucleolar organizer was localized in the proximal heterochromatic end of the X-chromosome. In addition, a smaller number of micronucleoli of identical appearance are produced at many other bands. A careful analysis was made to localize these bands with respect to their map position. The majority were identified with the heteropycnotic regions which, from a previous study, are known to be asynchronous in their DNA replication. It was also observed that micronucleoli are produced at the DNA puffs, a fact previously known, and occasionally at bulbs. As yet we have no direct information on the functional significance and the interrelations of these different RNA-containing structures. (From abstr.)

233 Jacob, J., Sirlin, J.L. ELECTRON MICROSCOPE AUTORADIOGRAPHY OF THE NUCLEOLUS OF INSECT SALIVARY GLAND CELLS. Nature, Lond. 202 (1964) 622-23.

Larval salivary glands of the chironomid Smittia were incubated in vitro for 20-25 min in Morgan, Morton and Parker's Medium 199 supplemented with ^{3}H-uridine at 60 µCi/cc (specific activity 3.0 Ci/mM). After incubation the glands were fixed in cold 1% OsO_4 buffered with veronal acetate and embedded in methacrylate mixture. Pale gold sections were mounted on grids (Formvar on nickel), subsequently covered with Ilford L4 emulsion. After varying exposures at 4-5°C they were developed in Kodak D-19b or "Microdol-X" for 5 min at 20°C, and fixed for 10 min in acid hardening fixer (Johnson's "FIX-SOL") diluted 9 times with water. Grids were then stained for at least 1 h in a saturated solution of uranyl acetate in 50% alcohol, the gelatine being removed at that stage or earlier on. A definite autoradiographic response is obtained over the nucleolus after a 60 d exposure. The autoradiographs shown were obtained after a 90 d exposure. The organizer evidently does not contribute to any observable extent to the synthesis of nucleolar RNA in the larval salivary gland of cells of Smittia.

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234 Bowers, W.S., Thompson, M.J. IDENTIFICATION OF THE MAJOR CONSTITUENTS OF THE CRYSTALLINE POWDER COVERING THE LARVAL CUTICLE OF Samia cynthia ricini (Jones). J. Insect Physiol. 11, 7 (1965) 1103-11.

A white crystalline powder was observed to accumulate superficially on the larval cuticle of S. cynthia ricini (Jones). Most of this powder (92.6%) was shown to be a mixture of two straight chain saturated alcohols, 99.4% n-triacontanol ($C_{30}H_{62}O$) and 0.8% n-octacosanol ($C_{28}H_{58}O$). Larval synthesis of these alcohols was demonstrated by injecting 2-d-old 5th instar larvae with 3 million counts of 1-^{14}C-sodium acetate (specific activity 23.6×10^6 cpm/mg) each. Subsequent analyses are described.

235 Lipke, H., Leto, S., Graves, B. CARBOHYDRATE-AMINO ACID CONVERSIONS DURING CUTICLE SYNTHESIS IN Periplaneta americana. J. Insect Physiol. 11, 9 (1965) 1225-32.

The administration of glucose-U-^{14}C to larvae resulted in significant incorporation of isotope into nutritionally essential amino acids in 24 h. Valine, tyrosine, phenylalanine, histidine, and threonine of cuticle and fat body protein acquired radioactivity indicating that this transformation was mediated with the aid of the intracellular symbionts. The leucines, however, originated primarily in the diet. No significant difference in the rate of synthesis of these amino acids was observed between the fourth and eighth day postmoult although some depression in symbiont activity may have occurred in the premoult stage. The specific activity of the glutamic acid, glycine, threonine, proline, and valine free in the blood was of the same order of magnitude as that newly incorporated in the cuticle protein. Cuticle alanine, however, exceeded plasma and fat body alanine in specific activity by

a factor of three or more. Phenylalanine and tyrosine may share a common precursor rather than exist in a product-precursor relation and the same may be true of the glutamic acid-proline pair. A high rate of conversion of proline to trehalose characterized the intermoult period; serine, however, was not glycogenic in this species. In experiments with glucose-1-^{14}C and L-proline-3,4-^{3}H the radioactive compounds were injected simultaneously on the second day following moulting.

236 Locke, M. Condoulis, W.V., Hushman, L.F. MOLT AND INTERMOLT ACTIVITIES IN THE EPIDERMAL CELLS OF AN INSECT. Science, N.Y. 149 (1965) 437-8.

In the larva of the butterfly Calpodes ethlius (Lepidoptera: Hesperiidae) moult and intermoult syntheses by the epidermis were each preceded by a phase of RNA synthesis. Endocuticle deposition and the secretion of wax are controlled not only by the moulting hormone when they take place during the intermoult period. The control of endocuticle deposition was studied autoradiographically, using ^{3}H-glucose as a marker for chitin and ^{3}H-tyrosine for the protein component. RNA synthesis was studied using ^{3}H-uridine (10 µCi/g weight of Calpodes larva, in 0.1 ml Ringer solution).

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237 Akai, H., Kobayashi, M. INCORPORATION OF LABELLED THYMIDINE INTO THE SILK GLAND OF THE SILKWORM. Nature, Lond. 206 (1965) 847-8.

Electron microscopic autoradiography was used to study silk glands of Bombyx mori larvae (5th day after 4th moult). Silk glands were dissected out either 30 min or 2 h after injection of 50 µCi of thymidine-6-^{3}H. The technique used subsequently is described. Results indicated that in the nucleus of the silk gland DNA is synthesized on chromatin bodies and diffuse chromatins prior to the so-called endomitosis without cell division. The function of the chromatin in the nucleus of the silk gland may therefore well correspond to that of the polytene chromosome in the salivary gland of Diptera, although no chromosomes have yet been observed in the silk gland of B. mori.

238 Berreur, P. EFFECT OF THE MOLTING HORMONE ON THE SYNTHESIS OF NUCLEIC ACIDS IN THE IMAGINAL DISKS OF Calliphora erythrocephala. C.r. hebd. Séanc. Acad. Sci., Paris 260, 10 (1965) 2914-16. (In French)

The synthesis of DNA and RNA in C. erythrocephala was studied by a historadiographic technique applied to normal larvae and to larvae deprived of the moulting hormone by removal of the Weissmann ring. In the absence of the hormone, DNA synthesis disappeared and elaboration of RNA was considerably reduced. The re-introduction of the hormone by implantation of the Weissmann ring caused the re-appearance first of RNA synthesis in the nucleus and later the elaboration of new molecules of DNA. (CA 62: 1965, 15136f)

239(2) Bier, K. AUTORADIOGRAPHISCHE UNTERSUCHUNGEN ÜBER DIE LEISTUNGEN DES FOLLIKEL-EPITHELS UND DER NÄHRZELLEN BEI DER DOTTERBILDUNG UND EIWEISSYNTHESE IM FLIEGEN-OVAR. (Autoradiographic investigations on the function of the egg follicles and the nurse cells during yolk formation and protein synthesis in the fly ovary). Wilhelm Roux Arch. EntwMech. Org. 154, 6 (1963) 552-75. (In German, with English summary)

Development of the egg-follicle in Calliphora erythrocephala and Musca domestica (similar for both) is divided into six stages. This study concentrates on stages two and three when yolk formation is already initiated while the nurse cells are still in their full functional phase. The incorporation of ^{3}H-L-histidine was followed during different incubation periods. From the shift of the maximum radioactivity from the follicle epithelium with a high turnover to the nurse cells it is concluded that the pool of the labelled amino acid is largely exhausted 1 h after injection. The radioactivity of the yolk border and spheres is ascribed to labelled proteins, which are transported into the oocyte with the help of the follicle cells. By ovary implantation in previously incubated host females the path of the yolk precursors through the intercellular spaces in the follicle epithelium up to the cortical regions of the oocyte was effectively demonstrated, without any cytoplasmic incorporation of ^{3}H-histidine. The entry of labelled protein from the nurse cells into the oocyte during stage two is questionable, and improbable during stage three. During this period, however, RNA (labelled by using ^{3}H-cytidine and ^{3}H-uridine) from the nurse cells enters the oocyte via the intercellular cytoplasmic bridges and there maintains protein synthesis. In stage four the cytoplasm of the degenerating nurse cells flows into the oocyte. The significance of the function of the nurse cells as sources

of RNA and cytoplasm, which exert direct influence on ooplasmic growth and embryonic development is discussed relative to the follicle cells which gather and transport blood proteins intended for deposition in the yolk platelets.

240 Engels, W., Drescher, W. EINBAU VON H^3-D-GLUCOSE WÄHREND DER OOGENESE BEI Apis mellifica L. (Incorporation of H^3-D-glucose during oogenesis in Apis mellifica L.). Experientia 20, 8 (1964) 445-7. (In German, with English summary)

The incorporation of ^3H-glucose into the ovary of honeybee queens was studied by autoradiography. During the last stages of oogenesis, the synthesis of respectable amounts of glycogen was found in the reticulolasm of the developing eggs. The follicle epithelium and also the nurse cells only appeared more lightly and transitorily labelled at medium stages. A hypothesis was established concerning an antagonism of protein and polysaccharide formation in the cytoplasm corresponding to the rather late occurrence of glycogen in insect oogenesis. (Auth. summary).

241 Feir, D., O'Connor, G.M., Jr. MITOTIC ACTIVITY IN THE HEMOCYTES OF Oncopeltus fasciatus (Dall). Expl Cell Res. 39, 2-3 (1965) 637-42.

Milk weed bugs received 2 µl of ^3H-thymidine solution and the controls 2 µl of 0.7% saline. The tritium had a specific activity of 1.90 Ci/mM and a concentration of 0.50 mCi/ml. Each insect was injected once and bled once. The 5th instars used showed high peaks of incorporation of ^3H-thymidine into their haemocytes on 5-6 and 9-10 d after moult, regardless of the day in the fifth stadium when the injection of thymidine is given. In most groups there was considerable delay after injection before incorporation was seen in the haemocytes, and no incorporation was seen when the thymidine was administered 48 and 24 h before the adult moult. Variable percentages (0-15) of mitosis were seen throughout the stadium. There was no correlation of the mitotic index with post-moult age of the insect, day of injection, or peaks of ^3H-thymidine incorporation. Delayed incorporation in the haemocytes, sudden very high peaks of cells with incorporation, and a low level of mitotic activity in the haemocytes compared with the sudden high percentages of cells with incorporation indicate that a portion of the circulating haemocytes are formed in fixed tissue sites or organs and are released into the circulating haemolymph.

242 Hanser, G., Rembold, H. ANALYTISCHE UND HISTOLOGISCHE UNTERSUCHUNGEN DER KOPF- UND THORAXDRUSEN BEI DER HONIGBIENE Apis mellifica. (Analytical and histological study of the head and thorax glands in the honeybee Apis mellifica). Z. Naturf. 19b, 10 (1965) 938-43. (In German)

External conditions modify the biopterin and pantothenic acid contents in the mandibular glands of nurse bees. The heterocyclic compounds characteristic for royal jelly and brood food are only found in the pharyngeal glands. These findings and the histo-autoradiographic demonstration of the oriented incorporation of [2-^{14}C]biopterin imply that brood food is basic food secreted by the pharyngeal glands. Comparative histological studies show gland enlargement and an increase in the deep-seated cells of the postgenal glands in nurse bees of the royal brood. The roles played by various glands in the formation of brood food is discussed.

243 Heslop, J.P. THE ESTIMATION OF ADENOSINE TRIPHOSPHATE AND RELATED COMPOUNDS IN INSECT TISSUE. Biochem. J. 91 (1964) 183-7.

Some conditions for the successful extraction of labile phosphorus compounds from frozen house fly tissue have been investigated. Phosphorus compounds in the thorax were estimated by the labelled-pool technique. The concentration of ATP in the thorax was determined by the labelled-pool technique, adenine estimation, firefly luciferin, and phosphoglycerate kinase. Evidence is presented for the existence in insect tissues of a non-phosphorylated substance found to interfere with the estimation of ATP by two widely used assay systems.

244(2) Highnam, K.C. NEUROSECRETORY CONTROL OF OVARIAN DEVELOPMENT IN THE DESERT LOCUST. p. 370-90 of "Proceedings of the 3rd International Symposium on Neurosecretion, Bristol, England, 1961".

^{35}S-cystine was used in a comparison of the neurosecretory system in Schistocerca gregaria females reared with or without males.

245[2] Highnam, K.C. NEUROSECRETORY CONTROL OF OVARIAN DEVELOPMENT IN THE DESERT LOCUST. Mem. Soc. Endocr. 12 (1962) 370-90.

".... The rate of incorporation of ^{35}S-amino acids into the neurosecretory system (of oocytes) suggests that when small amounts of histologically visible material are present, the neurosecretory system is rapidly synthesizing and releasing developmental factors, whereas some synthesis but little release of neurosecretory factors occurs in a system where large amounts of paraldehyde fuchsin (PF)-staining material are present...." (Cited in J. Insect Physiol. 10:1964, 859).

246 Kilby, B.A. INTERMEDIARY METABOLISM AND THE INSECT FAT BODY. p. 39-48 of "Aspects of Insect Biochemistry. Biochemical Society Symposium No. 25, London, 1 Apr. 1965". Goodwin, T.W., Ed. London, Academic Press. 1965, 107p.

Some of the published work on intermediary metabolism of fat, carbohydrate, protein, and purines in fat body are reviewed; the fat body is seen to be able to synthesize fat, carbohydrates and protein from a variety of substances and store them ready for mobilization when required as a source of energy or for the building of new tissue. It is a site of much intermediary metabolism, a regulator or some blood constituents, a location for detoxification and, in some cases, of waste products and symbionts. Radioisotopes were used in a number of studies.

247 Langer, H. PHOSPHATE METABOLISM OF THE COMPOUND EYE, IN DARKNESS AND IN LIGHT. Helgoländer wiss. Meeresunters. 9, 1/4 (1964) 251-60. (In German)

The concentration of various compounds involved in the phosphate metabolism was detected in the eyes of u.v.-exposed Calliphora erythrocephala. The controls were kept in darkness. The values for phosphatides (I), nucleic acids (II), ATP, ADP, AMP, and free inorganic phosphate were 27.5, 12.3, 2.02, 0.78, 1.74, and 4.65 nanomoles/eye, respectively, in 6 h u.v.-exposed insects, and 26.7, 12.2, 2.73, 0.58, 1.97 and 3.95 nanomoles/eye, respectively, in 6 h u.v.-exposed insects, and 26.7, 12.2, 2.73, 0.58, 1.97 and 3.95 nanomoles/eye, respectively in controls. Starved C. erythrocephala flies were fed 1 µCi $^{32}PO_4^{3-}$/fly. Four h after feeding, the overall ^{32}P incorporation was 35% higher in the eyes of u.v.-exposed flies as compared with the eyes of flies kept in darkness. The rate of ^{32}P incorporation into various compounds was in the following order, acid-soluble compounds (III) ≫ phosphoproteins (IV) > II > I for u.v.-exposed flies and III ≫ IV > II > I for flies kept in darkness. (CA 62:1965, 9505d)

248 Marcuzzi, G., Degasperi, P. APPLICATION OF THE AUTORADIOGRAPHIC TECHNIQUE TO THE STUDY OF THE EXCRETION IN THE COLEOPTEROUS INSECT Tenebrio molitor L. EUR-2200e. Dec. 1964, 514p. p. 127-29 of "Preparation and Biomedical Application of Labelled Molecules. Proceedings of a Symposium, Venice, 23-29 Aug. 1964".

Penicillin-^{14}C was used in the autoradiographic study of the excretory function of malpighian tubules of the coleopterous insect T. molitor. Results indicated that penicillin is eliminated by malpighian tubules through a process of passive diffusion, perhaps reinforced by secretion when the substance is very diluted in the haemolymph. (NSA 19:1965, 31762)

249 Münchberg, P. ZUR DEMONSTRATION DER DURCHBLUTUNGSVERHÄLTNISSE DER LIBELLENFLÜGEL DURCH INJEKTIONEN VON LÖSUNGEN VON $Na_2{}^{35}SO_2$ UND $Na_2H^{32}PO_4$. (Demonstrating the haemolymph circulation in dragonfly wings by means of injections of $Na_2{}^{35}SO_2$ and $Na_2H^{32}PO_4$ solutions). Z. Naturf. 19b, 7 (1964) 634-40. (In German)

In order to follow haemolymph circulation in the wing, ^{35}S in $Na_2{}^{35}SO_4$ which is a source of soft β-rays proved preferable to the considerably higher energy available from $Na_2H^{32}PO_4$. Although ^{32}P gives pictures of good contrast some wing regions remain empty or apparently structureless due to excessive irradiation. Thoracic injections were given below the wing insertion at the meso- and metapleura; activities of 10 µCi were used in 0,5 ml solution for ^{32}P and 0,2 ml for ^{35}S, Zygoptera receiving 0,025-0,05 ml, and Anisoptera 0,05-0,1 ml. Two injections were used for large dragonflies (Aeschna and Cordulegaster). The following species were studied: Lestes sponsa Hansemann, Pyrrhosoma nymphula (Sulzer), Calopteryx virgo (L.), Sympetrum vulgatum (L.), Aeschna mixta (Latr.), and Cordulegaster boltonii (Donovan). Zones of intensive circulation of blood in Odonata were noted not only in the venation at the anterior margin of the wing but throughout the veins at the wing tips. Reasons are put forward which indicate a pulsating function of the pterostigma.

250 Oak Ridge National Lab., Tenn. CYTOLOGY AND GENETICS. p. 36-49 of "Biology Division Semiannual Progress Report for Period Ending July 31, 1965". ORNL-3853. Nov. 1965, 222p.

Amongst other work, tracer studies of the metabolism of polytene chromosomes, spermatogenesis, and oogenesis in Rhynchosciara angelae (Sciaridae) are reported.

251 Taylor, J. H. THE ARRANGEMENT OF CHROMOSOMES IN THE MATURE SPERM OF THE GRASSHOPPER. J. Cell Biol. 21, 2 (1964) 286-9.

In order to study the chromosome arrangement within the sperm nucleus males of the grasshopper Romalea microptera (Beauvoir) were injected during the last instar with 20 μCi of ^{3}H-thymidine (specific activity 1000 mCi/mM). Mature labelled sperm were obtained within 60 d under the experimental conditions described. A tandem alignment was observed, with each chromosome occupying a short segment of the elongated head. Chromosomes were found to be randomly disposed along the length of the nucleus.

252 Treherne, J. E. THE DISTRIBUTION AND EXCHANGE OF INORGANIC IONS IN THE CENTRAL NERVOUS SYSTEM OF THE STICK INSECT Carausius morosus. J. exp. Biol. 42 (1965) 7-27.

Flame photometry and radioactive tracers were used. The inulin space in the central nerve cord was made using ^{14}C-labelled inulin. ^{22}Na was used for measuring the uptake of sodium by the nerve cord in (in vivo) experiments and for measuring sodium efflux. The effect of a metabolic inhibitor, 2,4-dinitrophenol, on sodium and potassium uptake were studied using ^{22}N and ^{42}K, respectively. The efflux of calcium ions from isolated nerve cord was studied with ^{45}Ca, and ^{36}Cl was used to investigate the uptake and efflux of chloride ions. The exchanges of labelled ions showed rapid and slow components which correspond to extra- and intracellular compartments within the central nervous system. The uptake of Na from the haemolymph and its concentration in the extracellular fluid is reduced in the presence of metabolic inhibitors. The distribution between haemolymph and extracellular fluid of Ca and Mg, also of Na in poisoned preparation, conforms to a Donnan equilibrium. The distribution of K, even in poisoned preparations, does not conform and it is suggested that the acitivity of this ion may be lower than in free solution. The concentration of Mg is appreciably greater in the extracellular than in the intracellular compartment. The possible role of Mg in nervous transmission in this insect is discussed.

253 Treherne, J. E., Smith, D. S. THE PENETRATION OF ACETYLCHOLINE INTO THE CENTRAL NERVOUS TISSUES OF AN INSECT (Periplaneta americana L.) J. exp. Biol. 43 (1965) 13-21.

^{14}C-labelled acetylcholine was found to penetrate rapidly into the tissues of the intact abdominal nerve cord. Uptake in the presence of 10^{-4} M eserine occurred as a two-stage process, the initial rapid influx being identified as the penetration into the extracellular system of the nerve cord. There was a more rapid accumulation of radioactivity in normal preparations as compared with those treated with 10^{-4} M eserine, presumably as a result of intracellular uptake of the products of hydrolysis of the acetylcholine. The level of radioactivity in the rapidly exchanging fraction was consistent with the hypothesis that the acetylcholine ions were distributed in the extracellular fluid according to a Donnan equilibrium with the haemolymph in eserinized preparations. These results are discussed in relation to the possible physiological role of acetylcholine in synaptic transmission in this insect. (Auth. summary)

254 Treherne, J. E., Smith, D. S. THE METABOLISM OF ACETYLCHOLINE IN THE INTACT CENTRAL NERVOUS SYSTEM OF AN INSECT (Periplaneta americana). J. exp. Biol. 43, 3 (1965) 441-54.

In studies to test the possibility that the cholinergic system operates in the ganglia of the cockroach, acetylcholine-^{3}H iodide (I) was rapidly metabolized by the intact nerve cord from the cockroach, P. americana, bathed in solutions containing up to 10^{-2} M I; eserine completely prevented this metabolism. Comparison of chromatograms of tissue extracts from whole nerve cords with those from a single terminal ganglia indicated that the latter preparation metabolized I more rapidly, due to the smaller surface/volume ratio and the higher cholinesterase content in this structure. Appreciable hydrolysis of I occurred at the periphery of the nerve cord, an observation which correlated well with the electron-microscopic demonstration of regions of eserine-sensitive cholinesterase on the glial membranes in the periphery of ganglia and connectives. Accumulation of some diffusible acetylcholine in the fibrous layer suggested that some hydrolysis may also occur here. The high activity of the cholinesterase system in this insect explains the relative insensitivity of the insect

central nervous system to applied I and excludes the existence of a peripheral diffusion barrier to this substance. The higher concentrations of acetylcholine required to produce a discharge in the presence of eserine over that concentration required in vertegrates was accounted for by postulating a relatively low sensitivity of the insect subsynaptic membrane to acetylcholine; this insensitivity could be correlated with the higher order of concentration of acetylcholine in insect nervous tissue over that in vertebrate nervous tissue. (CA 64: 1966, 8687b)

See also:

37 Données biochimiques et histochimiques sur l'incorporation du sulfate de sodium radioactif, chez Gryllus bimaculatus de Geer (Insecte, Orthoptère). (Martoja, R., 1964)

49 Polysaccharide and glycoprotein formation in the cockroach. II. Incorporation of D-glucose-^{14}C into bound carbohydrate. (Lipke, H. et al., 1965)

53 Sites of fibroin formation in the silk gland in Bombyx mori. (Akai, H., Kobayashi, M., 1965)

60 Formation of the specific structural and enzymic pattern of the insect flight muscle. (Bücher, Th. 1965)

64 The biosynthesis mechanism of silk fibroin. (Filippovich, Yu. B., 1964)

65 Brain glutamic acid decarboxylase and synthesis of γ-aminobutyric acid in vertebrate and invertebrate species. (Frontali, N., 1964)

66 Biosynthesis of drosopterin in the eye pigment of Drosophila melanogaster. (Goto, M. et al., 1964)

70 Incorporation of ^{14}C-glycine into the proteins of the fat body of the desert locust during ovarian development. (Hill, L., 1965)

80 The chemistry and physiology of the brain hormone. (Kobayashi, M., 1963)

86 Protein synthesis in silk glands. V. Relation of ribosomes to endoplasmic reticulum during fibroin synthesis. (Miura, Y. et al., 1964)

92 Revealing of intermediate stages of protein synthesis in the nuclei of Drosophila melanogaster salivary gland cells. (Platova, T.P., 1965)

96 On the contribution of the follicle epithelium to the deposition of yolk in the oocyte of Panorpa communis (Mecoptera). (Ramamurty, P.S., 1964)

97 Experimental activation of specific loci in polytene chromosomes of Drosophila. (Ritossa, F.M., 1964)

99 Yolk protein uptake in the oocyte of the mosquito Aedes aegypti L. (Roth, T.F., Porter, K.R., 1964)

100 Acetylcholinesterase in motor end-plates evaluated by electron microscope autoradiography. (Salpter, M.M., O'Connor, A., 1965)

102 Tyrosine metabolism of insects. XIII. Autoradiographic localization of tyrosine metabolites in the cuticle of Schistocerca gregaria. (Schlossberger-Raecke, I., Karlson, P., 1964)

107 Participation of ribosomes in the biosynthesis of silk fibroin. (Smirnov, V.N. et al., 1964)

111 Nucleotide composition of rapidly tagged ribonucleic acid in silk gland of Bombyx mori. (Antonov, A.S. et al., 1964)

112 An autoradiographic study of RNA synthesis in isolated salivary glands of Drosophila hydei. I. Autoradiographic studies. (Arnold, G., 1965)

113 RNA metabolism in pupae of the oak silkworm, Antheraea pernyi: The effects of diapause, development, and injury. (Barth, R.H., Jr. et al., 1964)

114 The labelling of individual chromatids of giant chromosomes with ^{3}H-thymidine. (Beermann, W., Pelling, C., 1965)

115 Correlation of genetic activity, heterochromatization, and RNA metabolism. (Berlowitz, L., 1965)

119 Nucleolus: A site of transfer ribonucleic acid synthesis. (Birnstiel, M.L. et al., 1965)

122 Puffing changes in incubated and in ecdysone treated Chironomus tentans (Clever, U., 1965)

123 Les "puffs" des chromosomes géants révèlent l'activité de gènes que déclenchent une hormone. (Dajoz, R., 1964)

124 Synthetic activities during spermatogenesis in the locust. (Das, N.K. et al., 1965)

125 (Gay, H., 1963)

126 New evidence on chromosome structure and function. (Gay, H., 1964)

129 RNA synthesis during male meiosis and spermiogenesis. (Henderson, S.A., 1964)

II 320 Ribonucleic acid metabolism in the posterior silkgland of silkworm, Bombyx mori, during the fifth instar. (Hosoda, J. et al., 1963)

130 Synthesis of RNA (ribonucleic acid) in vitro stimulated in dipteran salivary glands by 1,1,3-tricyano-2-amino-1-propene. (Jacob, J., Sirlin, J.L., 1964)

131 Content of nucleic acids in silk glands of silkworm varieties differing by their productivity. (Kulleyev, P., 1965)

132 RNA (ribonucleic acid) biosynthesis in the silk gland of the silkworm. (Kulleyev, P. et al., 1964)

133 Sedimentation characteristics of rapidly labelled RNA from the salivary gland cells of Rhynchosciara angelae. (Lara, F.J.S. et al., 1965)

134 Some factors influencing the utilization of tritiated thymidine in grasshopper embryos. (Leach, W.M., 1965)

135 Retention of tritiated thymidine in grasshopper neuroblasts. (Leach, W.M., 1964)

137 Metabolism of ribonucleic acid (RNA) in the silk gland of Samia ricini. (Lu, C.-H. et al., 1964)

138 Ribonucleic acid in the silk gland of silkworm (Attacus ricini) (Lu, C.-H. et al. 1964)

142 Protein synthesis in silk glands. VI. RNA metabolism in fifth instar larvae. (Miura, Y., 1965)

143 Autoradiographic study of nucleic acid synthesis during spermatogenesis in the grasshopper, Melanoplus differentialis. (Muckenthaler, F.A., 1964)

144 Autoradiographic study of nucleic acid synthesis during spermatogenesis in the grasshopper, Melanoplus differentialis. (Muckenthaler, F.A., 1964)

147 On the presence of DNA in larval salivary gland nucleoli in Drosophila melanogaster. (Nash, D., Plaut, W., 1965)

148 X chromosome DNA replication, developmental shift from synchrony to asynchrony. (Nicklas, R.B., Jaqua, R.A., 1965)

149 L'incorporation de la thymidine au cours de l'ovogenèse et du développement embryonnaire chez la drosophile. (Nigon, V., Gillot, S., 1964)

150 RNA and DNA synthesis during activation and secretion of the prothoracic glands of saturniid moths. (Oberlander, H. et al., 1965)

151 Fibroin synthesis in posterior silk glands. VI. Metabolic changes in RNA during the fifth instar. (Ogoshi, S., 1965)

152 Autoradiographic study of nucleic acid synthesis during spermatogenesis in Drosophila melanogaster. (Olivieri, G., Olivieri, A., 1965)

153 Presence of a different sequence in the terminal region of glycine-specific tRNA (transfer RNA). (Onodera, K. et al., 1965)

154 Glycine-specific transfer ribonucleic acid (t-RNA) in the posterior silk gland of Bombyx mori. (Onodera, K., Komano, T., 1964)

158 RNA synthesis by the giant chromosomes of Chironomus tentans. (Pelling, C., 1964)

160 Localized DNA synthesis in polytene chromosomes and its implications. (Plaut, W., Nash, D., 1964)

161 An autoradiographic study of RNA systhesis in isolated salivary glands of Drosophila hydei. II. Interferometric studies. (Pollister, A.W., 1965)

162 On the origin of the RNA in the growing egg cells of Panorpa communis (Insecta, Mecoptera). (Ramamurty, P.S., 1963)

163 The incorporation of uridine-^{3}H into the cellular structures of the silk gland and the effect on this process of actinomycin D. (Ramenskaya, G.P., 1965)

164 Behaviour of RNA and DNA synthesis at the puff level in salivary gland chromosomes of Drosophila. (Ritossa, F.M., 1964)

165 The action of ribonuclease on salivary gland cells of Drosophila. (Ritossa, F.M. et al., 1964)

166 On the action of ribonuclease in salivary gland cells of Drosophila. (Ritossa, F.M. et al., 1965)

167 Localization of the additional RNA synthesis in trypsin-treated giant chromosomes of Tendipes thummi. (Robert, M., Kroeger, H., 1965)

168 Recent autoradiographic observations on the incorporation of labelled precursors of nucleic acids and proteins in the fatty bodies of Musca domestica. (Russo-Caia, S., 1964)

169 Ribonucleic acid synthesis in neuroblast of the grasshopper Chortophaga viridifasciata. (Schiff, S.O., 1965)

170 Ribonucleic acid synthesis in neuroblasts of Chortophaga viridifasciata (de Geer), as determined by observations of individual cells in the mitotic cycle. (Schiff, S.O., 1965)

174 The mechanism of action of hormones. V. The effect of ecdysone on RNA metabolism in the epidermis of the blowfly, Calliphora erythrocephala. (Sekeris, C.E. et al., 1965)

175 Ribonucleic acid synthesis of silk-secreting gland of Bombyx mori. (Smirnov, V. N. et al., 1964)

176 The ribonucleic acid from the silk gland of the silkworm and the amino acid code. (Szafrański, P. et al., 1964)

177 Distribution of tritium-labelled DNA among chromosomes during meiosis. I. Spermatogenesis in the grasshopper. (Taylor, J. H., 1965)

178 Cytochemical and autoradiographic observation of nucleic acid metabolism in the oogenesis of Dytiscus marginalis. (Urbani, E., Russo-Caia, S., 1964)

179 Synthesis and transfer of DNA, RNA, and protein during vitellogenesis in Rhodnius prolixus (Hemiptera). (Vanderberg, J. P., 1964)

181 Evidence for a lampbrush type structure in grasshopper spermatocyte chromosomes. (Watkins, M. J., 1964)

182 The metabolism of ribonucleic acid in cecropia silkmoth pupae in diapause, during development and after injury. (Wyatt, G. R., Linzen, B., 1965)

197 Phospholipid composition of flight muscle sarcosomes from the housefly, Musca domestica. (Crone, H. D., 1964)

198 Some aspects of lipid catabolism in saturniid moths. (Domroese, K. A., 1964)

199 The role of lipid in adult development and flight muscle metabolism in Hyalophora cecropia. (Domroese, K. A., Gilbert, L. I., 1964)

224 Regulation of cockroach fat-body metabolism by the corpus cardiacum in vitro. (Wiens, A. W., Gilbert, L. I., 1965)

226 Studies in D-serine and D-2,3-diaminipropionic acid in Bombyx mori. (Corrigan, J. J., 1965)

258 Blood volume and water content of the male American cockroach, Periplaneta americana L. — Methods and the influence of age and starvation. (Wharton, D. R. A. et al., (1965)

264 Some physiological aspects of adult reproductive diapause in the chrysomelid beetle, Galeruca tanaceti (Linn.). (Siew, Y. C., 1963)

265 The endocrine control of adult reproductive diapause in the chrysomelid beetle, Galeruca tanaceti (L.)III. (Siew, Y. C., 1965)

266 Biochemical changes associated with growth and development of the larval blowfly Phormia regina (Meigen). (Wimer, L. T., 1963/64)

268 The action of serum albumin on oxidative phosphorylation in insect mitochondria. (Wojtczak, L., Wojtczak, A. B., 1959)

299 Study of the flight range and gonotrophic cycles in Anopheles stephensi using ^{32}P. (Quraishi, M. S., 1964)

10. Miscellaneous (including Nutrition, Metabolism and Growth Phenomena, Respiration)

255 Devine, T., Wharton, G. W. TRANSPIRATION AND SORPTION OF WATER BY ACARINES AT EQUILIBRIUM. Bull. ent. Soc. Am. 11, 3 (1965) 173. Abstr. 382. Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov.-2 Dec. 1965".

Tritiated water was found to move in or out of female Echinolaelaps echidninus and larval Dermacentor andersoni when exposed to atm whose relative humidity was at 93%. The tritiated water moved along an activity gradient from high to low. At 93% relative humidity both acarines can maintain an equilibrium weight. (Abstr.)

256(4) Marcuzzi, G., Santoro, V. STUDIES ON THE WATER EXCHANGE OF Tenebrio molitor BY TRITIATED WATER. Ricerca scient. 12 (1959) 2576-81. (In Italian)

The exchange of water in larvae of T. molitor was studied by utilizing tritiated water as the radioactive tracer. The results show that the rate of water exchange between the larva and its surrounding surrounding environment was identical (half-time of 198 ± 21 h) either when the ambient amount was saturated with water vapour or when the relative humidity was 85%. This is especially interesting in view of the fact that at a humidity of 100% the insects are hygroscopic, while in a relative humidity of 85% the insects neither absorb nor lose water. (CA 54: 1960, 16677a)

257 Treherne, J.E. ACTIVE TRANSPORT IN INSECTS. p. 1-13 of "Aspects of Insect Biochemistry. Biochemical Society Symposium No. 25, London, 1. Apr. 1965". Goodwin, T.W., Ed. London, Academic Press. 1965, 107p.

The author reviews data for various insects on the active transfer of water and of inorganic ions. Their transfer across the cell membrane is examined, particular attention being paid to sodium, potassium, and chloride ions. (In a number of the studies cited radioisotopes had been used although this fact is not stressed in the text.) Several unusual features can be seen to be involved in these processes, and there is likely to be diversity of transport mechanisms in insect cells and tissues; even sodium and potassium transport can probably not be accounted for by a single mechanism.

258 Wharton, D.R.A., Wharton, M.L., Lola, J.E. BLOOD VOLUME AND WATER CONTENT OF THE MALE AMERICAN COCKROACH, Periplaneta americana L. - METHODS AND THE INFLUENCE OF AGE AND STARVATION. J. Insect Physiol. 11, 4 (1965) 391-404.

The water per cent changes little, if at all, with the age of the adult insect. The blood volume per cent decreases markedly during the first 4 d and only slightly thereafter. There was no correlation between the daily fluctuations of blood volume per cent and those of total water per cent. Whereas the total water per cent remained relatively stable in the fed insect after the first week, it increased to a significant degree in the starved insect, especially after the 6th d of starvation in both the insects examined whole and eviscerated. The blood volume per cent decreased as a result of starvation. The blood volume per cent of 36·3 ± 0·68 (for 2- to 3-week-old males) is much higher than previously reported. Within 4-fold limits (15 000-62 000 cpm) the dose of ^{14}C inulin injected had no significant effect on the blood volume. Heating the insect at 50 or 55°C did not alter the blood volume, but heating at 60°C for 15 s caused an increase. Heating at 60°C for 1 min coagulated the outer tissues of the insect and made bleeding difficult. Chilling, which retarded coagulation, failed to change the blood volume. Starvation reduced coagulation. It also reduced the blood volume which nevertheless stayed at a high level. Age and starvation are discussed with respect to their influence on water balance. The findings are also discussed with respect to the techniques employed by ourselves and other investigators. (Auth.)

259 Cohen, A.I., Smith, J.N. COMPARATIVE DETOXICATION. 9. THE METABOLISM OF SOME HALOGENATED COMPOUNDS BY CONJUGATION WITH GLUTATHIONE IN THE LOCUST. Biochem. J. 90, 3 (1964) 449-56.

The study was carried out in order to determine whether cysteine or glutathione conjugates were formed in locusts from compounds like benzyl chloride that contain labile or reactive halogen. Such simple compounds might serve as models for the more complex chlorinated insecticides. Fifth-instar hoppers or adults of Schistocerca gregaria were used. They were dosed with DL-[^{35}S]cysteine or labelled sodium cystinate, benzyl chloride being injected subsequently. The various experimental procedures are given. S-(p-Nitrobenzyl)glutathione, S-(naphth-1-yl-methyl)glutathione, S-(2-phenylethyl)glutathione and a glutathione conjugate of phenoltetrabromophthaleindisulphonate were synthesized. Locusts rapidly metabolized p-nitrobenzyl chloride to S-(p-nitrobenzyl)glutathione. This glutathione conjugate was subsequently hydrolysed in locust gut, Malpighian tubes and excreta to S-(p-nitrobenzyl)cysteine, which was in turn converted into unidentified products. Glutathione conjugates and cysteine conjugates of phenoltetrabromophtaleindisulphonate, benzyl chloride, p-chlorobenzylchloride, p-nitrobenzyl bromide, 1-chloro-2,4-dinitrobenzene, 1-fluoro-2,4-dinitrobenzene and 3,4-dichloro-1-nitrobenzene have been identified chromatographically in locusts dosed with these compounds.

260 Kumar, S.S., Hodgson, E. METABOLISM OF CHOLINE IN Periplaneta americana. Bull. ent. Soc. Am. 10, 3 (1964) 164. Abstr.

Choline metabolism has been investigated in 5th-instar roaches by injection of either methyl-^{14}C-choline or 1,2-^{14}C-choline followed by purification and identification of metabolites. Phosphoryl choline appears to be the principal water soluble metabolite and investigations are proceeding on its biosynthesis. ^{14}C-choline is incorporated into phosphatidyl choline. (Abstr.)

261 Lambremont, E.N., Stein, C.L. $C^{14}O_2$ PRODUCTION IN THE BOLL WEEVIL, Anthonomus grandis, AFTER INJECTION OF C^{14}-1-ACETATE. Ann. ent. Soc. Am. 58, 5 (1965) 765-6.

Newly emerged, unfed, adult weevils, reared aseptically were weighed and then anaesthetized with CO_2 in a sterile container for 30 min. Each was then injected in the abdomen with 1 µl of ^{14}C-1-acetate solution delivering 0.2 µCi of ^{14}C and 14.8 µg of sodium acetate. In the initial series of tests, 22 injected adults were placed in the metabolism cage and $^{14}CO_2$ was collected at 10 min intervals for 1½ h. Results indicate that acetate injected into the boll weevil undergoes almost immediate oxidative metabolism, with significant ^{14}C appearing in the CO_2 within 10 min. The decline in $^{14}CO_2$ release after about 1 h suggested that from that point onward progressively less acetate was available for various biosynthetic processes. Since the release rate at 2 h was about half that at the 1 h maximum, a 2 h incubation period would probably include the most productive time for synthesis of fatty acids.

262 Luedicke, M., Peterhänsel, H. DIE MARKIERUNG BESTIMMTER PIGMENTFELDER AUF DEN FLÜGELN VON SCHMETTERLINGEN MIT ^{35}S-NATRIUMSULFAT- UND ^{35}S-DL-CYSTINLÖSUNGEN. (Labelling of certain areas of pigmentation on butterfly wings with ^{35}S-sodium sulphate and ^{35}S-DL-cystine solutions). Naturwissenschaften 52, 5 (1965) 113-4. (In German)

The larva of Araschnia levana, Inachis io, Aglais urticae, Papilio demodocus, Rhyparia purpurata, and Arctia caja were grown on the feed plants treated with labelled compounds, or the labelled compounds were injected between the abdominal segments of the larvae. The localization of isotopes was detected in the pigments of wings of young butterflies. The isotopes were found in the red, red-brown, red-yellow, and dark-yellow spots containing different degree of oxidation of ommochrome, and none or very little with brown, light-yellow, and black spots. (CA 62; 1965, 13560e)

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The mechanisms enabling certain insects to adapt to tobacco as a primary food source were studied utilizing radiometric, chromatographic, and spectrophotometric techniques. Nicotine was metabolized to other alkaloids in all insects studied with the exception of lepidopterous larvae, in which case nicotine was excreted intact. There was no evidence for the metabolism of nicotine after the administration of topical, injected, and ingested doses to the tobacco hornworm, Protoparce sexta (Johannson). Dissections of the larval tissues after ingestion of tomato foliage pre-treated with ^{14}C-nicotine showed that the non-eliminated radioactive nicotine was localized in the digestive tract. Topical and injected doses of nicotine also were excreted unchanged in the larval faeces. Following ingestion of tobacco foliage, the alkaloids in the tobacco plant were eliminated unchanged in the hornworm faeces within 30 min. At least 4 µg of nicotine were detected in the blood of larvae feeding on tobacco. Two other lepidopterous pests of tobacco, the tobacco budworm, Heliothis virescens (Fabricius), and the cabbage looper, Trichoplusia ni (Hübner), also appeared to tolerate the alkaloids in the tobacco plant because of an efficient excretory mechanism. The differential grasshopper, Melanoplus differentialis (Thomas), metabolized a topical dose of nicotine to four metabolites that were recovered in the faeces. Three alkaloids were recovered in the faeces of tobacco-fed grasshoppers which were not present in the tobacco plant. One of the metabolites was identified as cotinine, and a second metabolite was tentatively identified as a quaternary ammonium compound. In the tobacco wireworm, Conoderus vespertinus (Fabricius), a similar pattern of metabolism appeared and the primary metabolic product had paper chromatographic properties consistent with cotinine. The cigarette beetle, Lasioderma serricorne (Fabricius), apparently metabolized nicotine to other alkaloids. Musca domestica Linnaeus metabolized approximately 80% of a topical dose of nicotine to cotinine and two other metabolites. The enzymatic degradation of nicotine by house fly microsomes was activated by DPNH and TPNH, and influenced by nicotinamide and the pH of the incubation mixture. (From DA).

264(2) Siew, Y. C. SOME PHYSIOLOGICAL ASPECTS OF ADULT REPRODUCTIVE DIAPAUSE IN THE CHRYSOMELID BEETLE, Galeruca tanaceti (Linn.). Thesis, London Univ. (England), May 1963, 190p.

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the corpus cardiacum/allatum activity: (1) increase in volume of the glands, (2) decrease in nuclear-cytoplasmic ratios, and (3) increase in nuclear volumes. Cauterization and implantation experiments indicated a close inter-relationship between the neuro-endocrine centres, and the possibility of complex feed-back mechanisms. Respiratory rates, fat and water contents in the pre-diapause, diapause, and ovarial maturation phases were compared.

265 Siew, Y.C. THE ENDOCRINE CONTROL OF ADULT REPRODUCTIVE DIAPAUSE IN THE CHRYSOMELID BEETLE, Galeruca tanaceti (L.) III. J. Insect Physiol. 11, 7 (1965) 973-81.

The use of radioactively labelled amino acid ^{35}S-DL-cystine in autoradiographic studies substantiated previous findings that the phases of diapause, ovarian maturation, and oviposition in G. tanaceti are controlled by different levels of neuro-endocrine activity. The rate of turnover of radioactive cystine increases about 2-fold when a mature female begins to oviposit and about 10-fold when a female goes from diapause to oviposition. Results from this study also substantiate histological evidence that there is a differential rate of storage and of discharge of neurosecretory material from the corpus cardiacum. In diapausing females there is a build up of ^{35}S in the corpus cardiacum up to 120 h after injection with ^{35}S-DL-cystine, whereas in ovipositing females most of the radioactive substances accumulated in the corpus cardiacum is discharged within 24 h. The dynamics of neurosecretion are discussed. (Auth.)

266 Wimer, L.T. BIOCHEMICAL CHANGES ASSOCIATED WITH GROWTH AND DEVELOPMENT OF THE LARVAL BLOWFLY, Phormia regina (Meigen). Diss. Abstr. 24 (1963/4) 2631-2.

Radioactive glucose has been used as a substrate for the investigation of certain biochemical changes associated with growth and development of the insect larva. The larvae of P. regina (Meigen) were reared under rigidly controlled conditions in order to eliminate variations of environmental and nutritional origin. It was found that larval weight could be used as a basis for the determination of physiological age with a minimum of variation in stage of development. Larvae of similar physiological age were then selected for experimentation on each day of 3d instar development. The wet weight and dry weight of the whole larva and of the fat body were determined, and the per cent of larval dry weight represented by the fat body was calculated. The growth of the fat body was then compared with that of other selected larval tissues on the basis of dry weight determinations. The per cent radioactivity incorporated into the various body tissues and evolved as CO_2 was measured following the dissection of larvae previously injected with glucose uniformly labelled with ^{14}C. An evaluation of the data has indicated that the fat body is important in the synthesis and storage of glucose metabolites. The fat body was fractionated and analysed for its major organic components. The total amounts of fat, carbohydrate (glycogen and other anthrone positive material), and protein were determined. An analysis of the per cent radioactivity incorporated into these fractions was then made, and the data discussed with reference to larval growth and development. The importance of biochemical investigations of this type in the study of hormonal control mechanisms has also been mentioned. (DA)

267 Gregg, C.T., Johnson, J.R., Heisler, C.R., Remmert, L.F. INHIBITION OF OXIDATIVE PHOSPHORYLATION AND RELATED REACTIONS IN INSECT MITOCHONDRIA. Biochim. biophys. Acta 82 (1964) 343-49.

The effects of the uncoupling agent 2,4-dinitrophenol (DNP) and the insecticide DDT on respiration, phosphorylation, and the ATPase and ATP-P_i exchange activities of house fly mitochondria were investigated. For assay of the ATP-P_i exchange reaction, incorporation of ^{32}P was determined. DDT at 0.1 mM abolishes phosphorylation, the ATP-P_i exchange, and the DNP-stimulated ATPase activity in these mitochondria. DDT does not, however, affect the Mg^{2+}-stimulated ATPase activity; in this respect it appears to be unique among known uncouplers or inhibitors of mitochondrial ATPase. DDT also inhibits that portion of the total respiration which is "tightly-coupled" to oxidative phosphorylation: "uncoupled" respiration is not depressed by DDT. Anomalously, DNP frequently strongly inhibits respiration in the presence of ADP and P_i and fails to stimulate pyruvate oxidation in the absence of ADP and P_i.

268(z) Wojtczak, L., Wojtczak, A.B. THE ACTION OF SERUM ALBUMIN ON OXIDATIVE PHOSPHORYLATION IN INSECT MITOCHONDRIA. Biochim. biophys. Acta 31 (1959) 297-9.

Using mitochondria from larvae of the wax moth, Galleria mellonella L., a pronounced stimulatory effect on the oxidative phosphorylation was observed with both human and bovine serum but with

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Using mitochondria from larvae of the wax moth, Galleria mellonella L., a pronounced stimulatory effect on the oxidative phosphorylation was observed with both human and bovine serum but with

neither egg albumin nor an albumin fraction from an acetone powder of frog muscle. To explain the nature of this effect the adenosine triphosphate (ATP)-orthophosphate exchange reaction was investigated. The incubation medium also contained a phosphate buffer (pH 7.5) to which 5 μCi ^{32}P (3 μM) had been added. Results indicate that an inhibitor of the exchange reaction (and perhaps of oxidative phosphorylation) is present in insect mitochondria and can be removed by washing with serum albumin solution. It is possible to extract this inhibitor by organic solvents after thermal coagulation of albumin from the washing fluid.

269(1) Wojtczak, L., Wojtczak, A.B. UNCOUPLING OF OXIDATIVE PHOSPHORYLATION AND INHIBITION OF ADENOSINE TRIPHOSPHATE-ORTHOPHOSPHATE EXCHANGE BY A SUBSTANCE FROM INSECT MITOCHONDRIA. Biochim. biophys. Acta 39 (1960) 277-86. (In English)

Human and bovine serum and plasma albumins, and to a lesser extent β-lactoglobulin, stimulated oxidative phosphorylation and adenosine triphosphate-ortophosphate exchange in mitochondria from whole larvae of the greater wax moth, Galleria mellonella. This effect was the result of the removal by the proteins of an uncoupling agent present in isolated mitochondria. The uncoupling agent was found to contain fatty acids, of which palmitic, stearic, oleic, linoleic, and linolenic acids were identified by paper chromatography. It could be isolated by washing the mitochondria with a sucrose-albumin solution and subsequent extraction of the washing fluid with organic solvents. Besides the five fatty acids, other active components were also present; eluates from paper chromatograms of the inhibitor inhibited adenosine triphosphate-orthophosphate exchange. ATP-P_i exchange was investigated using a medium slightly modified from that described by Hülsmann et al. (ibid. 267), which contained ^{32}P (3 μM, ~10^6 cpm) in a phosphate buffer pH 7.5. ^{32}P-ATP was formed. Preliminary experiments on ATP-ADP exchange were carried out in the same medium except that ^{32}P was omitted and 3 μM ADP containing about 150 000 cpm [^{32}P]ADP were added. For the preparation of [^{32}P]ADP, see p. 853 in "Methods in Enzymology". Vol. 4. New York, Academic Press, 1957.

270 Yurkiewicz, W.J. FLIGHT EXHAUSTION STUDIES ON THE BLOW FLY Phaenicia sericata USING C^{14}-LABELED SUCROSE. Ann. ent. Soc. Am. 58, 5 (1965) 766.

Experiments were devised to determine the extent of carbohydrate depletion during flight to exhaustion at several temperatures (15°, 20°, 25°, and 30°C). The disappearance of ^{14}C-labelled sucrose was measured by feeding the exhausted fly a measured amount of fuel, and then recording the time taken to reach exhaustion again. Male flies (7 to 10 d old) were initially exhausted by attaching them to wire supports by a wax connection to the thorax and placing them before a fan. The loss of tarsal contact as the fly was picked up initiated flight while the moving air maintained continuous flight. The fly was considered exhausted if, on stopping, tarsal stimulation produced flights of < 10 s on five successive trials. Flight time and wing beat frequency were recorded with stop watch and strobe light. Through the temperature range of 15-20°C wingbeat frequency increased from 128 to 177 cps. The metabolic rate as expressed by carbohydrate utilization increased from 18.2 to 37.5 mg sucrose-^{14}C/g live wt/h. At least between 15 and 30°C exhausted flies metabolize essentially all the carbohydrate fed to them.

271 Lloyd, D., Calley, A.G. THE ASSIMILATION OF ACETATE AND PROPIONATE BY Prototheca zopfii. Biochem. J. 97 (1965) 176-79.

The tricarboxylic acid and glyoxylate cycles are of major importance in the assimilation of acetate and propionate by P. zopfii. The pattern of assimilation of acetate-2-^{14}C and propionate-2-^{14}C by whole cells growing with their respective substrates is similar except that with propionate, β-hydroxypropionate is the first labelled intermediate detected. CO_2 fixation is of little quantitative importance for the growth of this organism with propionate. The yield of cells obtained/mole of acetate is similar to that obtained/mole of propionate and about half that obtained/mole of butyrate, these substrates acting as sole sources of C and energy. (CA 63: 1965, 10364b)

See also:

118 The nucleus-plasma relationship and its bearings on the giant growth of the egg cell. (Bier, K., 1964)

290 Comment caractériser le transit intestinal chez les guêpes sociales. Les conséquences biologiques. (Montagner, H., 1964)

570 Drosophila cytology and genetics. (Oak Ridge National Laboratory, 1965)

777 Metabolism of crickets. (Menhinick, E.F., 1964)

1047 A simplified ionization chamber procedure for the continuous measurement of respiratory $C^{14}O_2$ of insects. (Levenbook, L., Dinamarca, M.L., 1965)

1048 Continuous measurement of $C^{14}O_2$ respired by insects. An ionization chamber method. (Robinson, J.R., Chefurka, W., 1964)

C. ECOLOGY

1. General Articles. Surveys

272 Norris, K.R. THE BIONOMICS OF BLOW FLIES. A. Rev. Ent. 10 (1965) 47-68.

Review article. Radioisotopes were used for labelling larvae and for studying insect ecology (dispersion and population density). (The use of radioisotopes in studies covered elsewhere in this bibliography is not always mentioned specifically).

2. Behaviour

(a) Feeding*
(including Mechanisms of Feeding and Transmission of Food)

273 Abdel-Malek, A.A. STUDY OF THE FEEDING HABITS OF MALE Anopheles sergenti Theo. AT SIWA OASIS USING RADIOPHOSPHORUS. Bull. Wld Hlth Org. 30 (1964) 137-9.

The feeding habits of male A. sergenti were studied in Siwa, an oasis covering 200 km, at 22 m below sea level, approximately 600 km northwest of Cairo. The males were reared in the laboratory from larvae collected in the field. Samples of the various plants in and around the larval habitats were cut in the field under water, and subsequently labelled by keeping the cut stems dipped in 30 ml of $NaH_2{}^{32}PO_4$ (at 20 μCi/ml). Adult mosquitoes were then given the opportunity to feed on them. Out of the 40 species of plants investigated, only three proved suitable for food. In descending order of suitability these plants are Salicornia fruticosa (L.) L. (average: 324 cpm), Alhagi maurorum Medic. (145 cpm), and Juncus arabicus (Asch. et Buch.) Adams (47 cpm). Feeding took place on both flowers and leaves, and lasted 10 min on the average. A paper of the same title was presented at the "12th International Congress of Entomology, London, 8-16 July 1964", see ref. 274.

274 Abdel-Malek, A.A. STUDY OF THE FEEDING HABITS OF MALE Anopheles sergenti Theo. AT SIWA OASIS USING RADIOPHOSPHORUS. p. 758 of "Proceedings of the 12th International Congress of Entomology, London, 8-16 Jul. 1964". Freeman, P., Ed. London, Royal Entomological Society of London. 1965.

For abstract, see 273.

275 Auclair, J.L. RECENT ADVANCES IN THE FEEDING AND NUTRITION OF APHIDS. Can. Ent. 96, 1-2 (1964) 241-9.

Recent developments on aphid digestive enzymes, aphid feeding, and nutrition on host plants and on artificial media are reviewed, with 39 references. Radioisotopes were utilized in a number of studies cited although this fact is not specifically mentioned in the text.

* See also Food Chains (3-a).

276[1] Boorman, J. P. T. OBSERVATIONS ON THE FEEDING HABITS OF THE MOSQUITO Aëdes (Stegomyia) aegypti (Linnaeus): THE LOSS OF FLUID AFTER A BLOOD-MEAL AND THE AMOUNT OF BLOOD TAKEN DURING FEEDING. Ann. trop. Med. Parasit. 54 (1960) 8-14.

A batch of mosquitoes, used the 4th day after emergence, were allowed to feed on heparin-treated mouse blood (50 units/ml) confined over a mouse-skin membrane and made active by adding 0.1 ml of a solution containing ^{144}Ce or ^{35}S. The fluid passed from the gut of the mosquito immediately after a blood meal was studied, the volume of fluid being estimated at ~1.5 mm^3. It is suggested that this fluid is derived mainly from the blood meal, by absorption through the midgut wall and by excretion via the Malpighian tubes and hind gut. In a small number of cases whole blood was passed out. In these cases, when the blood meal contained living virus, virus was present in the faeces; when the blood was not passed, virus was absent from the faeces. It is concluded that defaecation after feeding is unlikely to be of importance as a means of mechanical transmission of virus (Semliki Forest virus, KMV strain). The use of radioisotopes for the estimation of blood meals size provides a method independent of faecal loss of fluid. These estimates were 68% higher than the commonly accepted estimates obtained by weighing insects before and after feeding. It is suggested that the normal size of a blood meal for A. aegypti is of the order of 4.0-4.5 mm^3.

277 Chauvin, R., Lecomte, J. SUR LES ECHANGES DU "DEUXIEME DEGRE" ENTRE COLONIES FILLES DE Formica polyctena ETUDIES AU MOYEN DES RADIO-ISOTOPES. Insectes soc. 11, 2 (1964) 97-104. (With English summary)

Le transfert d'isotopes (^{198}Au) entre les colonies filles de Formica polyctena, à partir d'une des colonies marquées, suit des voies préférentielles, malgré l'activité des butineuses plus ou moins également réparties entre les fourmilières. Certaines colonies procèdent à des échanges actifs de glucides et d'isotopes, d'autres ne reçoivent rien ou presque rien. Le transfert est limité d'ailleurs à une petite fraction de la quantité totale qui a été distribuée. Le marquage a été effectué à l'aide de 30 mCi de ^{198}Au. L'or était mélangé à 3/4 de litre ou 1/2 litre de sirop sucre à 50% au moment de l'emploi et l'ensemble était versé sur le sommet du dôme d'une des fourmilières.

278 Dame, D. A., Fye, R. L. STUDIES ON FEEDING BEHAVIOR OF HOUSE FLIES. J. econ. Ent. 57, 5 (1964) 776-7.

The study was undertaken in order to determine the age at which Musca domestica L. begins feeding and the relative acceptability of liquid versus dry bait formulations. Young flies were allowed to begin ad libitum feeding on radioactive (^{32}P) or poisoned baits at the time of emergence and determining the resulting radioactivity or mortality at various intervals. (120 μCi of ^{32}P-phosphoric acid was mixed with 15 g sugar and about 0.5 g placed in each cage; 990 flies were used in the ^{32}P-tests). Results are shown graphically. No difference in feeding behaviour was found between the sexes. On the liquid bait 50% of the flies had fed by the 5th and more than 90% by the 12th hour when only 50% had fed on the dry baits. Since fly mating does not occur before the 16th hour, a liquid bait-chemosterilant placed in a breeding site may be expected to be more effective than a dry bait.

279 Devine, T. L., Venard, C. E., Myser, W. C. MEASUREMENT OF SALIVATION BY Aedes aegypti (L.) FEEDING ON A LIVING HOST. J. Insect Physiol. 11 (1965) 347-53.

A. aegypti mosquitoes having tritiated water in their body fluids were permitted to feed on living suckling mice. The quantity of saliva a mosquito left in a mouse was computed as the ratio of the radioactivity of the ^3H found in the mouse and of the specific activity in the mosquito fluids. The fluids were extracted from individual mice and individual mosquitoes by lyophilization, and they were assayed for ^3H in a liquid scintillation spectrometer. The quantity of saliva left in a mouse when a mosquito took a blood meal had a range of 1-13 μg, with a mean of 4.7 μg. (Auth.)

280 Entwistle, P. F., Longworth, J. F. Rep. W. Afr. Cocoa Res. Inst. 1962/63 (1964) 87p.

During investigations on the feeding behaviour of the mealybugs, radioactivity counts were made on adults and nymphs of Planococcoides njalensis (Laing) that had fed for 24 h on young wood and on old secondarily thickened stems of cacao seedlings of which the second leaf from the apex had previously been exposed for 3 h to carbon dioxide [$^{14}CO_2$]. Counts per minute for mealybugs on the young stems were 218 for adults directly in line below the treated leaf, 15 for adults below but not in

line with it and 108 for nymphs from all round the stem: for adults and nymphs on the old stems, they were 1105 and 501, respectively, and the background count was about 15. In sections of the old stems that were mounted, covered with photographic emulsion and developed after storage in a deep-freeze for 16 d, the silver grains of the emulsion were located over the youngest phloem near the cambium, indicating that P. njalensis can feed in the phloem; whether it does so exclusively is not known. (From RAE-A 52: 1964, 568)

281 Kasting, R., McGinnis, A.J. MEASURING CONSUMPTION OF FOOD BY AN INSECT WITH CARBON-14 LABELED COMPOUNDS. J. Insect Physiol. 11, 9 (1965) 1253-60.

A radioisotopic procedure was investigated in which sucrose-U-^{14}C or cellulose-U-^{14}C was incorporated into artificial diets. Measurements of food consumption by 5th-instar larvae of the pale western cutworm, Agrotis orthogonia, by the radioisotopic method and either the gravimetric or chromic oxide methods agreed well. Results from applying the radioisotopic method to individual 1st-instar larvae of the cutworm fed a sprout and cellulose (1: 1) diet varied with the individual; the quantities consumed ranged between 1.4 and 24 γ for a 6 h feeding period. However, significant differences in the quantities of some diets consumed by 1st-instar larvae could be detected by the radioisotopic method. It was concluded that the radioisotopic procedure offers a means of measuring and comparing the quantities of food consumed by very small insects. (CA 63: 1965, 15261g)

282 Lee, W.R. RELATION OF DISTANCE TO FORAGING INTENSITY OF HONEY BEES (Apis mellifera) ON NATURAL FOOD SOURCES. Ann. ent. Soc. Am. 58, 1 (1965) 94-100.

In experiments conducted during two seasons, several variables affecting the relation of distance to foraging intensity were tested simultaneously by labelling bees with genetic markers and either ^{32}P or ^{131}I. During one season the weather, though variable, permitted normal flight and there was no significant variation among the days sampled; during the other season cold weather and frequent rains limited flights to short, intermittent periods and there was large variation among samples taken on different days at the same location. Weather, having a major effect only under marginal flight conditions, is therefore a "threshold" factor. During the season when weather permitted normal flight, the bees were so distributed that a linear relation to distance was found in the proportion of bees between any two of the three apiaries. When the proportion of distance that bees from each apiary had to fly to the sampled location was plotted against the proportion of bees for each location, the steep slope of each line obtained indicated a rapid decrease in relative attractiveness of a food source with increased distance from the apiary. The body-colour mutation "cordovan" did not affect the distribution of foragers or their pollen-gathering activity. During the season when weather conditions permitted normal flight, ^{131}I showed no effect on the distribution of foragers, but ^{32}P had a slight effect. Even if the data from the apiary that was fed ^{32}P are omitted, it is concluded that there is a rapid decrease in relative attractiveness of a food source with increased distance from the apiary. (Auth.)

283 Orenski, S.W., Murray, J.R., Maramorosch, K. FURTHER STUDIES ON THE FEEDING HABITS OF ASTER YELLOWS VIRUS-CARRYING CORN LEAFHOPPERS. Contr. Boyce Thomson Inst. Pl. Res. 23, 3 (1965) 47-50.

No significant differences were found in the isotope uptake from ^{32}P-labelled China aster (Callistephus chinensis) leaves by virus-free or viruliferous insects (Dalbulus maidis). The more prolonged survival on healthy asters of viruliferous insects is apparently the result of greater digestibility of the sap. The isotope uptake by both virus-free and viruliferous insects was several-fold greater on diseased asters than on healthy plants. (CA 63: 1965, 13705h)

284 Seay, T.N., Rodriguez, J.G. THE EFFECT OF COLORED LIGHTS ON INGESTION BY IMMATURE TWO-SPOTTED SPIDER MITES. Bull.ent. Soc. Am. 11, 3 (1965) 160. Abstr. 112. Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov.-2 Dec. 1965".

A technique has been developed whereby immature two-spotted spider mites, Tetranychus urticae (Koch), may be fed sucrose solutions or chemically defined diets through a collodion membrane. The effect of coloured lights on ingestion may be determined by incorporating the radioisotope ^{32}P into the solutions or diets. (Abstr.)

285 Strong, F.E., Landes, D.A. FEEDING AND NUTRITION OF Lygus hesperus (HEMIPTERA: MIRIDAE). II. AN ESTIMATION OF NORMAL FEEDING RATES. Ann. ent. Soc. Am. 58, 3 (1965) 309-14.

Four methods were employed to determine the amounts of food ingested by L. hesperus Knight. Three of them were satisfactory. (1) By weighing the food source before and after being fed upon, adult males were found to consume an amount equal to 112% of their body weight per 24 h. (2) When ^{32}P was utilized as a tracer, 3rd-instar nymphs were found to ingest an amount equal to 283% of their initial weight in 24 h. Expressed as a percentage of body weight, the amounts ingested per unit time decreased as the nymphs matured. (^{32}P was added to fresh bean juice in the form of $H_3\,^{32}PO_4$, to yield 195 cpm/µl of juice. Preliminary experiments on oral secretions with ^{86}Rb, which is not metabolized, indicated that during their feeding activities L. hesperus apparently recycles appreciable amounts of fluid; this suggests that values obtained with ^{32}P measured gross rather than net food consumption, for ^{32}P is not recycled back into the host. (3) A direct estimate of food consumption was obtained when bugs were fed through a Parafilm membrane sealing the end of a food tube connected to a capillary. Females were thus found to ingest an amount equal to 169% of their body weight in 24 h, while males ingested only 98% of theirs.

See also:

20 A change in the activity of feeding and mobility of the fleas Xenopsylla cheopis marked with radioactive phosphorus ^{32}P. (Kharlamov, V.P., 1965)
32 Radiocesium accumulation and feeding by willow leaf beetles (Chrysomela knabi Brown). (Crossley, D.A., Jr., 1964)
33 Biological half-life for radiocesium in aphids. (Crossley, D.A., Jr., 1964)
242 Analytical and histological study of the head and thorax glands in the honeybee Apis mellifica. (Hanser, G., Rembold, H., 1965)
288 The wood-destroying carpenter ant and its importance in forestry studied by tracer technique. (Kloft, W., Hölldobler, B., 1964)
289 Radiotracer investigations to determine the nest area of wood-destroying ants Camponotus herculeanus AND C. ligniperda Latr. (Kloft, W. et al., 1965)
290 Comment caractériser le transit intestinal chez les guêpes sociales. Les conséquences biologiques. (Montagner, H., 1964)
291 Etude du comportement alimentaire et des relations trophallactiques des mâles au sein de la société de guepes au moyen d'un radio-isotope. (Montagner, H., 1964)
305 Landscape studies using radioactive tracers: III. Interdependence between arthropod food chains in a tulip poplar forest. (Crossley, D.A., Jr., 1963)
318 Swarming, mating, and density in nature of Anopheles stephensi mysorensis. (Quraishi, M., 1965)

(b) General Behaviour

286 Dame, D.A., Schmidt, C.H. P^{32}-LABELED SEMEN FOR MOSQUITO MATING STUDIES. Radioactive semen of male Anopheles quadrimaculatus Say and Aedes aegypti (L.), reared in media containing 0.1, 0.25, and 0.5 µCi/ml of ^{32}P per larva, was detected in the spermathecae of their mates after copulation. The radioautographic techniques employed for detection of semen from treated males can be utilized in field investigations of mosquito-mating behaviour. Furthermore, male A. quadrimaculatus sterilized by tepa after semen tagging with radiophosphorus were competitive with untreated males for mates among untreated females. (Auth.)

287 Hölldobler, B. UNTERSUCHUNGEN ZUM VERHALTEN DER AMEISENMÄNNCHEN WÄHREND DER IMAGINALEN LEBENSZEIT. (The behaviour of male ants during their imaginal life span). Experientia 20, 6 (1964) 329-30. (In German, with English summary)

Several phases in the imaginal life of males were identified: I = social phase; II = rest phase; III = sexual phase; and IV = death phase. ^{32}P and ^{131}I were used to study their behaviour, and differences in life and phase spans were observed between Camponotus ligniperda Latr. and C. herculeanus L. on the one hand, and the much shorter-lived Formica polyctena on the other.

Formica also proved much more independent on emergence, and more specifically adapted for the sexual phase. Various other differences were observed.

See also:

5 Three experiments with Cryptorrhynchus lapathi L. by means of radioactive marking. (Dafauce, C. et al., 1963)

9 Labelling of eggs of the carob moth, Ectomyelois ceratoniae (Zeller), with P^{32} for ecological studies. (Peleg, B.A., Gothilf, S., 1964)

20 A change in the activity of feeding and mobility of the fleas Xenopsylla cheopis marked with radioactive phosphorus ^{32}P. (Kharlamov, V.P., 1965)

309 Radioecology of mud-dauber wasps. (Shinn, F., 1964)

318 Swarming, mating, and density in nature of Anopheles stephensi mysorensis. (Quraishi, M.S., 1965)

989 Activities of the medfly investigation section July 10, 1963-June 30, 1964 on insect control by radiation. Oirsa, San Salvador, El Salvador. (Morales, E., nd)

(c) Social Behaviour

288 Kloft, W., Höildobler, B. UNTERSUCHUNGEN ZUR FORSTLICHEN BEDEUTUNG DER HOLZ-ZERSTÖRENDEN ROSSAMEISEN UNTER VERWENDUNG DER TRACER-METHODE. (The wood-destroying carpenter ant and its importance in forestry, studied by tracer technique). Anz. Schädlingsk. 37 (1964) 163-9. (In German, with English summary)

Carpenter ants (Camponotus sp.) are known to occur in forests in northern and southern Europe. However, they can also be shown to be a serious menace in Central Europe, as illustrated in a forest at 340 m above sea level in northern Bavaria. Whereas isolated infested trunks may occur throughout an entire forest area, a high percentage of infested trunks was found in sunny and warm marginal zones. In that particular forest the ants appeared to prefer Norway spruce but also settled on pine and, occasionally, on oak, beech, and birch. Damage was primarily caused by Camponotus herculeanus L. ^{131}I in solution in honey water was fed to the ants. Regurgitation allowed the nest areas of Camponotus colonies to be determined with precision. The nest area of a single colony could be shown to cover several trunks and to be much wider than could be supposed from damage visible externally.

289 Kloft, W., Höildobler, B., Haisch, A. TRACERUNTERSUCHUNGEN ZUR ABGRENZUNG VON NESTAREALEN HOLZZERSTÖRENDER ROSSAMEISEN (Camponotus herculeanus L. UND C. ligniperda Latr.). (Radiotracer investigations to determine the nest area of wood-destroying ants (Camponotus herculeanus and C. ligniperda Latr.) Entomologia exp. appl. 8, 1 (1965) 20-26. (In German, with English summary)

Regurgitation is particularly important in the feeding behaviour of wood-destroying ants. In tests in Germany, radioactive iodine, ^{131}I, in honey-water was fed to colonies of C. herculeanus, and a scintillation counter was used to determine the nest area (the area that was radioactive following regurgitation) in trees. The apparatus gave very consistent results with different types of wood. The nest area of a single colony was found to include several trunks and covered a much larger area than the external damage revealed.

290 Montagner, H. COMMENT CARACTERISER LE TRANSIT INTESTINAL CHEZ LES GUEPES SOCIALES. LES CONSEQUENCES BIOLOGIQUES. C. r. hebd. Séanc. Acad. Sci., Paris 259, 12 (1964) 2016-9.

Les travaux ont porté sur Paravespula germanica et P. vulgaris. L'auteur a utilisé deux méthodes pour rendre compte de la durée du transit intestinal: 1) La mesure proprement dite de la période biologique, période effectivement mesurée, et 2) Le calcul du rapport radioactivité des excreta/radioactivité des insectes. - Pour une durée d'expérience de 24 h, il apparaît que le rapport est d'autant plus faible que les insectes sont plus nombreux. La rétention intestinale est d'emblée très bonne pour les groupements d'au moins 30 individus, alors que le transit est beaucoup plus rapide pour ceux qui ne comportent que quelques unités. Ce phénomène s'accentue pour une

température nettement inférieure à la température sociale du nid, 23°C contre 28°C. Les expériences ont également montré que l'économie de nourriture est la mieux réalisée dans un groupe qui a gardé la structuration sociale la plus proche de la normale. Au contraire, les ouvrières isolées montrent une rétention de nourriture très faible. Variations comparées des périodes biologiques des ouvrières et des mâles montrent le caractère réduit de la vie sociale chez les mâles dont les seules composantes véritables sont la recherche des régurgitations larvaires et l'accomplissement des fécondations.

291 Montagner, H. ETUDE DU COMPORTEMENT ALIMENTAIRE ET DES RELATIONS TROPHALLACTIQUES DES MALES AU SEIN DE LA SOCIETE DE GUEPES AU MOYEN D'UN RADIO-ISOTOPE. Insectes soc. 11, 4 (1964) 301-16.

Le marquage des insectes (Paravespula vulgaris) a été effectué en fournissant du miel auquel a été incorporé de l'or radioactif (^{198}Au) en solution colloïdale, de façon que chaque individu puisse absorber au moins l'équivalent de 1 µc. Les auteurs ont montré que les mâles des nids actifs s'alimentaient convenablement d'eux-mêmes, alors que dans les nids avancés les jeunes étaient seuls capables de le faire. Les adultes de ces derniers ont toujours une alimentation faible ou nulle. Les ouvrières ne les nourissent qu'avec réticence. Par contre, ils semblent très aptes à soliciter les régurgitations des larves. Tant que le nid reste actif et bénéficie d'un apport de nourriture abondante, les mâles sont probablement capables de puiser leur propre nourriture à des sources variées, comme les autres habitants. Mais lorsque le nid périclite ou lorsque les fondatrices filles apparaissent, les pourvoyeuses les délaissent au bénéfice des autres ouvrières, des fondatrices et de leur larves. Il semble alors que les mâles n'acquièrent jamais de façon parfaite le mécanisme de la trophallaxie dont les phases complexes deviennent des réflexes entre les ouvrières. Ce sont des individus inadaptés à la vie sociale du nid, n'ayant que peu de relations avec leurs ouvrières et vivant en parasites sur les régurgitations des larves. D'ailleurs, ils ne sont pas capables de nourrir le couvain, même lorsqu'on leur fournit une nourriture abondante et ils s'alimentent seuls.

See also:

277 Sur les échanges du "deuxième degré" entre colonies filles de Formica polyctena étudiés au moyen des radio-isotopes. (Chauvin, R., Lecomte, J., 1964)
287 The behaviour of male ants during their imaginal life span. (Höllidobler, B., 1964)

(d) Dispersal and Migration

292 Dlabola, J., Taimr, L. THE DISPERSAL FLIGHT OF Meligethes BEETLES AND SPRING MIGRATION OF DELPHACIDS WITH SPECIAL REFERENCE TO THE APPLICATION OF THE TRACER METHOD. p. 328 of "Proceedings of the 12th International Congress of Entomology, London, 8-16 Jul. 1964". Freeman, P., Ed. London, Royal Entomological Society of London, 1965.

Radioisotopes were first used in Czechoslovakia for work on the ecology of the leafhopper Javesella pellucida Fabr., the vector of oats sterile dwarf virus, to study its migration from hibernation to spring oats. Other experiments were carried out with bees to test their effectiveness in visiting alfalfa flowers and with Meligethes beetles visiting rape flowers. A solution of $Na_2H^{32}PO_4$ or $NaH_2{}^{32}PO_4$ of specific activity 50-150 µCi/ml labelled the plant sap. Leafhopper activity reached 100-1000 cpm, ensuring adequate detection up to 4 weeks of capture. Pollinators were marked by feeding on honey and sugar paste to which water was added, mixed with $H_3{}^{32}PO_4$ (50 µCi/ml) but no positive result was obtained in alfalfa fields. Meligethes beetles were dipped (aqueous solution of $H_3{}^{32}PO_4$, at 11.7 µCi/ml, for 4 min). The detection of radioactive specimens after 8 d exposure was secured by gluing them on a safety pack- x-ray film, thus permitting differences of 5 cpm to be measured. Only one labelled female was found in the oat field of release, and one male specimen about 600 m to the south east. The following year about 17 000 labelled specimens were released at their hibernation site and checked at successive weekly intervals. Of 5572 specimens swept only eight were radioactive. Maximum migration from the point of release was 824 m to the south east (the prevailing wind direction), with an evident spread over an area exceeding 2-3 km in diameter, because no strikingly higher number of radioactive specimens had been found in fields closest to the point of release. The marked 138 000 Meligethes spp, predominantly M. aeneus F., were released some metres from the flowering rape. The speed of flight of the

beetles was 150 m/h. 85 samples swept after 1, 50 and 98 h contained 465 labelled specimens out of 131 300, showing the dispersal to be nearly regular over the area. In a second experiment 483 000 specimens were marked, in a different area, near a wood in the centre of some distant fields of rape. In the nearest field (200 m away), labelled beetles were found 2 h after release. A sweep in all three fields within a circle of one km in diameter 24 h later gave an average of 26 labelled specimens in 25 000 beetles checked. Similar sampling 8 d later at about 4.3 km gave an average of 10 specimens. The radius of action and mobility of flying insects appears to be much higher than previously supposed, so that the actual maximum distance of migration can hardly be ascertained either by means of a portable detection apparatus or by sweeping.

293 Dustan, G. G. TAGGING THE ORIENTAL FRUIT MOTH, Grapholita molesta (Busck) WITH RADIOACTIVE PHOSPHORUS FOR FLIGHT AND DISPERSAL STUDIES. Can. Ent. 97, 8 (1965) 810-16.

Large numbers of Oriental fruit moth adults were successfully tagged (500 or more cpm) by holding them for 24-48 h in cages provided with cotton wicks moistened with a water-solution of ^{32}P at 20 µCi/ml. The addition of sugar to the tagging solution did not increase its effectiveness. Approximately 80% of the total radioactivity of the tagged moths was internal due to ingested liquid and the remainder was on the surface of their bodies; 73% of the total was in and on the abdomen. The loss in radioactivity of tagged moths in 1-6 d was 2.2-4.7 times greater than the theoretical loss due to isotope decay alone. The highest rate of loss occurred during the first day, probably through excretion before the ^{32}P was absorbed from the digestive tract. Egg laying contributed to loss of radioactivity. Though water and liquid bait removed some ^{32}P from tagged moths this did not result in appreciable contamination of other moths trapped in the liquids. Attempts to tag large numbers of moths (400-1000 per cage) for release and recovery experiments were only partially successful as the radioactivities attained by individual moths varied widely at different times and from cage to cage, even under the same environmental conditions. This appeared to be partly due to differences in the feeding behaviour of different batches of moths and it may have been influenced by the conditions under which they were reared. (Auth.)

294 Fussell, E.M. DISPERSAL STUDIES ON RADIOACTIVE-TAGGED Culex quinquefasciatus Say. Mosquito News 24, 4 (1964) 422-6.

$H_3{}^{32}PO_4$ was used for labelling larvae at 0.079 mCi ^{32}P/l water, at a larval concentration of 4000 larvae/ft^2 water surface. Previous studies had shown the Waipio Peninsula to be the primary source of C. quinquefasciatus for the Pearl Harbor area. Out of 275 000 labelled mosquitoes released on the peninsula 634 were recovered at distances up to 3.5 miles and 20 beyond the 0.5 mile radius of the release point. Whereas wind direction had some effect, dispersal distance was not affected by the sex of the mosquito.

295 Impens, R., François, E., Riga, A. Myzus persicae Sulz. ET Aphis fabae Scop.; LEUR DISPERSION SUIVIE A L'AIDE DE ^{32}P. Revue Agric., Brux. 17, 7/8 (1964) 905-19. (With English summary)

Ces essais ont été menés au cours de l'année 1963. Un procédé de marquage d'aphides au moyen de ^{32}P et de comptage de l'activité absorbée par ceux-ci est décrit. Des betteraves cultivées en vases de végétation, furent arrosées avec une solution contenant 1 mCi de ^{32}P (solution à laquelle avait été ajoutée une certaine quantité de ^{32}P stable sous la même forme chimique d'orthophosphate). Les pucerons restèrent 2 ou 3 j sur les plantes radioactives. Les essais principaux, en plein champ, sur des parcelles de betteraves sucrières, furent conçus de manière à pouvoir étudier la dispersion des deux pucerons virulifères: Aphis fabae Scop. et Myzus persicae Sulz. L'utilisation d'un appareil de détection à grande sensibilité et à faible mouvement propre a permis de mesurer les activités, quelquefois très faibles, de la fraction des insectes capturés provenant des plantes-sources marquées. Les résultats sont encourageants. Des précisions sont apportées sur l'écologie des deux pucerons.

296 (x) Jeski, R. STUDIA NAD BIOLOGIĄ I EKOLOGIĄ NASIONNICY TRZEŚNIÓWKI Rhagoletis cerasi L. (DIPT., TRYPETIDAE). (Studies on the bionomics and ecology of Rhagoletis cerasi L.). Polskie Pismo ent. B, Pt. 3-4 (1963) 153-240. (In Polish, with English and Russian summaries)

^{32}P was used in some attempts to determine the duration and range of adult flight but was found to be unsuitable as the tracer was transmitted to eggs and larvae by the female, and cherries became contaminated.

297 Lewis, C. T., Waloff, N. THE USE OF RADIOACTIVE TRACERS IN THE STUDY OF DISPERSION OF Orthotylus virescens (Douglas and Scott) (MIRIDAE, HETEROPTERA). Entomologia exp. appl. 7, 1 (1964) 15-24. (With French summary)

A method is described by means of which large numbers of O. virescens captured on broom (Sarothamnus scoparius) in England were labelled with ^{32}P and ^{35}S that could be readily differentiated autoradiographically. Samples of insects labelled differently were released in two sections of the broom plantation, and subsequent recaptures from inside and outside the plantation provided evidence of a considerable edge effect of the habitat on the movement of the Mirids. (From auth. summary)

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299 Quraishi, M.S. STUDY OF THE FLIGHT RANGE AND GONOTROPHIC CYCLES IN Anopheles stephensi USING P^{32}. p. 426-28 of "The Role of Science in the Development of Natural Resources with Particular Reference to Pakistan, Iran and Turkey. Symposium of the Cento Scientific Council, Lahore, Jan. 1962". Oxford, Pergamon Press 1964, 454p.

Over the last two years, field studies were carried out, in collaboration with the Iranian Institute of Malariology and Parasitology, in which a total of 190 000 ^{32}P-labelled A. stephensi were released among a group of isolated villages. After large-scale collection 287 labelled insects were recaptured at distances up to 4½ km from the release point. All captured females were classified according to the amount of undigested blood (Sella stage) and then dissected to find the stages of development of their ovaries (Christopher's stage). The number of dilations in the ovarioles revealed the number of gonotrophic cycles completed by the females (Polovodova). The study thus provides an effective determination of the flight range, the development of the ovaries in relation to the age of the mosquito and the length of the gonotrophic cycle on nature.

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301 Rubtsov, I.A. MODE AND RANGE OF BLACK FLY (DIPTERA: SIMULIIDAE) LARVAL MIGRATIONS. Ent. Obozr. 43, 1 (1964) 52-66. (In Russian). English Translation: Ent. Rev. 43, 1 (1964) 27-33.

Migration of the blackfly was studied by direct visual observation of larval displacement in bodies of water; clearing (e.g. by insecticides) sectors of water below sites where mass concentrations have been found and then studying the colonization of the cleared sections; tagging larvae with radioisotopes, then releasing them into the water, recovering them and counting the tagged specimens; observation of the distribution of larvae and pupae in drained riverbeds after the spring floods have subsided; and other indirect methods. Difficulties in recovering tagged insects under natural conditions make a valid interpretation of results almost impossible, particularly assessments of the distance to which larvae are actually able to migrate.*

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* see I/334.

302 Soria, F. STUDIES ON THE LONG-RANGE DISPERSION OF THE MEDITERRANEAN FRUIT FLY UNDER VARIOUS CONDITIONS IN TUNISIA. WP/31/7, International Atomic Energy Agency, Vienna (Austria). 1965, p. 4.

303 Stern, V.M., Schlinger, E.I., Bowen, W.R. DISPERSAL STUDIES OF Trichogramma semifumatum (HYMENOPTERA: TRICHOGRAMMATIDAE) TAGGED WITH RADIOACTIVE PHOSPHORUS. Ann. ent. Soc. Am. 58, 2 (1965) 234-40.

About 2 million T. semifumatum (Perkins) were released in the first study, in the Imperial Valley, Calif., and about 1½ million in a second study near Shafter, Calif., in 1960. Females tended to disperse more rapidly than males, 1 ♀ being recovered 2000 ft from the release point 17 h after release, while 2 ♂ were taken 400 ft from the release point after another 24 h had elapsed. One individual (sex not determined) was recovered 3500 ft from the release point, 62 h after release. Since the radioactive wasps were found to live at least 15 d after release, females could have dispersed up to 10 miles and males up to 1 mile of they dispersed unidirectionally from the area of release or emergence. Specimens were easily recovered within 200 ft of the release point, but the factor of area dilution is extremely important in connection with recovery of tagged specimens, whose number decreased markedly with increased distance. In the absence of rigorous weather

conditions, the extent to which temperature and wind aided or hindered dispersal could not be determined. Tagging procedures and vacuum suction sampling methods are discussed. ^{32}P was administered in a honey-water solution (2/3 honey and 1/3 water), smeared on glass plate tops to feed and tag the parasites as they emerged and flew towards the light (being positively phototropic). Many of the parasites ingested enough radioactive honey-water to give 1500 cpm on a G-M scaler.

304 Taimr, L., Dlabola, J. RADIOISOTOPES AS TRACERS USED FOR MIGRATION STUDIES OF THE LEAFHOPPER SPECIES Caligypona pellucida F. Acta agron. hung. 12, 3/4 (1963) 321-34. (In Hungarian)

See also:

1 Radiomarking in the study of insect pests. (Andreev, S.V. et al., 1964)
2 Labelling of adults of Chilo partellus Swinhoe. (C. zonellus), the stalkborer of maize and "jowar", with radioactive phosphorus (P^{32}). (Chatterji, S. et al., 1964)
6 Three techniques for labelling Culicoides (Diptera: Heleidae) with radioactive tracers both in the laboratory and in the field. (Davies, J.B., 1965)
9 Labeling of eggs of the carob moth, Ectomyelois ceratoniae (Zeller), with P^{32} for ecological studies. (Peleg, B.A., Gothilf, S., 1964)
272 The bionomics of blow flies. (Norris, K.R., 1965)
282 Relation of distance to foraging intensity of honey bees (Apis mellifera) on natural food sources. (Lee, W.R., 1965)
318 Swarming, mating, and density in nature of Anopheles stephensi mysorensis. (Quraishi, M.S., 1965)
319 Les radioisotopes in écologie animale: I. Expériences sur le marquage de pucerons vecteurs de la jaunisse de la betterave. (Impens, R. et al., 1965)
988 The application of nuclear energy to agriculture. (Moh, C.C., 1964)
989 Activities of the medfly investigation section during July 10,1963 - June 30,1964 on insect control by radiation. OIRSA, San Salvador, El Salvador. (Morales, E., nd)

3. Inter-Relations

(a) Insect Environment (Radioactive Contaminated Systems, including Deliberate Contamination and Fallout, and Food Chains)

305(2) Crossley, D.A., Jr. LANDSCAPE STUDIES USING RADIOACTIVE TRACERS: III. INTERDEPENDENCE BETWEEN ARTHROPOD FOOD CHAINS IN A TULIP POPLAR FOREST. Bull. ecol. Soc. Am. 44, 3 (1963) 74. Abstr.

The contrasting movements of ^{137}Cs through two types of food chains is being followed in a tulip poplar stand. One food chain was based on green foliage. The principal herbivores were geometrid larvae and aphids; principal predators were chrysopids and spiders. The other food chain was based on litter. Distribution of ^{137}Cs in plants, herbivores and predators was similar to that found for the soil-plant-insect food chain on the White Oak Lake bed. Concentrations of ^{137}Cs in leaf litter herbivores, and predators collected from the forest floor, suggest that some of the forest floor animals meet their energy requirements through the green foliage food chain. Current research is using physical and biological aspects of the movement of ^{137}Cs to define more precisely the interactions between food chains based on different parts of the ecosystems. (Abstr.)

306 Nelson, D.J. BIOLOGICAL VECTORS AND RESERVOIRS OF STRONTIUM-90. Nature, Lond. 203 (1964) 420.

The roles of emergent Chironomidae as vectors of ^{90}Sr and freshwater clams as reservoirs of ^{90}Sr in the Clinch and Tennessee Rivers were assessed. Fallout entering the Clinch River added 45 times as much ^{90}Sr as was removed by the emerging chironomids. Therefore, it was concluded that the general dispersion of ^{90}Sr by insects is not of great importance. Similarly, the annual removal and reservoir of ^{90}Sr in clams were small. It is suggested that general contamination of the landscape by mobile organisms is unlikely. (NSA 18: 1964, 36918)

307 Patten, B.C. STATIONARY DISTRIBUTION AND TURNOVER OF RADIOACTIVITY IN A HYPOTHETICAL FOOD CHAIN. p. 90-92 of "Health Physics Division Annual Progress Report for Period Ending July 31, 1965". ORNL-3849, Oak Ridge National Lab., Tenn. Oct. 1965, 263p.

A mathematical approach is described.

308 Rickard, W.H., Haverfield, L.E. PITFALL TRAPPING SURVEY OF AUTUMN-EMERGING DARKLING BEETLES IN DESERT STEPPE VEGETATION. HW-SA-3556, General Electric Co., Richland, Wash. Hanford Atomic Products Operation. 28 May 1964, 17p.

A continuous pitfall trapping survey of the autumn-emerging darkling beetles, Pelecyphorus densicollis Horn, and Stenomorpha puncticollis LeC., was made in adjacent greasewood and sagebrush communities on the Hanford Reservation, Benton County, Wash. in 1963. 49 pitfall traps arranged in a 7 × 7-m grid pattern with regular 3-m spacing were located in each community and visited at 3-4 d intervals. Pelecyphorus emerged slightly earlier than Stenomorpha but both species persisted until the first measured snowfall in early December. A total of 4378 beetles were captured, marked, and released. Beetles of the greasewood community tended to be higher in cations than those of the sagebrush community, especially with respect to Na. A comparison of the γ-emitting radionuclide content derived from worldwide fallout of vegetation and darkling beetles was made in the summer of 1962 (Table IV). Cerium-praseodymium-144, zirconium-niobium-95, and ruthenium-rhodium-106 were the most abundant γ-emitting radionuclides measured in the leaves, with very small amounts of ^{137}Cs. No accumulation from fallout was observed in darkling beetles. Some accumulation might be expected because of the high potassium content in beetles, and since ^{137}Cs is somewhat similar to K in chemical behaviour.

309 Shinn, A.F. RADIOECOLOGY OF MUD-DAUBER WASPS. Bull. ent. Soc. Am. 10, 3 (1964) 172. Abstr.

Sceliphron but not Trypoxylon mud-daubers used radioactive mud from liquid waste disposal areas for nest construction. Comparisons of adult emergence and parasites are given for radioactive and control nests of Sceliphron. Experiments for determination of dispersal after hatching, flight range, and radiation dose to free-living adult wasps are discussed.

310 Shinn, A.F., Dodson, G.J., Corley, C.L. TRANSPORT OF RADIOACTIVE MATERIALS BY MUD-DAUBER WASPS. p. 71-3 of "Health Physics Division Annual Progress Report for Period Ending July 31, 1964". ORNL-3697, Oak Ridge National Lab., Tenn. Oct. 1964.

The Black-and-Yellow mud-dauber wasps, Sceliphron cementarium, construct nests using radioactive mud from waste pits and the White Oak Lake bed. The Pipe-Organ mud-dauber wasp, Trypoxylon politum, common in the same areas, never uses radioactive mud. Mud is usually carried to the nest site from < 150 ft away but may be carried up to 650 ft. A short flight range is indicated. Several species of wasps, beetles, and flies use the mud nests of Sceliphron as parasites or tenants. The effect of the radiation on Sceliphron is to reduce successful emergence by a significant 40% ($P < 0.001$), and radioactive cells of the nests show a higher mortality from parasites ($P < 0.01$). Radioactive nests gave survey meter readings from slightly above background to > 1 R/h of mixed γ- and β-radiation, but neither spiders stored as food nor developing wasps were radioactive. ^{137}Cs, ^{106}Ru, ^{60}Co, ^{65}Zn, ^{144}Ce, and ^{90}Sr were identified in the nest as γ- and β-emitters, respectively. The total dose received by developing wasps was 10 630 rad: 110 rad to the eggs (3 d), 520 rad to the larvae (14 d), and 10 000 rad to the overwintering larva in its cocoon (9 months). The Sceliphron population will decline.

311 Wiegert, R.G., Odum, E.P., Marples, T.G. USE OF PHOSPHORUS-32 TO ISOLATE FOOD CHAINS IN INTACT ECOSYSTEMS. p. 87-92 of "Onsite Ecological Research of the Division of Biology and Medicine at the Savannah River Ecology Laboratory". TID-21713. Jan. 1965, 93p.

By labelling two different species of plants, Leptilon candensis (horseweed) and Heterotheca subaxillaris (camphorweed) with ^{32}P in the stand containing these among other species revealed striking differences in the transfer of P through the food chain. Phytophagous insects became much more highly labelled on Heterotheca as compared with Leptilon, especially during the first 2 weeks. Heterotheca is clearly "grazed" to a greater extent than Leptilon. The small ant, Dorymyrmex, on the other hand showed a much higher activity density on Leptilon; these ants are believed to feed extensively on plant exudates or natural "honeydew". The uptake pattern in the abundant green cricket (Oecanthus) at first had a much higher activity density in the populations on Heterotheca and then, after the 4th week, a much higher one on Leptilon. In general, small, active ants (e.g. Crematogaster in marsh or Dorymyrmex in old fields) are the first animals to reach peak activity following a single labelling dose applied within the plant tissues. Active grazing herbivores such as plant bugs (Trygonotylus) fulgoris (Prokelisia) or grasshoppers (Orchelimum) may reach a peak within 2-3 weeks while predators such as spiders (Arachnida) do not usually become highly labelled until 40-60 d after plant labelling.

See also:

316 Measurement of heterotrophic productivity with radioactive tracers. (Crossley, D.A., Jr., 1964)
940 Clinch river and related aquatic studies. (Nelson, D.J. et al., 1964)
952 Radiation ecology. (Auerbach, S.I., 1965)
953 Radioactive waste area and radiation effects studies. (Auerbach, S.I. et al., 1964)

(b) Insect-Microorganism

312 Fast, P.G., Angus, T.A. EFFECTS OF PARASPORAL INCLUSIONS OF Bacillus thuringiensis VAR sotto ON THE PERMEABILITY OF THE GUT WALL OF Bombyx mori LARVAE. J. Invertebrate Path. 7, 1 (1965) 29-32.

The effects of toxin from B. thuringiensis var sotto on the permeability of gut wall of B. mori larvae were studied using radioactive tracers. The toxin inhibited the transfer of glucose-U-^{14}C into the haemocoel, while transfer of labelled Na_2CO_3 was accelerated. Both effects were greater in the German White strain of B. mori than in the British Zebra strain. The results support the hypothesis that the general paralysis observed in the insect is due to changes in the haemolymph pH induced by altered gut wall permeability. (CA 63: 1965, 976)

313 Geesteranus, H.P.M. TITER DETERMINATION OF PREPARATIONS OF Bacillus thuringiensis Berliner. Entomophaga 10, 1 (1965) 27.

Bacterial suspensions were mixed with ^{32}P and spread on leaves on which 3rd-instar larvae were placed subsequently. First symptoms of intoxication were cessation of feeding and excretion of faeces. At concentrations which caused a mortality of 70-80% after 36 h, the dead caterpillars could be divided into two groups, according to high or low radioactivity, depending on experimental conditions. These differences are caused by the fact that the different toxins in the preparations react on different parts of the intestinal tract. A caterpillar of low radioactivity had reacted to the thermostable, water-soluble toxine, inducing a feeding stop in the first part of the gut system. A caterpillar with high radioactivity had not reacted to this exotoxin, but had stopped feeding at the moment of food entering the midgut, induced by crystals. An indication of the ratio of these two toxins in commercial preparations of these insect pathogenic bacteria is therefore given.

(c) Insect-Animal (including Parasites and Predator Relationships)

314 James, H.G. PREDATORS OF Aedes atropalpus (Coq.) (DIPTERA: CULICIDAE) AND OF OTHER MOSQUITOES BREEDING IN ROCK POOLS IN ONTARIO. Can. J. Zool. 43, 1 (1965) 155-59.

Predators of A. atropalpus (Coq.) and of other rockpool mosquitoes (Culex restuans Theob., C. territans Walk., and Anopheles punctipennis (Say)) were investigated at Cordova Mines, Ont., by

tagging larvae with radioactive phosphorus, ^{32}P. ^{32}P in the form of $H_3{}^{32}PO_4$ was added to bring the radioactivity of the rearing medium to 0.25 μCi/ml. Under the experimental conditions the average cpm for the 11 sample larvae was 63 440 (range 9 820-186 000) above background. High radiation counts showed that six species of dytiscids, two of Hemiptera, a leech, and a minnow were predators of A. atropalpus. The dytiscid Laccophilus maculosus Germ. exceeded other arthropod predators in numbers and in degrees of radioactivity. Hydra oligactis Pallas killed but did not ingest the tagged larvae. Other evidence suggested that H. oligactis inhibits breeding by capturing young larvae and paralysing later stages. Five species of aquatic insects were predacious on larvae of Anopheles and Culex.

315 Lebez, D., Maretić, Z., Kristan, J. STUDIES ON LABELED ANIMAL POISONS. I. DISTRIBUTION OF ^{32}P-LABELED Latrodectus tredecimguttatus VENOM. Toxicon 2, 4 (1965) 251-3.

Four adult L. tredecimguttatus were used during the summer months. Water was withheld from the spiders for 1 week prior to exposure to drinking water containing $Na_2H\,{}^{32}PO_4$. Two to four days later a guinea pig was exposed to one spider, and the distribution of ^{32}P studied in the envenomated guinea pig. Large amounts of ^{32}P were found in the central nervous system and peripheral nerves; small amounts were found in the liver, spleen, lungs, heart, kidneys, adrenals, muscles and blood.

See also:

10 A new method of P-32 labelling of the scale predator, Chilocorus bipustulatus L. (Coccinellidae), with possible application to other scale predators. (Peleg, B.A., Nadel, D.J., 1965)

279 Measurement of salivation by Aedes aegypti (L.) feeding on a living host. (Devine, T.L. et al., 1965)

305 Landscape studies using radioactive tracers: III. Interdependence between arthropod food chains in a tulip poplar forest. (Crossley, D.A., Jr., 1963)

(d) Insect-Plant (including Forest Infestation)

316 Crossley, D.A., Jr. MEASUREMENT OF HETEROTROPHIC PRODUCTIVITY WITH RADIOACTIVE TRACERS. p.74-5 of "Health Physics Division Annual Progress Report for Period ending July 31, 1964". ORNL-3697, Oak Ridge National Lab., Tenn. Oct. 1964.

Data obtained for the plant - insect herbivore - insect predator food chain on White Oak Lake bed were were used for the estimation of heterotrophic production and energy flow at the herbivore level, by combining information on radiocesium movement and information on biomasses, respiration rates, and caloric content of plants and insects. The equilibrium concentration of ^{137}Cs in predaceous insects (78%/g of dry weight) and an elimination constant corrected for the average size of the population (0.98 d^{-1}) suggest an intake rate of 72%/g dry weight of predator/d. From the average Cs concentration in herbivorous insects (78%/g), the food intake by predators was estimated to be 0.92 g eaten per g of predator/d. An integrated biomass curve indicated this as 630 mg of herbivore consumed/m^2 during the sampling period. Assuming a non-predatory mortality of 20%, total mortality would then be 788 mg/m^2. Total production for the herbivorous insect population during the 9 week sampling period is estimated at 140 mg/m^2 net increase plus 788 mg/m^2 loss to mortality, for a total of 928 mg/m^2 production. Net increase in biomass was only 15% of total production. Energy flow through herbivorous insects was estimated as 33.6 kcal/m^2 maintenance, 10.8 kcal/m^2 production, for a total of 44.4 kcal/m^2, corrected to a 20 week growing season.

317 Williams, M.W., Lindner, R.C. J. Insect Physiol. 11, 1 (1965) 51.

Tests conducted by the authors have shown that when psylla (Psylla pyricola Foerster) are allowed to become radioactive with ^{14}C and transferred to non-labelled pear seedlings, activity appears in the vascular system of the seedlings. This rather conclusively suggests an exchange between the insect and plant. (Unpublished data cited in their article "Biochemical Components of Pear Psylla and their Relative Toxicity to Excised Bean Plants", ibid. 41-52.)

See also:

5 Three experiments with Cryptorhynchus lapathi L. by means of radioactive marking. (Dafauce, C. et al., 1963)

4. Population Dynamics

318 Quraishi, M.S. SWARMING, MATING, AND DENSITY IN NATURE OF Anopheles stephensi mysorensis. J. econ. Ent. 58, 5 (1965) 821-4.

Swarm formation and copulation in swarms of A. stephensi mysorensis Sweet and Rao were studied. A few females were captured during copulation. They were found not to have fed but some had completed one or two gonotrophic cycles. Female-male ratio in the swarm was 3:5, in indoor catches 2.3:1, and in pit shelter 1:1. Swarm formation (of about 15 000 mosquitoes) was also studied on ^{32}P-labelled insects, when a few ♂ immediately formed swarms of 200-300 individuals. The capture of copulating pairs showed that the unfed ♀ mates immediately after release and before taking a blood meal. Once mated, the ♀ takes her first blood meal during the first night of flight. All labelled ♀ captured within 16 h of release had fed on blood. Both ♂ and ♀ are capable of flying a distance of 4.3 km; they can cover > 1.8 km overnight from the point of release.

See also:

3 The present state of the protection of potato against Colorado beetle in the USSR and the problems involved. (Chigarev, G.A., 1963)
296 Studies on the bionomics and ecology of Rhagoletis cerasi L. (Łęski, R., 1963)
302 Studies on the long-range dispersion of the Mediterranean fruit fly under various conditions in Tunisia. (Soria, F., 1965)

5. Life Cycle. Development

See:

3 The present state of the protection of potato against Colorado beetle in the USSR and the problems involved. (Chigarev, G.A., 1963)
296 Studies of the bionomics and ecology of Rhagoletis cerasi L. (Łęski, R., 1963)
299 Study of the flight range and gonotrophic cycles in Anopheles stephensi using P^{32}. (Quraishi, M.S., 1964)
309 Radioecology of mud-dauber wasps. (Shinn, A.F., 1964)
822 Studies on the rate of spermatogenesis in Drosophila: effects of x-rays and streptonigrin. (Martin, A.O., 1965)

D. INSECTS AS DISEASE VECTORS

319 Impens, R., François, E., Riga, A. LES RADIOISOTOPES EN ECOLOGIE ANIMALE: I. EXPERIENCES SUR LE MARQUAGE DE PUCERONS VECTEURS DE LA JAUNISSE DE LA BETTERAVE. Meded. LandbHoogesch. OpzoekStns Gent 30, 2 (1965) 1009-1015.

Les betteraves virosées, couvertes de pucerons, et arrosées au moyen d'une solution d'orthophosphate de sodium marquée au ^{32}P, furent placées au centre de parcelles de betteraves. La radioactivité absorbée par les insectes était suffisante pour permettre leur détection. Cette radioactivité était décelée par autoradiographie. Les captures des insectes marqués se furent surtout à proximité (dans un rayon de 4 m) des plantes radioactives. Des ailés de Myzus ont été retrouvés à près de 35 m

du point de lâcher. Des essais ont déjà été entrepris pour élucider le rôle d'Hyperomyzus staphyleae Koch, comme premier vecteur de la Jaunisse. Une technique originale a été mise au point qui consiste à injecter dans la racine une solution de saccharose ^{14}C. Ces racines sont ensuite placés en cave, au milieu d'un silo. La dispersion des pucerons à partir de ce silo, est suivie en disposant des pièges jaunes à proximité.

See also:

283 Further studies on the feeding habits of aster yellows virus-carrying corn leafhoppers. (Orenski, S.W. et al., 1965)

E. CHEMICAL CONTROL MEASURES

1. General Articles. Surveys

320 Dedek, W. DIE ANWENDUNG RADIOAKTIVER NUKLIDE IN DER CHEMIE DER PFLANZENSCHUTZ UND SCHÄDLINGSBEKÄMPFUNGSMITTEL. (The application of radionuclides in studying the chemistry of compounds for plant protection and pest control). Atompraxis 10, 2 (1964) 65-70. (In German)

Bibliographical review article (253 references) listing studies on insecticides, fungicides, herbicides, and growth regulators, in which radioisotopes had been employed. The isotopes used included ^{32}P, ^{35}S, ^{36}Cl, ^{82}Br, ^{14}C, and ^{3}H.

321 Georghiu, G.P. GENETIC STUDIES ON INSECTICIDE RESISTANCE. Adv. Pest Control Res. 6 (1965) 171-230.

Review article. After discussing the determination of the genotype, the author considers the inheritance of resistance (DDT, cyclodienes, organophosphates, and carbamates), dealing primarily with Musca domestica, mosquitoes, Drosophila, Stomoxys calcitrans, and Blattella germanica. Negatively correlated insecticides, cross resistance and multiple resistance, and vigour tolerance are also discussed. In some of the studies cited radioisotopes were used but this is not stressed. Mention is made of experiments on the induction of resistance by x-irradiation in Drosophila. (ref. 773).

322 Hilton, B.D., O'Brien, R.D. INSECTICIDE LABELING: A SIMPLE TECHNIQUE FOR TRITIATION OF AROMATIC INSECTICIDES. J. agric. Fd Chem. 12, 3 (1964) 236-8.

The tritiating technique of Yavorsky and Gorin (J. Am. chem. Soc. 84:1962, 1071) was used to label aromatic insecticides, and the degree of labelling, which varies greatly with different compounds, has been tentatively accounted for. The method is simple and requires little space and no expensive reagents or apparatus. The cost per labelled compound is low, on the average $7.00 for 100 - 200 mg of labelled compound. Activities up to 15.5 mCi/mM were obtained. Amongst the compounds labelled were various carbamates, including Sevin, DDT, Baytex, Co-ral, parathion, and naphthalene.

See also:

1070 Use of isotopes in the food-canning industry. (Mercer, W.A., Ralls, J.W., 1964)

Carbon Tetrachloride

323 Aiyar, A.S., Fatterpaker, P., Sreenivasan, A. LIPID METABOLISM IN LIVER INJURY CAUSED BY CARBON TETRACHLORIDE IN THE RAT. Biochem. J. 90, 3 (1964) 558-63.

The increase in liver lipids in rats given CCl_4 is restricted to fatty acids of the acetone-soluble lipids. The phospholipid concentration is significantly decreased. The incorporation of uniformly labelled [$^{14}C_2$]acetate into the fatty acids and cholesterol of liver slices is little affected in the early period (after 3 h) of poisoning with CCl_4, when there is a significant decrease in the specific activity of the phospholipids. The labelling of all these fractions is greatly diminished after 24 h. A significant decrease in oxidation rate of octanoate and of [1-^{14}C]palmitate by liver homogenates from rats given CCl_4 is observable 3 h after administration; activity is considerably impaired after 24 h. Poisoning with CCl_4 results in decreases in plasma albumin and in lipids of plasma lipoproteins even 3 h after administration, followed by a considerable decrease in the lipids of the lipoproteins of the cell sap. An impairment of lipoprotein synthesis and consequently of lipid transport may be the primary cause of the accumulation of lipid in liver injury caused by CCl_4. (Auth. summary)

324 Rubenstein, B., Rubinstein, D. THE EFFECT OF CARBON TETRACHLORIDE ON HEPATIC LIPID METABOLISM. Can. J. Biochem. 42, 9 (1964) 1263-73.

The effect of the administration of varying doses of CCl_4 upon the level of hepatic lipid fractions was investigated. The hepatic cholesterol esters are greatest at low doses of CCl_4, while the hepatic triglycerides and serum transaminase levels continue to rise as increasing amounts of CCl_4 are administered. The amount of liver triglycerides is significantly increased within 2 h after CCl_4 administration, while the hepatic cholesterol ester level and serum transaminase activity are not elevated until 6 h. An increase in the rate of incorporation of intravenously administered acetate-1-^{14}C into hepatic triglycerides occurred within 3 h after CCl_4 treatment, but no increase was noted in cholesterol and cholesterol ester radioactivity until an additional 3 h had elapsed. The treatment of CCl_4-intoxicated rats with phenoxybenzamine, although decreasing necrosis, does not prevent the accumulation of hepatic lipids. Slices of liver from CCl_4-intoxicated animals incorporate acetate-1-^{14}C more rapidly into cholesterol esters and less rapidly into cholesterol and triglycerides than liver slices from control animals. The presence of CCl_4 in the atmosphere above the liver slices from untreated animals induced an increase in acetate-1-^{14}C incorporation into both cholesterol esters and free fatty acids and a decrease in incorporation into cholesterol. The incorporation of radioactivity into triglycerides was not affected. (Auth.)

325 Rubinstein, D., Kanics, L. THE CONVERSION OF CARBON TETRACHLORIDE AND CHLOROFORM TO CARBON DIOXIDE BY RAT LIVER HOMOGENATES. Can. J. Biochem. 42, 11 (1964) 1577-85.

Conditions for the conversion of $^{14}CHCl_3$ and $^{14}CCl_4$ to $^{14}CO_2$ by liver homogenates were determined. The addition of a pyridine nucleotide in either the oxidized or reduced state was required for a significant $^{14}CO_2$ production. This effect was abolished when the homogenate was denatured. Glutathione further increased the activity. The optimum pH for the oxidation of $CHCl_3$ to CO_2 lay between 8.0 and 8.5. The dehalogenation of CCl_4 was relatively insensitive to changes in the pH of the incubation medium. At least two enzymes are probably required for the formation of CO_2 from the chloromethanes, since both the microsomal and soluble fractions of the homogenate are required for activity. Production of CO_2 was inhibited by tetrahydrofolate and p-chloromercuribenzoate. Inhibition by the latter could be overcome by glutathione. The coenzyme requirements suggest that $CHCl_3$ may be reduced to CH_2Cl_2, then successively oxidized to formaldehyde and formic acid. However, the formation of significant quantities of these substances from $CHCl_3$ could not be demonstrated. Inhibition of formic acid oxidation did not affect the production of $^{14}CO_2$ from $^{14}CHCl_3$. Radioactivity from $^{14}CHCl_3$ was found in the protein of the homogenate. (Auth.)

326 Weldon, P.R., Rubenstein, B., Rubinstein, D. THE DIRECT ACTION OF CCl_4 ON THE METABOLISM OF LIVER SLICES. Can. J. Biochem. 43, 6 (1965) 647-59.

A manometric study was made of the effect of varying amounts of CCl_4 on the metabolism of glucose, galactose, leucine, acetate, and palmitate by rat liver slices. At concentrations of

0.4-3.3 mg/g of liver, CCl_4 produced a decrease in $^{14}CO_2$ production from succinate-2,3-^{14}C and glucose-6-^{14}C, but not from glucose-1-^{14}C. The presence of CCl_4 did not appreciably affect CO_2 production from glucose-U-^{14}C or galactose-1-^{14}C but stimulated incorporation of the monosaccharides into glycogen at the lower concentrations (1 mg/g). Higher concentrations of CCl_4 (2 mg/g liver) inhibited glycogen synthesis. In this instance the activities of glycogen synthetase and phosphorylase were decreased, but amylase activity and the level of glucose-6-phosphate in the liver slices remained unchanged. The oxidation of palmitate-1-^{14}C and acetate-1-^{14}C to $^{14}CO_2$ was decreased at the higher concentrations of CCl_4, and lipogenesis from acetate was stimulated by lower concentrations of CCl_4. Esterification of palmitate was unaffected by CCl_4. Apparently the function of the tricarboxylic acid cycle is altered by CCl_4 with the result that acetate may be shunted into fatty acids. It is concluded that CCl_4 affects hepatic metabolism in vivo directly. (CA 63:1965, 4852d)

327 Zatti, M., Rossi, F., Zoppi, G. LIVER PHOSPHOLIPIDES AFTER CARBON TETRACHLORIDE INTOXICATION IN RATS. Experientia 21, 4 (1965) 215-6. (In English)

Already 80 min after CCl_4 administration ^{32}P-labelled lysolecithin increased markedly in liver extracts, whereas the incorporation of ^{32}P into phosphatidic acid diminished greatly. The specific activity of the latter was lowered, indicating a block in the synthesis of the compound. The precociously increased incorporation of ^{32}P into lysolecithin corresponds to the initial stage of transiently increased specific activity of the liver phosphatide.

Hydrogen Cyanide

328 Strobel, G.A. HYDROCYANIC ACID ASSIMILATION BY A PSYCHROPHILIC BASIDIOMYCETE. Can. J. Biochem. 42, 11 (1964) 1637-9.

An unidentified psychrophilic basidiomycete is known to incite winter crown rot of alfalfa and other forage crops. The distribution of ^{14}C after the administration of 20 μCi of H^{14}CN was analysed in the amino acid, organic acid, and neutral fractions. The particular psychrophilic basidiomycete proved clearly capable of fixing the C-atom of H^{14}CN. In the amino acid fraction most of the radioactivity was associated with alanine, with considerably less labelling in glutamate. At least 80% of the radioactivity in alanine appeared to be associated with the C-atom of the carboxyl group. Inasmuch as no radioactivity was associated with either asparagine or β-cyanoalanine, it is clear that the mechanism of cyanide assimilation in the organism differs from that proposed for higher plants.

Naphthalene

329 Philleo, W.W., Schonbrod, R.D., Terriere, L.C. METHYLENEDIOXYPHENYL COMPOUNDS AS INHIBITORS OF THE HYDROXYLATION OF NAPHTHALENE IN HOUSEFLIES. J. agric. Fd Chem. 13, 2 (1965) 113-5.

Hydroxylation by house fly microsomes, using naphthalene-1-^{14}C as substrate, has been tested as a possible site of action of the pyrethrin synergists. Five commercial and nine non-commercial compounds containing the methylenedioxyphenyl structure were inhibitory of this process. Inhibitory concentrations range from 10^{-3}M for piperonylic acid to 10^{-5} M for safrole and isosafrole. Of the commercial synergists, piperonyl cyclonene is the most potent inhibitor of microsomal hydroxylation. The commercial synergists, sesamex, sulphoxide, piperonyl butoxide, and n-propyl isome, and the non-commercial compounds, safrole, isosafrole, and piperonal, were found to be synergistic with naphthalene in in vivo tests with female house flies. (Auth.)

330 Meikle, R.W. THE FATE OF SULFURYL FLUORIDE IN WHEAT FLOUR. J. agric. Fd Chem. 12, 5 (1964) 464-7.

The chemical fate of sulphuryl fluoride absorbed by graham flour has been studied. Graham flour was exposed to sulphuryl-^{35}S fluoride and, after suitable fractionation, the protein fraction was found to be responsible for almost all of the decomposition of the absorbed fumigant. Some sulphate was formed. Fluoride, as a consequence of the decomposition of sulphuryl fluoride, is likewise present. (Auth.)

BHC (Benzene Hexachloride)

331 Koransky, W., Ullberg, S. DISTRIBUTION IN THE BRAIN OF BENZENE HEXACHLORIDE-^{14}C: AUTORADIOGRAPHIC STUDY. Biochem. Pharmac. 13, 11 (1964) 1537-8.

Autoradiograms of sections through the whole head of rats injected with benzene hexachloride-^{14}C intraperitoneally showed that after 24 h the radioactivity was almost exclusively located in white matter. How this occurs is not known. (CA 62:1965, 5823b)

332 Koransky, W., Portig, J., Vohland, H.W., Klempau, I. ACTIVATION OF MICROSOMAL ENZYMES BY HEXACHLOROCYCLOHEXANE ISOMERS. EFFECT ON SCILLIROSIDE POISONING IN RATS. Nauyn-Schmiedebergs Arch. exp. Path. Pharmak. 247, 1 (1964) 61-70. (In German)

Determination of the rate of oxidation of III shows that the activating effect lasts 2 weeks after II, 4 weeks after I, and 8 weeks after administration of δ-hexachlorocyclohexane. The narcotic effect of the barbiturate is diminished during activation. Administration of 0.4 mg scilliroside (IV)/kg to treated animals eliminated the typical convulsions occurring after 16-24 h. The development, intensity, and duration of IV tolerance parallel the activation. The enzyme activators phenobarbital, phenylbutazone, nikethamide, and Luminal also produce tolerance. Enzyme inhibitor CFT 1201 (Neubert and Gerken, CA 51, 16927d) abolished the IV tolerance produced by the 3 isomers or the activators. Ethionine (Kato et al., CA 57, 2795d), 200 mg/kg, inhibited the resistance produced by II and Luminal. Therefore, it is believed that the tolerance is due to the activation of microsomal enzymes. (CA 61:1964, 13818c)

333 Koransky, W., Portig, J., Vohland, H.W., Klempau, I. ELIMINATION OF α- AND γ-HEXACHLOROCYCLOHEXANE AND THE EFFECTS OF LIVER MICROSOMAL ENZYMES. Nauyn-Schmiedebergs Arch. exp. Path. Pharmak. 247, 1 (1964) 49-60. (In German)

Female rats were injected intraperitoneally with 2% α- or γ-hexachlorocyclohexane-^{36}Cl oxide (I and II, respectively) in oil, (100 and 40 mg/kg, respectively), and the excretion was determined over 40 d. Only 75-80% of the total radioactivity was excreted, 80% of which was eliminated in the urine and 20% in the faeces. Of the urinary activity, 60% was found in Cl^- and 40% in chlorinated organic compounds, the latter being greater just after administration. II was eliminated faster than I. Pretreatment with phenobarbital accelerated the elimination; organic metabolites increased, while $^{36}Cl^-$ decreased. A dose of 200 mg I/kg reduced the narcotic effect of hexobarbital (III) and Eunarkon during four weeks, while in vitro the oxidation of III by microsome preparations was accelerated. It is assumed that I and II are strong activators of the oxidizing enzymes of the liver microsomes which meanwhile serve as catalysts in the oxidative transformation of the mols. (CA 61:1964, 13818a)

334 Sieber, K., Jumar, A., Grosse-Ruyken, H. DETERMINATION OF THE CONTENT OF γ-HEXACHLOROCYCLOHEXANE IN TECHNICAL SAMPLES BY USING ISOTOPE DILUTION WITH ^{36}Cl. Chem. Tech., Berl. 16, 4 (1964) 222-5.

A method for the determination of γ-hexachlorocyclohexane (I) in technical I was elaborated by dilution with lindane containing ^{36}Cl as indicator, which is superior to using ^{2}H and ^{13}C. Add to the sample 120 mg of ^{36}Cl marked I and melt very carefully on a gas flame. Then add 2 ml MeOH and keep for 30 min at 40° C. Separate the mother liquor from the residue and cool the former for 30 min in a 20°C bath (a part of the extracted I). Dissolve the precipitate in 0.3 ml 96% EtOH at 40°C and precipitate again by cooling to 20°C. To obtain a very pure substance recrystallize first from a 1:1 mixture of 2,4-dioxane:BuOH and later from 0.2 ml EtOH. Dry at 70°C for 1 h. The yield is about 25 mg. Measure the activity with a counter and calculate the amount of I. Optimum conditions for the preparation of the ^{36}Cl-containing I are given in detail starting from a Na^{36}Cl sample with an activity of 40 μCi/g, which results in ^{36}Cl-I with an activity of 0.9 μCi/g. (CA 61:1964, 7707c)

335(1) Torii, T. PENETRATION AND TRANSLOCATION OF γ BHC TOPICALLY APPLIED TO SOME PLANTS WITH INSECT GALLS. (A SUPPLEMENT TO AND GENERAL CONSIDERATIONS ON STUDIES ON THE BIOLOGICAL CONTROL OF THE CHESTNUT GALL WASP). J. Fac. Agric. Shinshu Univ. 2, 3 (1960) 161-90.

Females of parasites of Dryocosmus kuriphilus Yasumatsu on chestnut [Castanea crenata] in Japan emerge in early summer. They oviposit in larvae and pupae of the Cynipid in the galls of the generations in which they themselves developed and also in other species of gall insects. One possible method of controlling D. kuriphilus is to apply γ BHC to the galls so as to kill the emerging Cynipids, but this may harm the parasites. Experiments on the extent to which γ BHC penetrates plants tissues were therefore carried out in the laboratory; ^{14}C-γ BHC was used. Emulsified solutions were applied topically to various parts of cut, gall-bearing plants, including chestnut. Insecticide was absorbed to a certain extent when applied to most tissues and translocated, presumably in the phloem. Applied to chestnut galls, however, the insecticide did not penetrate more than ~0.5 mm beneath the surface and did not injure insects inside the galls. As its action was limited in time, it appeared suitable for control of the Cynipids if applied at the optimum period for control, i.e. ~20 d after the emergence of the first parasite adults, and 10 d after D. kuriphilus. In the Ina district, it could be determined from galls collected between 15 - 20 June. (From RAE-A 53:1865, 366-7)

Aldrin. Dieldrin

336 Crothers, W.C., Forgash, A.J. STUDIES ON THE RATE OF PENETRATION OF DIAZINON, DIELDRIN AND MALATHION IN RESISTANT AND SUSCEPTIBLE M. domestica. Bull. ent. Soc. Am. 10, 3 (1964) 163. Abstr.

The cuticular penetration rate of ^{14}C-labelled diazinon, dieldrin, and malathion of one susceptible and five resistant strains of house flies was investigated. Results indicate the insecticides penetrate the cuticle of that strain more rapidly than the resistant strains at various exposure times.

337 Gerolt, Ph. THE FATE OF DIELDRIN IN INSECTS. J. econ. Ent. 58, 5 (1965) 849-57.

Use was made of ^{14}C-dieldrin, randomly labelled in the hexachlorocyclopentadiene moiety. Under normal physiological conditions the rates of penetration of dieldrin into S - and into R-flies, Musca domestica L., are similar, but in S-flies this rate becomes reduced coincident with the onset of symptoms of excitation. At the same time, the haemolymph of dieldrin-intoxicated flies becomes very much dehydrated and the intestines are swollen with fluid, a phenomenon also occurring with insecticides not related to dieldrin. Translocation of sublethal amounts of dieldrin via the legs to other body parts is similar in S-and R-flies. After a limited period of tarsal exposure to the toxicant, a concentration equilibrium is reached in the body within 2-3 h, the final distribution then being approximately: legs 5%, head 9%, thorax 22%, wings 1%, and abdomen 63%. The insecticide is less concentrated in the tissues of thorax and legs than in the head and abdomen, but there is also no difference between S- and R -flies in this respect. House flies converted only 10% of a sublethal dose into more hydrophilic and presumably nontoxic material in 24 h; with Aedes aegypti (L.) larvae this conversion is even less, under 5% in 3 d. There were no significant differences between the two strains in the rate of conversion.

338 Hamilton, E.W. METABOLISM OF ^{36}Cl LABELED ALDRIN AND DIELDRIN IN ALDRIN RESISTANT WESTERN CORN ROOTWORM. Bull. ent. Soc. Am. 11, 3 (1965) 157. Abstr. 48. "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov.-2 Dec. 1965".

Aldrin resistant western corn rootworm absorbed aldrin and dieldrin at a lower rate, and metabolized relatively less aldrin to dieldrin, than a susceptible strain. Dieldrin treated resistant rootworms metabolized some dieldrin to aldrin. The aldrin resistance mechanisms in this insect appear to affect the epoxidation chemistry of the insecticides. (Abstr.)

339 Hathway, D.E. THE BIOCHEMISTRY OF DIELDRIN AND TELODRIN. A Review of Recent Investigations Related to the Toxicity of These Compounds in Mammals. Archs envir. Hlth 11, 3 (1965) 380-88.

Review article, drawing liberally on results obtained by the use of radioisotopes (^{14}C to clarify, e.g. the partition of dieldrin and Telodrin between the cellular components and soluble proteins of blood, p.383-5; and to study the two-way transplacental passage of dieldrin and Telodrin, p.385-7).

340 Heath, D.F., Vandekar, M. TOXICITY AND METABOLISM OF DIELDRIN IN RATS. Br.J.ind. Med. 21, 4 (1964) 269-79.

The LD50 (in mg/kg) of pure dieldrin (I) in rats is 50.8-63.5 by oral, 55.9 by intraperitoneal, and 8.4-8.9 by intravenous route. During intravenous infusion, toxicity depended on the rate of infusion, with the tolerance at slow rates comparable to the oral values. Absorption of ^{36}Cl-labelled I from the gastrointestinal tract was much higher when fed as solution in arachis oil than in glycerol-$(MeO)_2$-CH_2; only 8% of the dose was recovered in lymph, showing that I was mostly absorbed via the portal vein. Faecal recovery in 24 h was 20-30, in 4 d 56, and in 28-42 d 70% of the dose after both oral and intravenous dosing, showing that bile was the most important route of elimination; urinary excretion remained below 10-15%. Organ distribution was initially general, but after a few hours it was heavily concentrated in fat. Starvation markedly increased ^{36}Cl excretion. Faeces yielded 4 metabolites distinct from I, but in rats with cannulated bile duct most faecal ^{36}Cl was present as I. Bile contained little unchanged I, with 78% of bilary ^{36}Cl apparently a glucuronide; 10% of the urinary ^{36}Cl was I, and 15% ionic. It was postulated that I was oxidized in the liver to a hydroxy compound, conjugated with glucuronic acid, secreted in bile, and reformed by the action of glucuronidase before excretion. Poisoning was manifested in epileptiform symptoms, with the first convulsion occurring at 40 min after administration over a wide variety of doses. In fatally poisoned animals death took place within 6 h or between 2 and 7 d after dosing; the delayed effect was also known to occur in man and was aggravated by fasting. It was concluded that the toxicity of I was controlled by its fat-solubility, and the delayed effects resulted from release of I during mobilization of adipose tissue where it was stored, rather than from producing a long-lasting lesion in the central nervous system. (Auth.)

341 Korte, F., Arent, H. METABOLISM OF INSECTICIDES. IX. ISOLATION AND IDENTIFICATION OF DIELDRIN METABOLITES FROM URINE OF RABBITS AFTER ORAL ADMINISTRATION OF DIELDRIN-^{14}C. Life Sci. 4, 21 (1965) 2017-26.

Orally administered dieldrin-^{14}C gave six different metabolites isolated in urine of rabbits. The main metabolite was present in amounts of approximately 86%. The chemical structure of the compound was determined. After purification and crystallization it was identified as one of two enantiomers of 1,2,3,4,10,10-hexachloro-6,7-trans-dihydro-1,4-endo-5,8-exodimethano-1,4,4a,5,6,7,8,8a-octahydronaphthalene (6,7-trans-dihydroxydihydroaldrin) (II) with $[\alpha]_D^{20} = -13.7$. The acute oral toxicity to mice of the metabolites was about 6-8% that of dieldrin LD50 = 1205 mg/kg. Male rats rats treated intravenously with metabolite excreted 82.2% of the administered activity within 3 d. The extract of faeces gave 84% unchanged I and 16% of a more hydrophilic compound. (CA 64:1966, 5693a)

341-a Ludwig, G., Weis, J., Korte, F. EXCRETION AND DISTRIBUTION OF ALDRIN-^{14}C AND ITS METABOLITES AFTER ORAL ADMINISTRATION FOR A LONG PERIOD OF TIME. Life Sci. 3, 2 (1964) 123-30.

^{14}C-aldrin was fed to male rats in doses of 4.3 µg/d for 3 months. The active material excreted in faeces and urine consisted of aldrin, dieldrin and considerable amounts (up to 75% in the faeces and up to 95% in the urine) of a mixture of hydrophilic metabolism products not yet identified. At the end of the feeding period, the rats had excreted approximately 90% of the total cumulative activity. Practically all (99.5%) of the material administered had been excreted 12 weeks after the last dose. After about 8 weeks approximately the entire activity administered daily was also daily excreted, which means that a saturation level was reached at that stage. Subsequent doses of aldrin did not lead to a cumulation of the toxicant in the organism. (Auth. summary)

341-b Matsumura, F., Hayashi, M. ABSORPTION OF C^{14} DIELDRIN TO THE NERVE COMPONENTS OF THE GERMAN COCKROACH. Bull. ent. Soc. Am. 11, 3 (1965) 157. Abstr. 53. Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov.-2 Dec. 1965".

It was found that dieldrin forms a complex with several nerve components of chlordane resistant and susceptible German cockroaches. The rate of formation was different in the resistant strains from

the susceptible ones. Attempts were made to find the component(s) which yielded the highest inter-strain by several biochemical techniques. (Abstr.)

342 Morley, H.V., Chiba, M. DIELDRIN UPTAKE FROM SOIL BY WHEAT PLANTS. Can. J. Pl. Sci. 45, 2 (1965) 209-10.

Separate analyses of the grain and the upper and lower halves of the stems of wheat plants grown in soil containing 2 mg ordinary dieldrin or dieldrin labelled with 10 μCi ^{14}C-dieldrin per 100 g soil in the greenhouse showed them to contain, respectively, 0.14, 0.65 and 0.4 ppm unlabelled dieldrin and 0.06, 0.22-0.67 and 1.05-1.57 ppm labelled dieldrin, thus confirming that the compound is taken up from the soil by wheat plants. (From RAE-A 54:1966, 19)

343 Oonnithan, E.S., Miskus, R. METABOLISM OF C^{14}-DIELDRIN BY DIELDRIN-RESISTANT Culex pipiens quinquefasciatus MOSQUITOES. J. econ. Ent. 57, 4 (1964) 425-6.

Metabolism of ^{14}C-dieldrin by dieldrin-resistant female adult C.p.quinquefasciatus Say has been investigated. Dieldrin is readily absorbed and is metabolized. Using paper chromatographic techniques to resolve dieldrin and metabolite, it has been found that the metabolite is excreted without storage in the body. The metabolite is more polar than dieldrin and was found to have an R_f value close to that of aldrin glycol. (Auth.)

344 Perry, A.S., Pearce, G.W., Buckner, A.J. THE ABSORPTION, DISTRIBUTION, AND FATE OF ALDRIN-^{14}C AND DIELDRIN-^{14}C BY SUSCEPTIBLE AND RESISTANT HOUSEFLIES. J. econ. Ent. 57, 6 (1964) 867-72.

^{14}C-aldrin (specific activity 3.60 mCi/g or 5820 cpm/μg) and ^{14}C-dieldrin (specific activity 3.53 mCi/g or 5750 cpm/μg) were used. Aldrin is epoxidized to dieldrin by both susceptible and dieldrin-resistant houseflies, Musca domestica. Colorimetric analysis, infra-red spectra, and paper chromatography of tissue extracts of treated flies showed no other metabolic product present. Loss of aldrin by volatilization from the surface of application accounts for 40-50% of the applied dose. Dieldrin is neither metabolized nor excreted, but 23-38% is lost by volatilization. In either case, the volatilized material can be recovered in an air-trap apparatus or on strippable film. No difference was found in the distribution of aldrin and dieldrin in the head, thorax, and abdomen of susceptible and resistant houseflies.

345 Shipp, O.E., Brazzel, J.R. DISTRIBUTION OF C^{14}-LABELED DIELDRIN IN DIELDRIN-RESISTANT AND SUSCEPTIBLE BOLL WEEVILS, Anthonomus grandis. J. econ. Ent. 57, 1 (1964) 174-5.

^{14}C-dieldrin (94.4% pure, specific activity 19.46 μCi/mg) was used to determine whether its distribution in A. grandis was related to fat distribution, paper chromatography to test whether a change had occurred in the absorbed insecticide. Dieldrin-resistant (DR) and -susceptible (DS) weevils were analysed. Based on fat content or dry weight of the body parts under consideration (head, thorax, abdomen), dieldrin was found to be distributed in about the same concentrations in DR and DS; in neither case was it related to fat distribution. Dieldrin-resistance may be related to the greater fresh weight of abdomen in DR-weevils.

Thiodan

346 Barnes, W.W. THE ABSORPTION AND METABOLISM OF C^{14}-LABELED ENDOSULFAN IN THE HOUSEFLY. Diss. Abstr. 25, 8 (1965) 4871.

For abstract see 347.

347 Barnes, W.W., Ware, G.W. THE ABSORPTION AND METABOLISM OF C^{14}-LABELED ENDOSULFAN IN THE HOUSE FLY. J. econ. Ent. 58, 2 (1965) 286-91.

The absorption rates of technical endosulfan and each of its four components were studied by paper and gas chromatography. The toxicant was applied topically to cyclodiene-resistant and susceptible female house flies, Musca domestica L., and recovered as external, internal, and faecal extracts in hexane for chromatographic analysis. Endosulphan ether and endosulphan alcohol were absorbed almost completely in less than 2 h, while residues of the high- and low-melting point isomers were

detectable in external extracts 24 h after treatment. No difference in the rate of absorption was noted between the two strains. Dosage-mortality determinations indicated the following relative toxicity to 3-d-old female flies of both strains: low-melting point isomer > technical endosulphan > high-melting point isomer > endosulfan sulphate. Endosulfan ether and endosulfan alcohol were relatively non-toxic. The metabolic fate of ^{14}C-labelled endosulfan was studied by the aforementioned means and autoradiography. A previously unreported metabolite found in the internal extracts of both fly strains was identified as endosulfan sulphate, the oxidized form of endosulfan. Endosulfan oxidized in vitro and the metabolite found in internal fly extracts gave identical R_f values and retention times when analysed by paper and gas chromatography. The identity of this metabolite was further confirmed by microcoulometric gas chromatography and by comparison with purified endosulfan sulphate. Judged from visual inspection of gas chromatograms of internal extracts, the high- and low-melting point isomers were metabolized to endosulfan sulphate, while endosulfan ether and endosulfan alcohol were degraded by a different route. The low-melting isomer was absorbing and metabolized to the sulphate more rapidly than the high-melting isomer. Faecal extracts contained traces of unchanged high- and low-melting point isomers but no endosulfan sulphate, indicating its possible role as an intermediate in the metabolic degradation of endosulfan. Paper chromatograms of faecal extracts revealed a water-soluble metabolite and an acetone-soluble metabolite in both strains of flies, but no hexane-soluble derivatives. (Auth.)

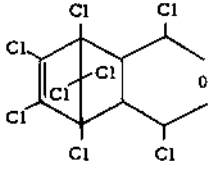
Telodrin

348 Cox, H.C., Bowman, M.C. UPTAKE OF TELODRIN BY FALL ARMYWORM LARVAE EXPOSED TO RESIDUES. J. econ. Ent. 58, 1 (1965) 87-93.

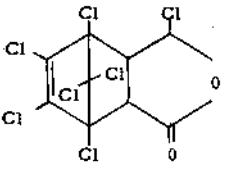
Different instars of the fall armyworm, Laphygma frugiperda (J.E. Smith), were exposed to residues of Telodrin® (1,3,4,5,6,7,8,8-octachloro-1,3,3a,4,7,7a-hexahydro-4,7-methanoisobenzofuran). Insecticide residues were determined by gas-liquid chromatography employing electron affinity detection, radiometrically, and by paper chromatography of ^{14}C-labelled Telodrin. Volatilization of Telodrin from open bioassay jars was considerable within 8 to 24 h. The quantity of toxicant required internally to produce mortality could not be precisely determined for 1st-instar larvae, although the range was 1.19-5.59 ppm. The lethal dosage of Telodrin in the integument and internal organs of third-instar larvae was 5.86 to 6.05 ppm, with about 3.5 ppm in the internal organs. There was no correlation between total lipid content and the lethal dose in individual grown larvae, although there was an indication that mortality of grown larvae was directly related to unsaturated fat content. No detectable metabolism of Telodrin occurred on or in the three larval instars examined under the conditions of these experiments. (Auth.)

349 Korte, F., Stiasni, M. INSECTICIDES IN METABOLISM. VI. CONVERSION OF TELODRIN-^{14}C BY MICROORGANISMS AND MOSQUITO LARVAE. Justus Liebigs Annln Chem. 673 (1964) 146-52. (In German)

Telodrin (I) -^{14}C (labelling with ^{14}C in hexachlorocyclopentene ring) and I-1,3-^{14}C were absorbed by micro-organisms (Aspergillus niger, A. flavus, Penicillium chrysogenum, and P. notatum) and mosquito larvae (Aedes aegypti) and converted into hydrophilic metabolites. After 7-32 d



(I)



(II)

of incubation, I-^{14}C and I-1,3-^{14}C were converted by the micro-organisms into metabolite A, which was converted by hydrolysis with aqueous alcoholic HCl into a weak hydrophilic product. Mosquito larvae converted I-^{14}C and I-1,3-^{14}C into metabolite B, which was different from metabolite A. Metabolite B consisted of at least three components. The hydrolysis product of one of these components was identified (by thin-layer and column chromatography) as II. (CA 61:1964,4894g)

350 Hoskins, W.M. THE METABOLISM OF DDT IN INSECTS. Wld Rev. Pest Control 3 (1964) 85-96.

Review article. The chronological development in the use of DDT from synthesis, reported in 1874, to large scale manufacture near the end of World War II is traced. The metabolism of DDT in insects and the development of resistance is discussed in detail. Considerable use has been made of radioisotopes, mostly ^{14}C, and numerous references are cited. A table gives results of various studies on the action of DDTase, mostly on Musca domestica. Fundamental differences in the nature of the enzyme in different species have emerged. A number of investigators, using radiometric and chromatographic techniques, have found roaches to form non-SH metabolites more polar than DDE. Typical chromatograms indicating four metabolites from Blattella germanica tissues and three from faeces at 2, 3, and 6d after topical treatment are shown (Fig. 2). An important metabolite, dicofol, has been identified in several species. So far, no synergist has been found to have a lasting effect on resistance. The question of how to decide whether resistance is due to one or more than one hereditable factor is still a matter of disagreement.

351 Agosin, M., Morello, A., Scaramelli, N. PARTIAL CHARACTERIZATION OF THE IN VIVO METABOLITES OF DDT-^{14}C IN Triatoma infestans. J. econ. Ent. 57, 6 (1964) 974-7.

T. infestans 3rd-instar larvae were topically treated with DDT-^{14}C and Kelthane® -^{14}C (1,1-bis (p-chlorophenyl)-2-2-2-trichloroethanol). After 72 h of DDT-intoxication, 2 DDT-metabolites were detected (metabolites no. 2 and no. 3), while only one was found from Kelthane after 10 d. DDT metabolite no. 3 was characterized by paper chromatography, chemical reactions, and the u.v. spectrum at the microchemical range. The results obtained indicate that metabolite no. 3 corresponds to Kelthane. Although no definite identification of DDT-metabolite No. 2 and the Kelthane-metabolite was possible, the available evidence suggests that they have the same structure. It is suggested that Kelthane is the precursor of DDT-metabolite no. 2, indicating that production of DDT-polar metabolites in T. infestans follows the sequence DDT ⟶ Kelthane ⟶ metabolite no. 2. (Auth.)

352 Atkins, D.L., Williams, R.K. RADIOMETRIC ANALYSIS OF TISSUES FROM CHICKENS FED ^{14}C-[LABELED] DDT. Tex. J. Sci. 16, 4 (1964) 442-45.

Twenty μCi of p,p'-chlorodiphenyl-4-^{14}C-trichloroethane (I) was administered orally in two equal doses at 3 d intervals to sexually mature male and female chickens. No toxicity symptoms were observed. Radiometric measurements of I residues extracted with C_6H_6 from kidney, liver, breast muscle, brain, and reproductive tissues showed accumulation of radioactivity in all tissues. Highest cpm/g of tissue were found in kidney, ovary, and male brain. A very low radioactivity level was absorbed by the testes. This may indicate that avian reproductive failure is a direct rather than indirect reaction of the ovary to I toxicity. (CA 62:1965, 16876h).

353 Backstrom, J., Hansson, E., Ullberg, S. DISTRIBUTION OF DDT-^{14}C AND DIELDRIN-^{14}C IN PREGNANT MICE DETERMINED BY WHOLE-BODY AUTORADIOGRAPHY. Toxic. appl. Pharmac. 7, 1 (1965) 90-6.

The distribution of labelled DDT and dieldrin was compared in pregnant mice, using whole body autoradiography. Both compounds were widely distributed, being found in fat depots, liver, intestines, kidney, mammary glands, urinary and gall bladder, blood, lung, spleen, adrenal, salivary glands, bone marrow, placenta, brain, and spinal cord. Moderate activities of both compounds were found in faetal liver, fat, and intestines. Both compounds also were excreted in the milk, as evidenced by accumulation in the mammary glands and the presence of high concentrations in suckling mice. (CA 62:1965, 13789h)

354 Beard, R.L. COMPETITION BETWEEN DDT-RESISTANT AND SUSCEPTIBLE HOUSE FLIES. J. econ. Ent. 58, 3 (1965) 584.

Radioactive labelling permits the mixing of adult flies of resistant and susceptible strains and identifying their progeny with respect to their parentage. ^{14}C-L-phenylalanine was added to milk powder and fed to newly emerged female flies, when it became metabolized and incorporated into eggs subsequently laid. Larvae, pupae and adults developing from them were radioactive. Radioactive flies of either strain were placed in a cage with non-radioactive flies of the other

strain. On the basis of the tests made it can be concluded that different fly strains do indeed differ with respect to their survival in competition, but this phenomenon is not necessarily associated with resistance.

355 Bowery, T.G., Gatterdam, P.E., Guthrie, F.E., Rabbi, R.L. FATE OF INHALED C^{14}-TDE IN RABBITS. J. agric. Fd Chem. 13, 4 (1965) 356-9.

New Zealand Red rabbits, selected for their tolerance to main-stream tobacco smoke, were exposed to smoke from cigarettes containing 12 and 48 µg of ^{14}C-TDE* per cigarette in Holland smoking boxes. The animals received smoke from 20 cigarettes per day for periods ranging from 2 weeks - 6 months, after which times they were sacrificed and 20 tissues examined for total and organosoluble radioactivity. The deposition via inhalation appears to follow that of oral ingestion with accumulation of TDE in the fat, followed by slow metabolism and elimination. There was no evidence of accumulation in the inhalation system or other vital organs. Human non-inhaling smokers appear to exhale all TDE components of main-stream smoke, whereas inhaling smokers appear to retain (for subsequent storage and metabolism) about 3% of the TDE contained in a cigarette. (Auth.)

* 1,1-dichloro-2,2-bis (p-chlorophenyl) ethane

356 Gatterdam, P.E., De, R.K., Guthrie, F.E., Bowery, T.G. THE ABSORPTION, METABOLISM, AND EXCRETION OF C^{14}-LABELLED TDE IN CERTAIN INSECTS. J. econ. Ent. 57, 2 (1964) 258-64.

Among the principal compounds used were 1,1-bis(p-chlorophenyl) 2,2-dichloroethane (TDE, Rhothane®, dichlorodiphenyl dichloroethane); 1,1-bis (p-chlorophenyl) 2,2-dichloroethanol (FW-152); and 4,4' dichlorobenzophenone (DBP). ^{14}C-TDE, labelled at carbon 1 of the ethane moiety was purified; the specific activity was 26 mCi/mM. Information on absorption, excretion, and metabolism of topical applications of ^{14}C-TDE was obtained for two species of lepidopterous larvae and the adult American cockroach, Periplaneta americana (L.). The tobacco hornworm, Protoparce sexta (Johannson), larva and the cockroach formed, internally, significant quantities of FW-152 whereas the red-banded leaf roller, Argyrotaenia velutinana (Walker), larva degraded only minor amounts of absorbed TDE to FW-152 and several other compounds. Certain analogues of TDE were applied to the hornworm and cockroach to determine whether the analogues are stable or transitory intermediates in the overall metabolic scheme. FW-152 appeared to be the major end product in both insects. The compound was apparently formed directly from TDE rather than from an unknown intermediate. There was some evidence that DBP was present in samples of the excreta of the cockroach later on.

357 Bridges, W.R., Kallman, B.J., Andrews, A.K. C^{14} DDT IN A MICROENVIRONMENT AT DENVER. Washington, Fishery Bull. Fish Wildl. Serv. US 199 (1964) 30 and 40.

600 µg of ^{14}C-DDT were placed in 30 l water in each of four aquaria, together with soil and aquatic vegetation. Small bluegills were added to two of them after 28 d, and snails (genus Ampullaria) after 6 weeks. The breakdown of DDT in parts of the system was studied, and also whether DDT would return to the water from high-residue components of the environment after the toxicant had reached near-zero levels in the water. 14 d after DDT had been added, the level in the water was down to 0.42 ppb, with 6.0 ppb in the soil, and 15 600 ppb in the vegetation. At 4 weeks, when the fish were added, the water contained 0.30 ppb. The fish accumulated residues to > 1000 ppb in 1½ weeks, while the amounts in the mud were decreasing and those in the vegetation still increasing. When the snails were added at 6 weeks, the water had 0.19 ppb, the soil 1.1 ppb, the vegetation 23 400 ppb, and the fish 1000 ppb. Two weeks later, the water was reduced to 0.08 ppb, vegetation to 20 700 ppb, and the snails contained 160 ppb. At 15 weeks, all parts of the environment still contained some DDT, but declines were apparent. Residue measurements of DDT and its metabolites are tabulated (Table B-6, p.40).

358 El Sayed, El Basheir, Lord, K.A. DDT TOLERANCE IN DIAZINON-SELECTED AND DDT-SELECTED STRAINS OF HOUSE FLIES. Chem. Ind. 37 (1965) 1958-9.

The metabolism and penetration of DDT in resistant strains of house fly selected by treatment with diazinon (SKA) and with DDT (F58W) were studied by determination of DDT in hexane washings

and extracts of the flies by gas-liquid chromatography. It is shown that the proportion of DDT lost from the surface of the F58W strain is less affected by the size of the dose than that lost from the surface of the SKA strain. Much more DDE was found in the F58W than in the SKA or susceptible strains, and the ability of the SKA strain to decompose DDE was demonstrated. Experiments with DDT containing ^{36}Cl gave residues containing ^{36}Cl not detected by the above procedure, indicating an additional unknown mechanism for the decomposition of DDT. (CA 64:1966, 4197a)

359 Hooper, G.H.S. THE MECHANISM OF DDT RESISTANCE IN THE SPOTTED ROOT MAGGOT Euxesta notata. J. econ. Ent. 58, 4 (1965) 608-11.

For absorption studies, a 0.1% wt./vol. solution of ^{14}C-DDT (0.5 µg insecticide) or a 0.01% wt./vol. solution of ^{14}C-dieldrin (0.05 µg insecticide) was applied. The mechanism of DDT-resistance in the spotted root maggot E. notata (Wiedemann), was found to be primarily attributable to decreased cuticular absorption of DDT, with the resistant strain absorbing only half as much as a susceptible strain, rather than to increased detoxication. This finding is of interest since DDT resistance in this fly is due to a single genetic factor. The only metabolite produced from DDT was DDE, and the DDT-susceptible strain showed a high level of dehydrochlorinating activity.

360 Kaddou, I.K., Bull, D.L., Lindquist, D.A. JOINT ACTION OF DDT AND DIELDRIN ON THE BOLL WEEVIL. Bull. ent. Soc. Am. 10, 3 (1964) 163. Abstr.

Combined treatment with DDT and dieldrin were more effective against cyclodiene-resistant and -susceptible boll weevils than either insecticide alone. Radio-labelled materials were used to study possible mechanisms of this joint action. Comparisons of the rates of absorption and metabolism of the insecticides, individually and in combination, will be reported.

361(2) Kalmykov, P.G., Kuftyreva, N.V. THE INSECTICIDAL PROPERTIES OF RADIOACTIVE DDT AND THEIR INFLUENCE ON ADULT FLIES AND LARVAE. p.56-59 of "Problemy Parazitologii", Trudy 4-oi Konferentsii Instituta Zoologii, Akad. Nauk Ukr. SSR, Lvov, 1963.

Adult flies and larvae of Protophormia terrae-novae were used. DDT-^{14}C was dissolved to 0.25% in Me_2CO and applied to the dorsal surface of the insects. After a certain time, the insecticide was removed from the body surface with Me_2CO. The cuticle was washed and the content of radioactive DDT measured. The partition of DDT among the organs was also studied by feeding the flies with milk or meat containing a 0.25% solution of radioactive DDT. The cuticle was permeable to the solution of DDT. One min after DDT was applied it could be detected in chitin, and after 24 h its content in the cuticle was > 2-fold higher. DDT could not diffuse through the cuticle of stage-III larvae. Immediately after application, DDT from the haemolymph was concentrated in the fat body of the fly. After 24 h, DDT was concentrated in the nerve ganglia and in the muscle tissues. After feeding, DDT was concentrated mainly in the nerve ganglia, in the digestive system, and the fat body. In larvae, all body organs were saturated with radioactive DDT within 24 h but only in the final 2 h of this period was DDT within 24 h but only in the final 2 h of this period was DDT concentrated in the nerve ganglia. Thus, the concentration of DDT in the nerve ganglia of the larvae was higher than in the same tissues of the adult flies. (CA 61:1964, 16497f)

362 Kimura, T., Duffy, J.R., Brown, A.W.A. DEHYDROCHLORINATION AND DDT RESISTANCE IN Culex MOSQUITOES. Bull. Wld Hlth Org. 32, 4 (1965) 557-61.

Resistant larvae of C. tarsalis detoxify DDT by dehydrochlorinating it to DDE (Aedes aegypti and the house fly do also), whereas susceptible larvae do not. Resistant larvae of C. fatigans convert all absorbed DDT to the metabolite DDE (according to the scanning of a gas-flow G counter of chromatograms of larvae exposed to radioactive DDT which has ^{14}C on either the C-1 or C-2 of the aliphatic chain). Spectrophotometry and enzyme assays with ring-labelled DDT-^{14}C and paper chromatography in vitro indicate that resistant C. fatigans has 10 times the dehydrochlorinating activity and resistant C. tarsalis 4 times that of their susceptible counterparts. The responsible enzyme in C. fatigans resembles that in A. aegypti in being 1/3 as active on o-chloro derivative of DDT as on DDT and in being inactive against deutero-DDT. It is less active on DDD than on DDT. (CA 63:1965, 13966h)

363 Land, J.D. ABSORPTION AND DISTRIBUTION OF DDT IN THE BOLL WEEVIL AND THE INFLUENCE OF SYNERGISTS ON TOXICITY. Diss. Abstr. 24 (1963/4) 3029.

A total of 58 materials was tested as synergists for DDT against chlorinated hydrocarbon susceptible and resistant boll weevils. The materials consisted of terpene derivatives, commonly available organic solvents, and various commercial products. Mixtures of candidate synergists plus DDT were compared with corresponding mixtures of acetone-DDT, toxaphene-DDT, and Strobane-DDT. Also included in the investigations were the effects of Strobane and two Heyden Newport Chemical Company experimental materials on the absorption of ^{14}C-labelled DDT. The distribution of various chlorinated hydrocarbon, organophosphate, and carbamate insecticides within the body of the boll weevil was studied using radiotracer techniques. Toxaphene, Strobane, and five experimental Heyden Newport chemicals were effective as synergists for DDT against the boll weevil. The experimental Heyden Newport chemicals compared favourably with Strobane as synergists for DDT regardless of whether or not the weevils were of chlorinated hydrocarbon resistant or susceptible strains. Terpene derivatives containing no chlorine were not toxic when applied at 20 µg per weevil but when combined with DDT at 10 µg per weevil the cyclic terpenes (pine oil, pinene, turpentine, camphene, and menthol) were considerably more toxic than the open-chain terpenes (citronella, citronellal, citronellol, and d- limonine). However, pine oil and turpentine were quite toxic when applied at 1 µl, per weevil. Treatment of weevils with 1 µl, of o-dichlorobenzene, tetralin, xylene, cyclohexane, cyclohexanone, cyclohexanol, 2-methyl cyclohexanol, and dipentene resulted in weevil mortalities of 70% or higher when used alone, and no more additive effects were noted when weevils were treated with these solvents plus DDT. Although toluene and isophorone treatments resulted in mortalities below 70% when used alone, these materials were highly effective against the boll weevil when combined with DDT. Armoflo 65 and Armoflo 49 were low in toxicity to the boll weevil but were highly synergistic for DDT. In general the toxicity of DDT-candidate solvent to the boll weevil decreased as the proportion of acetone in the mixture increased. The ratio of adjuvant to toxicant to carrier solvent was quite important in demonstrating synergistic effects. Weevil strain or age had little effect on the toxicity of DDT or toxaphene-DDT mixtures to the boll weevil. Strobane or two of its derivatives had no appreciable effect on the absorption of DDT by the boll weevil. In the distribution studies, considerable amounts of DDT, Sevin, and dieldrin were localized in the fat of the boll weevil; whereas Thio TEPA accumulated in the digestive and reproductive systems. In all treatments with radio-labelled insecticides, the exoskeleton and elytra contained a higher percentage of the applied dose than other tissues and organs assayed. (DA).

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366 Miller, S., Perry, A.S. SEPARATION AND PURIFICATION OF DDT-DEGRADING ENZYMES FROM THE HUMAN BODY LOUSE. J. agric. Fd Chem. 12, 2 (1964) 167-9.

^{14}C-DDT, 160 µCi/M, was prepared in the laboratory. Purified DDT-degrading fractions were separated from aqueous extracts of human body louse by tertiary amyl alcohol. Purification of the fractions was obtained by calcium phosphate gel adsorption and subsequent elution, acetone fractionation, and chromatography on hydroxylapatite. The crude fractions were heat stable and lost this property upon purification. Based on the various metabolites produced, several enzyme types were considered to occur naturally and not as the result of degradation of a single original native enzyme.

367 Miskus, R.P., Blair, D.P., Casida, J.E. CONVERSION OF DDT TO DDD BY BOVINE RUMEN FLUID, LAKE WATER, AND REDUCED PORPHYRINS. J. agric. Fd Chem. 13, 5 (1965) 481-83.

DDD is often detected as a residue in situations where only DDT has been used, and DDD appears to persist for unusually long periods. Studies with ^{14}C-DDT incubated with bovine rumen fluid, lake water, and aqueous solutions of reduced porphyrins showed partial conversion to ^{14}C-DDD. Conversion by bovine rumen fluid may explain certain DDD residues in milk, and conversion by lake water could account for the apparent extraordinary persistence of DDD in Clear Lake, Calif., because DDT may be available as a continuing precursor for DDD in these situations. The study with reduced porphyrins indicates a possible mechanism for this conversion in biological systems. (Auth.)

368 Morello, A. ROLE OF DDT-HYDROXYLATION IN RESISTANCE. Nature, Lond. 203 (1964) 785-6.

Triatoma infestans 3rd-instar larvae which are fairly tolerant to DDT were used. SKF 525-A (β-diethyl-aminoethyl-diphenylpropyl acetate) or 3-methylcholanthrene were applied topically to the ventral abdominal region of the insect. Iproniazid phosphate in aqueous solution 75μg/3.3μl) was injected intracoelomatically. After 24h, insects were topically intoxicated with 200 μg DDT in acetone per specimen. The effect of iproniazid, SKF 525-A and 3-methylcholanthrene on the in vivo production of DDT-^{14}C internal polar metabolites by nymphs was plotted for five experiments. Iproniazid and SKF 525-A potentiated the effects of DDT. Both were found to substantially decrease the rate of production of polar metabolites, while 3-methylcholanthrene increased their production. Ring-labelled DDT (5000 cpm/μg) was used. A negative correlation between mortality and the rate of production of DDT-polar metabolites was observed.

369 Morello, A. INDUCTION OF DDT-METABOLIZING ENZYMES IN MICROSOMES OF RAT LIVER AFTER ADMINISTRATION OF DDT. Can. J. Biochem. 43, 8 (1965) 1289-93.

DDT is metabolized by rat liver microsomes to a phenolic compound and to a reduced derivative similar to DDD. When rats were injected intra-peritoneally with DDT, the microsomal DDT-metabolizing activity was greatly increased. This effect was blocked by the administration of puromycin. DDT administration also increases the content of liver microsomal protein. The results show that the insecticide probably increases the DDT-metabolizing activity of mammalian liver by inducing enzyme synthesis. Ring-labelled ^{14}C-DDT was used for the enzyme assay.

370 O'Brien, R.D., Matsumura, F. DDT: A NEW HYPOTHESIS OF ITS MODE OF ACTION. Science, N.Y. 146 (1964) 657-58.

It is suggested that DDT and perhaps other chlorinated hydrocarbon insecticides owe their activity to the formation of a charge-transfer complex with a component of the nerve axon, with consequent disturbance of function. Experimental evidence is provided for the formation of two complexes with components of cockroach nerve; the complexes have been partially purified. Their formation is accompanied by an absorption in the 245- to 270-mμ range. Various concentrations of ^{14}C-labelled DDT were used.

371 Peterle, T.J., Meeks, R.L. CYCLING OF CHLORINE-36 LABELED DDT IN A MARSH ECOSYSTEM. p.67 of "Offsite Ecological Research of the Division of Biology and Medicine Terrestrial and Freshwater". TID-13358 (2nd rev.), Mar.1965.

The study is aimed at determining the fate of DDT in a marsh ecosystem, with special emphasis on the rate and quantity of DDT uptake by aquatic plants and organisms and to its subsequent translocation within the ecosystem for two growing seasons. On 7 July 1964, 3.9 mCi ^{36}Cl ring-labelled DDT on inert granules were applied by helicopter to an enclosed 4-acre marsh area at the rate of 0.2 lb technical DDT/acre. Plant, animal, soil, and water samples are being collected and analysed radiochemically for DDT 4 h, 8 h, 1 d, 3 d, 1 week, 2 weeks after application and then at 1 month intervals. Following the compilation of residue data based on the radioassay results, the distribution and bio-accumulation of the insecticide are to be described as related to time.

372 Pillai, M.K.K., Brown, A.W.A. PHYSIOLOGICAL AND GENETICAL STUDIES ON RESISTANCE TO DDT SUBSTITUTES IN Aedes aegypti. J. econ. Ent. 58, 2 (1965) 255-66.

Selection with a 1:1 mixture of WARF anti-resistant (N,N-dibutyl-p-chlorobenzenesulfonamide) and DDT, with Prolan® (1,1-bis (p-chlorophenyl)-2-nitropropane) or with malathion induced in larvae of the yellow-fever mosquito, A. aegypti (L.), a DDT resistance characterized by increased DDT-dehydrochlorinase activity. Mixture selection at first reduced the resistance levels of DDT-resistant strains, but ultimately induced high resistance to the DDT and to the mixture; Mixture-resistance derived from genetic influences on chromosome 3 in addition to the regular DDT-resistance gene on chromosome 2. Prolan selection developed the DDT-resistance and in addition a resistance mechanism of reduced Prolan absorption. Malathion selection induced the regular DDT-resistance on chromosome 2 as well as a malathion-resistance connected with multiple genes on chromosomes 2 and 3. The following radioactive chemicals were used: 1) ^{14}C-DDT (ring-labelled on the para-carbons from Tracerlab Inc., activity 3.22 mCi/g, for dehydrochlorination studies; or chain-labelled on the tertiary carbon, from Fordham University, activity 1.75 mCi/g, for absorption studies; and 2) ^{14}C-Prolan, chain-labelled on the tertiary carbon, synthesized at Fordham University, activity 1.30 mCi/g.

373 Plapp, F.W., Jr., Chapman, G. A., Morgan, J.W. DDT RESISTANCE IN Culex tarsalis Coquillett: CROSS RESISTANCE TO RELATED COMPOUNDS AND METABOLIC FATE OF A ^{14}C-LABELED DDT ANALOG. J. econ. Ent. 58, 6 (1965) 1064-9.

Larvae of a highly DDT-resistant strain of the mosquito C. tarsalis Coquillett were resistant also to dehydrochlorinatible analogues of DDT and to nondehydrochlorinatible analogues such as Prolan® (1,1-bis (p-chlorophenyl)-2-nitropropane) and to o-chloro DDT (1,1,1-trichloro-2-(4-chlorophenyl)-2-(2,4-dichlorophenyl) ethane. Combinations of DDT and synergists known to block dehydrochlorination failed to overcome resistance. Certain analogues of DDT in which the hydrogen atom on carbon no. 2 was replaced by less easily oxidized groups largely overcame resistance, that is, were about equally toxic to larvae of susceptible and resistant strains. Experiments with a ^{14}C-labelled sample of TDE indicated that both susceptible and resistant larvae detoxified the insecticide by dehydrochlorinative and oxidative routes. The results suggest that resistance to DDT and related compounds in C. tarsalis involves a mechanism other than dehydrochlorination. The precise nature of an alternative mechanism was not demonstrated and the nature of the resistance factor must be considered unknown. ^{14}C-TDE, labelled on no. 2 carbon (between the phenyl rings) was used for preparing ^{14}C-TDEE. (Essentially auth.)

374 Schwabe, U. ÜBER DIE VERTEILUNG VON DDT-^{14}C IM ZENTRALNERVENSYSTEM DER KATZE. (The distribution of ^{14}C-labelled DDT in the central nervous system of the cat). Nauyn-Schmiedebergs Arch. exp. Path. Pharmak. 250, 1 (1965) 84-94. (In German, with English summary)

The distribution of labelled DDT in eight different regions of the brain was studied in the cat. After intravenous injection of 25 mg/kg DDT characteristic differences of a dynamic distribution were observed. Within the first 30 min DDT accumulated in brain regions with grey matter. At the same time the white matter contained half as much DDT. This pattern of distribution corresponds to differences in the vascularity of the brain regions. After 4 h the DDT content in the white matter approaches equality to that of the grey matter. Within 24 h and later the DDT level in the whole brain declined. DDT disappeared predominantly from the grey matter, which contained now only half as much DDT as the white matter. At that time the distribution of DDT follows the lipid content of the various brain regions. Convulsion producing doses of DDT (50 mg/kg intravenous) additionally increased the accumulation in the grey matter. This did not occur after suppression of the convulsions by pentobarbital anaesthesia. (Auth. summary)

375 Stenersen, J.H.V. DDT-METABOLISM IN RESISTANT AND SUSCEPTIBLE STABLE-FLIES AND IN BACTERIA. Nature, Lond. 207 (1965) 660-1.

Resistant and susceptible stable-flies (Stomoxys calcitrans (L.)) were treated with 0.0164 µg ^{14}C-DDT in acetone by topical application. Excrements were collected and extracted. No difference could be observed in the rate of absorption, detoxication or excretion of DDT by resistant and susceptible flies. Both produce only small amounts of DDE. TDE was the only substance detected on the chromatograms of extracts of TDE-treated flies. In the excrements of ^{14}C-DDT-treated flies, DDT, DDE, TDE, and MI were found. MI was water-soluble and could be hydrolysed by acid to give a substance less soluble in water. When growing anaerobically or in oxygen deficiency, the facultative anaerobes Serratia marcescens, Escherichia coli, and an unidentified strain converted DDT almost completely (~90%) and DDE slightly (5%). In aerated cultures neither the facultative anaerobes nor the obligate aerobes converted any DDT to TDE or other products. As there is no difference in the rate of absorption, metabolism or excretion by resistant and susceptible flies, the resistance mechanism must be of an unusual kind, and not a detoxication mechanism despite the high degree of resistance present.

376 Upshall, D.G., Goodwin, T.W. SOME BIOCHEMICAL INVESTIGATIONS INTO THE SUSCEPTIBILITY OF BARLEY VARIETIES TO DDT. J. Sci. Fd Agric. 15, 12 (1964) 846-55.

The internal DDT deposits in the leaves of a barley strain (Rika) which is susceptible to DDT and of one (Proctor) which is resistant, were found to be the same. DDT specifically accumulated to the same extent in both strains. Neither DDT (2.56×10^{-5} M) nor DDE (2.75×10^{-5} M) inhibited the Hill reaction in either strain. When DDT at approximately 30 ppm was included in a water culture solution, no adverse effect on the root system of either strain was noted; only very slight uptake of DDT into the plant was noted. The susceptible strain when germinated in the presence of DDT is not adversely affected until the 10th d, i.e. when all food reserves are used up. No significant metabolism of

DDT by either strain could be observed even when ^{14}C-DDT was used. Examination of 19 DDT analogues revealed three structural requirements for toxicity. (^{14}C-DDE was prepared from chromatographically pure ^{14}C-pp'-DDT by exposing DDT in alkaline ethanol to u.v. light.) It is concluded that DDT exerts its toxic effect in Rika by gaining access to a functional lipoprotein in the chloroplast by being able to penetrate the membrane; in Proctor it is adsorbed on the chloroplast but presumably cannot penetrate the chloroplast membrane. (Essentially auth.)

377 Zubairi, M.Y., Cutkomp, L.K. THE PICK-UP OF ^{14}C-DDT AT DIFFERENT TEMPERATURES. Entomologia exp. appl. 7, 2 (1964) 139-43.

An account is given of experiments carried out with larvae of Aedes aegypti (L.) to test the hypothesis that the cuticle of insects sorbs more of a toxicant at a lower temperature and thus may permit greater availability at the site of action than at a higher temperature. The larvae picked up progressively greater amounts of ^{14}C-DDT with increasing temperature in the range of 10-30°C, but mortality decreased. The pick-up relations were the same when heads, thoraces and abdomens were compared separately. The thoraces contained greater concentrations than heads or abdomens at 30 and 20°C. At 10°C, heads contained more than thoraces and abdomens, but the amount was still less than that picked up at 20 and 30°C. The results show a positive coefficient of pick-up DDT but a negative temperature coefficient for mortality, provided that the concentration of DDT is not too high. The latter relation agrees with considerable earlier research. The explanation for the negative temperature effect of DDT is still not understood, but the evidence indicates that it is not positively related to pick-up by whole larvae or portions of them. (From RAE-B 53:1965, 151)

Chlordan

378 Poonawalla, N.H., Korte, F. METABOLISM OF INSECTICIDES, VIII (1): EXCRETION, DISTRIBUTION AND METABOLISM OF α-CHLORDAN-^{14}C. Life Sci. 3 (1964) 1497-1500.

After intravenous administration male rats excreted 30% of the injected 27 μg of α-chlordan-^{14}C, most of which was found to have been metabolized. The alimentary tract contained a high percentage of metabolites, whereas unchanged α-chlordan was found in subcutaneous fat only. (Auth. summary)

See also:

435 Penetration of insecticides through rat skin. (O'Brien, R.D., Dannelley, C.E., 1965)

4. Organophosphorus Insecticides

General

379 Kaloyanova-Simeonova, F.P. TOXICOLOGY OF ORGANIC PHOSPHORUS COMPOUNDS. Toksikol. Novykh Prom. Khim. Veshchestv 7 (1965) 122-38. (In Russian)

Rats, guinea pigs, and rabbits received daily, for up to 2.5 months, subcutaneous injections of 1/4 the LD50 of parathion (I), chlorothion (II), or malathion (III). The administration of I and III caused rabbits to die within a month, guinea pigs within 10-25 d, and rats within 17-90 d, while on II rabbits survived over 2 months, guinea pigs over 50 d, and rats survived longer than the rabbits. Determination of blood cholinesterase activity (IV) revealed it to be practically identically affected by the three pesticides under investigation; after approximately ten injections, the IV activity drops in all the animals to ~20% of its original value, and continues low thereafter.

The effect of II and III on protein synthesis was studied in two groups of rats administered a single 4/5 LD50 amount of these pesticides, followed 3 h later by intraperitoneal injections of methionine-^{35}S or glycine-^{14}C. After 24 h the rats were sacrificed and the labelled methionine and glycine content in the protein of liver, brain, and blood serum globulins was determined. A definite lowering of the incorporation of ^{35}S was observed in rats having received II, and a trend in the same direction in those treated with III, while the incorporation of ^{14}C was invariably higher, as compared with the controls (CA 63:1965, 7603g)

Phosphorus Aliphatic Derivatives

Dipterex

380 Hassan, A., Zayed, S.M.A.D. METABOLISM OF ORGANOPHOSPHORUS INSECTICIDES. III. FATE OF THE METHYL GROUPS OF DIPTEREX IN VIVO. Can. J. Biochem. 43, 8 (1965) 1271-5.

Direct evidence for the hydrolysis of O-methyl ester linkage(s) of Dipterex in the rat has been obtained using Dipterex in which the two methyl groups are ^{14}C-labelled. (A patent has been applied for this method of preparing radioactive Dipterex). Following a single intraperitoneal injection of radio-Dipterex, about 60% of the ^{14}C activity was recovered, after 24 h, in the expired air and in the urine. $^{14}CO_2$ and ^{14}C-formate constituted about 50% of the recovered radioactivity. The contribution of P–OCH_3 cleavage to the detoxification of the insecticide has been discussed. A scheme for the fate of the methyl groups has been suggested.

381 Hassan, A., Zayed, S.M.A.D., Hashish, S. METABOLISM OF ORGANOPHOSPHORUS INSECTICIDES. VI. MECHANISM OF DETOXIFICATION OF DIPTEREX IN THE RAT. Biochem. Pharmac. 14, 11 (1965) 1692-94.

To study the mechanism of detoxification of Dipterex in rats, a sublethal dose (100 mg/kg body weight) of the labelled drug was injected intraperitoneally. Within 48 h 75-85% of the administered dose was excreted in the urine; monomethyl phosphate accounting for 20-30%, dimethyl phosphate accounting for 60-70%, and an unidentified metabolite accounting for ~10% of the total metabolites. After acid hydrolysis, only monomethyl phosphates and dimethyl phosphates were detected by paper chromatography, probably indicating that the unidentified metabolite gave mono-Me phosphate or di-Me phosphate upon hydrolysis. It was concluded that the activities of esterase and phosphatase proceeded independently; yet products formed by hydrolysis through phosphatases were further acted upon by esterases so that metabolites with an intact phosphonate bond never appeared in the urine. (CA 64:1966, 5690f)

382 Hassan, A., Zayed, S.M.A.D., Abdel-Hamid, F.M. METABOLISM OF ORGANOPHOSPHORUS INSECTICIDES. II. METABOLISM OF O,O-DIMETHYL-2,2,2-TRICHLORO-1-HYDROXYETHYL PHOSPHONATE (DIPTEREX) IN MAMMALIAN NERVOUS TISSUE AND KINETICS INVOLVED IN ITS REACTION WITH ACETYLCHOLINE ESTERASE. Can. J. Biochem. 43, 8 (1965) 1263-9.

The metabolism of ^{32}P-labelled Dipterex in rat brain homogenates has been investigated. The presence of four metabolites, three acidic and one nonacidic, has been demonstrated. Mono-demethylated Dipterex and monomethylphosphate contributed to 37% and 7% of the total metabolite output respectively. The third acidic metabolite (16%) is believed to be 2,2,2-trichloro-1-hydroxyethyl phosphonic acid. The non-acidic compound has not yet been identified. The reaction of Dipterex with acetylcholine esterase has been found to be of bimolecular nature. (Auth.)

383 Hassan, A., Zayed, S.M.A.D., Abdel-Hamid, F.M. METABOLISM OF ORGANOPHOSPHORUS INSECTICIDES. V. MECHANISM OF DETOXIFICATION OF DIPTEREX IN Prodenia litura. Biochem. Pharmac. 14, 11 (1965) 1577-84.

The metabolism of Dipterex in the cotton leaf worm P. litura has been investigated in vivo, using ^{32}P- and ^{14}C-labelled insecticide. From the topically applied dose (2 mg/g insect), 40-45% was excreted as ^{32}P-labelled hydrolytic products during 20 h. The first major ^{32}P-labelled metabolite is produced by hydrolysis of both O-Me ester linkages, and eliminated as

glucuronide. This metabolite constitutes 65-75% of the total metabolite output. The second metabolite contributes 25-30%, and was dimethyl phosphate. Monomethyl phosphate (~5%) was also identified as a metabolic product. Radioactive CO_2 in the expired air accounted partly for the fate of the Me groups of the insecticide. The possible metabolic pathways have been discussed. (CA 64:1966, 4196d)

II/674 Kühnert, M., Dedek, W., Schwarz, H. DETERMINATION OF THE EFFECT OF THE PHOSPHONATE TRICHLORPHON, IN THE COMMERCIAL PREPARATION BUBULIN, ON THE METABOLISM AND EXCRETORY MECHANISM OF COWS GIVEN INTRAVENOUS AND INTRAMUSCULAR INJECTIONS, WITH THE AID OF RADIOACTIVE PHOSPHORUS. Arch. exp. Vet Med. 17 (1963) 403-17. (In German)*

Bubulin (I), a commercial preparation containing 500 g O,O-dimethyl 1-hydroxy-2,2,2-trichloroethylphosphonate (trichlorphon), 5 g pyridine-2-aldoxime methiodide (PAM), and 1.5 g atropine sulphate in 1 l of higher alcohols, was labelled with ^{32}P and injected into cows. Only traces of radioactivity were found in the faeces. Blood determinations showed that > 95% of I was metabolized to non-toxic products within 1 h after intravenous injection, but I was detected in the blood as long as 6 h after intramuscular injection. I was excreted in the milk for as long as 10 h after intramuscular injection, whereas injected DDVP could not be detected. Mainly non-toxic metabolites of I were detected in the urine. Injection of I lowered the Ca and Hg content and erythrocyte and lymphocyte counts of the blood serum and increased the granulocyte count. Intravenous and intramuscular injection of 20 and 25 mg I/kg respectively, evoked no histopathological changes in the liver. (CA 63:1965, 15471c)

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* See II/674 (without abstract).

384 Mostafa, I.Y., Hassan, A., Zayed, S.M.A.D. METABOLISM OF ORGANOPHOSPHORUS INSECTICIDES: TRANSLOCATION AND METABOLISM OF ^{32}P-LABELLED DIPTEREX IN COTTON PLANT. Naturwissenschaften 20b, 1 (1965) 67-70. (In English)

^{32}P-labelled Dipterex was prepared from the hemiacetal obtained by inter-reaction of equivalent amounts of chloral and methanol. This method is under patentation. The uptake of ^{32}P-Dipterex by the cotton plant, Gossypium barbadense, was studied following topical application on the leaf, as well as via the root. The insecticide did not penetrate into the leaf cells when applied topically but was readily taken up by the root when immersed in a solution of radioactive insecticide. The rate of respiration was found to increase significantly in plants treated with sublethal concentrations of Dipterex. The metabolic fate of Dipterex within the plant tissues was also investigated. Dimethylphosphate, monomethylphosphate and inorganic phosphate have been identified as degradation products of the insecticide.

385 Vashkov, V.I., Khudadov, G.D., Zakolodidna, V.I. THE RATE OF PENETRATION AND ACCUMULATION OF CHLOROPHOS-^{32}P IN VARIOUS ORGANS AND TISSUES OF HOUSE FLIES. Zh. Mikrobiol. Épidem. Immunobiol. 42, 8 (1965) 3-6. (In Russian)

Experiments with chlorophos-^{32}P were carried out on 7-d domestic female flies (laboratory strain) sensitive to insecticides. Alcoholic chlorophos solution (0.6-0.9 g/fly) was applied to the mediodorsal region with a micropipette. The insects were kept in glass jars covered with gauze on which a piece of cotton moistened with sugar sirup was placed for purposes of nutrition. The flies were examined 30 min, 1, 2, 3, 4, and 6 h after insecticide application. The greatest amounts of chlorophos or its metabolites were detected in the haemolymph, digestive system, and heat ganglion 30 min after the application; 1-6 h after the application, the amount of chlorophos or its metabolites manifested a considerable reduction in the digestive system and the Malpighian vessels. The amount of chlorophos or its metabolites in the thoracic ganglion increased at first and then lessened. Traces of chlorophos or its metabolites were detected 1-2 h after the application, but none was found later. Small amounts of chlorophos and its metabolites were detected in the wing muscles 30 min after application of the insecticide. The amount increased 1 h after the application and then decreased. (CA 63:1965, 17069a)

386 Zayed, S.M.A.D., Hassan, A. METABOLISM OF ORGANOPHOSPHORUS INSECTICIDES. I. DISTRIBUTION AND METABOLISM OF DIPTEREX IN ADULT LARVA OF THE COTTON LEAF WORM (Prodenia litura F.). Can. J. Biochem. 43, 8 (1965) 1257-62.

The distribution of ^{32}P-labelled Dipterex among different organs of the adult larva of the cotton leaf worm showed that the major radioactivity was translocated in haemolymph and gut. Dipterex was readily metabolized in vitro to give monodemethylated Dipterex which contributed to 91% of the acidic metabolites. Monomethylphosphate (about 9%) could also be identified as a metabolic product. The low toxicity of Dipterex to Prodenia larvae is probably due to preferential methyl ester cleavage. (Auth.)

387 Zayed, S. M. A. D., H assan, A., Hussein, T. M. STUDIES ON ORGANOPHOSPHORUS INSECTICIDES II. DISTRIBUTION AND METABOLISM OF ^{32}P-O-O-DIMETHYL-2,2,2-TRICHLORO-1-METHOXYETHYL PHOSPHONATE IN THE ADULT LARVA OF "Prodenia litura F." Z. Naturf. 20b, 6(1965)587-91. (In English)

The distribution of ^{32}P-labelled O,O-dimetheyl-2,2,2-trichloro-1-methoxyethyl phosphonate (I) among different organs of adult larva of P. litura F., showed that considerable radioactivity was translocated in haemolymph and gut. Significant accumulation of the ^{32}P-activity in the fat with time has been observed. The in vivo metabolic rate of I in Prodenia larvae was relatively small (12-16% of the applied dose during 20 h). The major metabolite (75-85%) is produced by splitting of both O-methyl ester linkages, and excreted as glucuronide. Monomethyl- (5-10%) and dimethyl phosphates (10-15%) were also identified as metabolic products. I was originally obtained by methylation of Dipterex, and was found to be more stable and possess a lower anticholinesterase activity. Its toxicity to P. litura was comparable to Dipterex.

388 Zayed, S. M. A. D., Hassan, A., Fakhr, I. M. I. I. PREPARATION OF SOME DIPTEREX ANALOGUES AND STABILITY OF O,O-DIMETHYL-2,2,2-TRICHLORO-1-METHOXYETHYL PHOSPHONATE. Z. Naturf. 20b, 8 (1965) 786-90. (In English)

Dipterex (O,O-dimethyl-2,2,2-trichloro-1-hydroxy-ethyl phosphonate) was synthesized with ^{32}P, and labelled O,O-dimethyl-2,2,2-trichloro-1-methyoxyethyl phosphonate (I_b) prepared from it. Dipterex and its homologues were obtained in good yields by a single vessel reaction. The stability of I_b towards temperature and pH variation was studied using labelled compounds; I_b proved much more stable than the parent substance, Dipterex. The anticholinesterase activity of Dipterex was found to be more than 300 times higher than that of the methyl ether I_b, thus proving a correlation between the presence of the free hydroxyl group in Dipterex and its anticholinesterase activity.

389 Zayed, S. M. A. D., Mostafa, I. Y., Hassan, A. METABOLISM OF ORGANOPHOSPHORUS INSECTICIDES. VII. TRANSFORMATION OF ^{32}P-LABELED DIPTEREX THROUGH MICROORGANISMS. Arch. Mikrobiol. 51, 2 (1965) 118-21.

During the metabolism of Dipterex-^{32}P (1-hydroxy-2,2,2-trichloroethylphosphonic acid (I) di-Me ester) by Aspergillus niger, Penicillium notatum, and Fusarium spp., at least two hydrolytic metabolites have been detected. One of them is identified as O-methyl-2,2,2-trichloro-1-hydroxylethyl-phosphonic acid and comprises 30-44% of total metabolite output. The other is believed to be I. (CA 63:1965, 12254b)

Dichlorvos

390 Millar, K. R., Aitken, W. M. RESIDUE IN MEAT FOLLOWING EXPOSURE TO ^{32}P-LABELED DICHLORVOS VAPOR IN AN ENCLOSED SPACE. N. Z. Jl agric. Res. 8, 2 (1965) 350-62.

Concentrations of dichlorvos (I) were determined in meat samples following exposure to the insecticide maintained at a concentration of approximately 0.5 γ/l of air for 30 min. The I did not penetrate deeply into tissues and it was readily decomposed in minced meat and steak. Frying and boiling steak containing I completely destroyed the insecticide, only hydrolytic products being found. The effect of I on adult blowflies (Lucilia sericata) was also investigated, both during actual spraying and in the period following treatment. Two weeks after spraying, a complete kill of released flies was obtained after 3-4 h of exposure. In general, meat treated with I under conditions effective in practice would be safe for human consumption. (CA 63:1965, 3536h)

Azodrin

391 Bull, D.L., Lindquist, D.A. METABOLISM OF AZODRIN IN INSECTS, RATS, AND PLANTS. Bull. ent. Soc. Am. 11, 3 (1965) 56. Abstr. 42. Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov. -2 Dec. 1965".

The oxidative and hydrolytic metabolism of radiolabelled Azodrin was compared in five species of insects, white rats, and cotton plants. Oxidative conversion of Azodrin to the N-methylol derivative was an important reaction in animals but not in plants. N-demethylation appeared to be a minor reaction (Abstr.)

392 Ridgway, R.L. SYSTEMIC ACTIVITY OF AZODRIN* IN THE COTTON PLANT. Bull. ent. Soc. Am. 11, 3 (1965) 177. Abstr. 459. Presented at the "Annual Meeting of the Entomological Society of America, New Orleans, 29 Nov. -2 Dec. 1965".

Bioassay and radioassay techniques were used to study the systemic activity of Azodrin in the cotton plant. Little or no Azodrin translocated following foliar application. However, relatively large amounts were found in nectar following stem application. Azodrin was not particularly effective when applied as a seed or soil treatment. (Abstr.)

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* SD-9129 (3-hydroxy-N-methyl crotonamide dimethyl phosphate)

Bidrin

393 Bull, D.L., Lindquist, D.A. METABOLISM OF 3-HYDROXY-N,N-DIMETHYLCROTONAMIDE DIMETHYL PHOSPHATE BY COTTON PLANTS, INSECTS, AND RATS. J. agric. Fd Chem. 12 (1964) 310-7.

The nature and rate of the in vivo metabolism of the experimental systemic insecticide Bidrin were compared in cotton plants, two species of cotton insects (boll weevil and boll worm), and white rats, through the use of radiometric techniques. Bidrin-^{32}P or Bidrin-^{14}C was used. Oxidative demethylation of the toxicant to its equally toxic N-methyl derivative occurred in all biological materials, but all toxic products decomposed rapidly. Of nine P-containing metabolites detected, six hydrolytic and two oxidative products were identified tentatively. A major metabolite that occurred in treated plants was not completely identified, but was shown to contain almost all the original Bidrin molecules.

394 Bull, D.L., Lindquist, D.A. THE EFFECTS OF CHRONIC DOSES OF AN ORGANOPHOSPHORUS INHIBITOR ON CHOLINESTERASE ACTIVITY IN BOLL WEEVILS. Experientia 21, 5 (1965) 262-3.

Adults of Anthonomus grandis Boheman were fed with sustained doses of Bidrin (3-hydroxy-N,N-dimethyl-cis-crotonamide dimethyl phosphate). Sublethal and lethal doses were used. Some physiological mechanism stopped cumulative inhibition and allowed recovery of cholinesterase activity in spite of continued treatment. ^{14}C-Bidrin was used.

395 Corey, R.A. LABORATORY TESTS WITH BIDRIN INSECTICIDE. J. econ. Ent. 58, 1 (1965) 112-4.

Bidrin® insecticide (3-(dimethoxyphosphinyloxy)-N,N-dimethyl-cis-crotonamide), or SD 3562, was found highly toxic to nine insect or mite species in laboratory tests. It is a systematic toxicant which can enter plants through roots, seeds, or leaves. Bidrin is water soluble and leaches readily through soil, and is quickly decomposed in moist soil. The stability of Bidrin in a sandy loam soil of varying moisture content was measured by means of liquid-liquid partition or paper chromatography of a ^{14}C-labelled product. That it is relatively stable in plants is shown by its residual toxicity to two-spotted spider mites, Tetranychus telarius (L.), and Mexican bean beetle (Epilachna varivestis Mulsant) larvae in the laboratory and to grape leafhoppers, Erythroneura comes (Say), and walnut aphids, Chromaphis juglandicola (Kaltenbach), in field tests.