RIESE, W. Über Riechhirnmangel. Zeitschr. ges. Neur. u. Psych,. **69.**
———— Zur vergleichenden Anatomie der striofugalen Faserung. Anat. Anz., **57**, 1924.
———— Über faseranatomische Verbindungen im „striären System" der wasserlebenden Säuger. Zeitschr. ges. Neur. u. Psych., **90**, Heft 3 u. 5.
———— Beiträge zur Faseranatomie der Stammganglien. J. Psych. u. Neur. **31**, 1924.
———— Formprobleme des Gehirns. 1. Vorl. Mitt. Körperform und Hirnform. J. Psych. u. Neur., **31**, Heft 3 u. 4.
———— Formprobleme des Gehirns. 2. Mitt. Über die Hirnrinde der Wale. Ein Beitrag zum Furchungsproblem. J. Psych. u. Neur., **31**, Heft 5.
———— Über die Stammganglien der Wale. J. Psych. u. Neur., **32.**
RIESE, W. Bau und Leistungen des Zentralnervensystems eines vierjéhrigen riechhirnlosen Kindes. Deutsche Zeitschr. Nervenheilkunde, **89**, 1925.
———— Über anatomische und funktionelle Differenzen im optischen System. J. Psych. u. Neur., **32**, Heft 6.
———— Über den Bau und die Leistungen des akustischen Systems der Wale. J. Psych. u. Neur., **34**, Hef. 3 u. 4.
———— Anpassungen und Konvergenzen am Gehirn. Die Naturw., **15**, Heft 40.
———— Konvergenzerscheinungen am Gehirn. J. Psych. u. Neur.; *33*, Heft 1 u. 2.
———— Über das Vorderhirn des Walfoetus (Megaptera boops). Anat. Anz., **65**, 1928.
RIESE, W. und GOLDSTEIN, K. Klinische und anatomische Beobachtungen an einen vierjährigen riechhirnlosen Kinde. J. Psych. u. Neur., **32.**
VIALLETON, L. Un problème de l'évolution. Montpellier, Coulet & fils. Librairie de l'Université, und: L'origine des êtres vivants. Paris, Librairie Plon, 1929.
WILSON, R. B. The anatomy of the brain of the whale (Balaenoptera sulfurea). J. Comp. Neur., **58.**

Medicine. — *Remarks with regard to the "Courte instruction pour la détermination des variétés d'Anopheles maculipennis" by the Malaria Committee of the League of Nations.* By J. H. DIEMER and P. H. VAN THIEL. (From the Laboratory of Tropical Hygiene of the Institute of Tropical Medicine, University of Leyden. Director Prof. P. C. FLU.) (Communicated by Prof. J. VAN DER HOEVE.)

(Communicated at the meeting of November 30, 1935).

The Committee of Experts (CHRISTOPHERS c.s.) appointed by the Malaria Committee of the League of Nations has composed a short instruction for the determination of the different varieties of Anopheles maculipennis. By this publication it has done useful work, which may serve as a good guide for many persons. It gives rise to some remarks in consequence of the spread of the different varieties in relation to the modern race-circle theory ("Rassenkreislehre"), and also in consequence of the nomenclature of some varieties.

A. *The principle of the (geo)biotypes and (geo)biotype-circles.*

The Committee of the League of Nations mentioned above, while writing the key for the determination of the different varieties, has placed itself

on a morphological point of view and has given the name of varieties to the subdivisions of the old systematic species Anopheles maculipennis.

In his thesis DIEMER (1935), in the light of a historical-critical examination of the use of the categories species, subspecies, race, and variety, in old morphological systematics as well as in modern more physiological systematics, examined what systematical rank is due to these subdivisions. The term race should be avoided; it should be used only for products of culture. From a consequent morphological point of view Anopheles maculipennis is doubtless a species and the types are varieties, except probably elutus. But from a physiological point of view within the morphologically bounded species three physiologically bounded species may be distinguished, two of which are geobiotype-circles (= so-called "Rassenkreise") and one a biotype. Wrongly Anopheles maculipennis should be after HACKETT (1934) a "Rassenkreis".

A biotype — it comprises the morphological and the physiological part — is defined by DIEMER (1935) as "the organic structure type of all specimens, which have the same structure in the same stage of life and phaenotypically show only inconstant differences, which live in a coherent territory or in the same conditions of life, which in nature mate spontaneously and produce a perfectly fertile progeny".

These biotypes are "units of life", with which one has to do in the practice of malaria investigations. The following biotypes are known: labranchiae, atroparvus, elutus, messeae, melanoon, typicus, and probably also sicaulti and fallax.

DIEMER further distinguishes between biotypes whose areas vicariate (= living in mainly adjoining areas, separated by climatic factors) and biotypes which replace each other in different environments. The former (the so-called geographical races) are named "geobiotypes" and the latter (the so-called biological and oecological races) "oecobiotypes". The latter do not concern us here.

Geobiotypes may be united into a "geobiotype-circle" (= Formenkreis of KLEINSCHMIDT and = Rassenkreis of RENSCH). It is a complex type, which DIEMER defines as "the organic structure type of all specimens, which in a certain area show only inconstant differences, in neighbouring areas on the contrary constant differences in one or more features, often showing such a transition that the types are separated by no cleft, and of which the neighbouring specimens mate under natural conditions and produce a very viable and fertile progeny" [1]).

In the following part the principle of geobiotype-circles will be applied to Anopheles maculipennis, because it is of importance for our insight in

---

[1]) In crosses between biotypes of different biotype-circles a certain degree of viability and fertility may occur, e.g. in the crossbreeding experiments by DE BUCK c.s. (1934) with atroparvus × melanoon and in those by VAN THIEL (DIEMER and VAN THIEL, 1935) with atroparvus × messeae. Neither do vicariating biotypes of the same circle always give rise to a viable and fertile hybrid generation, although this as a rule occurs.

the spread of the component parts of Anopheles maculipennis and the sexual affinity of these parts with respect to one another [1]). The data will be used from the maps published by the Committee of Experts. Here and there changes are made, which will be mentioned.

The first geobiotype circle is composed of the biotypes labranchiae, atroparvus and elutus and probably also of sicaulti. Labranchiae and atroparvus vicariate: atroparvus occurs from the North of Europe as far as the North of Italy, while labranchiae is found only in more southern countries, e.g. in Middle- and South Italy. Further DE BUCK c.s. (1934) succeeded in obtaining very fertile hybrids (all ♀ and part of ♂) by reciprocal crossbreeding experiments of atroparvus × labranchiae.

Also elutus, from a physiological and genetical point of view, may be classed in the same geobiotype-circle, while it vicariates with labranchiae and atroparvus and crosses of atroparvus ♂ × elutus ♀ gave viable larvae and few hybrid mosquitoes. Crosses of labranchiae × elutus failed owing to the eurygamy of both types. Although the viability of the hybrid generation here was not so great as in the cross atroparvus × labranchiae, still elutus fits very well in the same biotype-circle.

A further common physiological feature of the three types is their usually breeding in brackish water. From a morphological point of view, on the contrary, elutus is reckoned as a separate species next to Anopheles maculipennis, while the adults can be determined fairly well and the structure of the eggs deviates most from the eggs of the other types.

So far as is known at present, in the biotype-circle of atroparvus, labranchiae, elutus (Fig. 1), in Europe a line can be drawn from the South of Spain, northward of Sardinia, southward of Genoa towards the South of Russia; near Venice a line splits up towards the South through the Adriatic. North of this line atroparvus occurs, to the South-West labranchiae and to the South-East elutus. In the borderland one type may be found by the side of the other (In Gorino near Venice VAN THIEL even found 20 per cent atroparvus and 27 per cent elutus). Sicaulti, very congenial with labranchiae, taking the place of labranchiae in Morocco (ROUBAUD, 1935), probably fits in the same circle.

Messeae and melanoon [2]) very likely compose the second geobiotype-circle. Messeae is found in Europe nearly wherever atroparvus lives, except in Spain, while it should occur moreover in the whole of Italy and in all the Balkans. Melanoon, on the contrary, should occur only in Albania, in the whole of Italy and on the east coast of Spain. According

---

[1]) For the Netherlands it means that it is theoretically not excluded that atroparvus and messeae, a more and a less malaria dangerous variety, mate and produce a progeny with a certain fertility. Practically the origin of hybrids has hardly any significance here, as is described in the thesis of DIEMER and in our article on the racial purity of Anopheles maculipennis atroparvus and messeae.

[2]) The experiments of DE BUCK c.s. with "Italian messeae" concern also melanoon, as Dr. DE BUCK wrote to us.

to those data, published by the Committee of Experts, these biotypes do not vicariate clearly. However, it is very dubious if these data are right [1]).

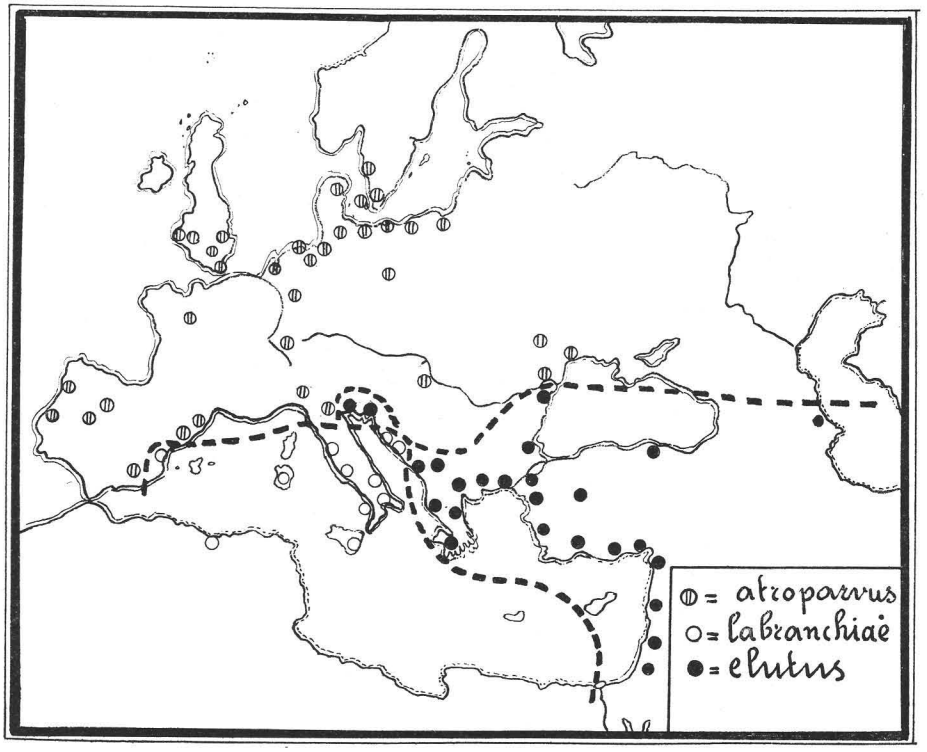

Fig. 1

In Italy at least one of us (VAN THIEL, 1933) found that many batches of ova were formerly determined as messeae, while they concerned still melanoon. Only in the North of Italy mosquitoes were found which by their eggs could not be differentiated from the Dutch messeae. We should not be surprised if there exists in Italy between messeae and melanoon a similar vicariation as between atroparvus and labranchiae, viz. messeae at the utmost in the North of Italy and more southward only melanoon. Crossbreeding experiments could not be made here owing to the eurygamy of the two biotypes. However, morphologically and physiologically they

---

[1]) It will be possible to decide if melanoon and messeae occur in Italy side by side and if the last named is identical with the Dutch messeae, when an accurate examination will have decided if the eggs with the entirely or almost entirely dark design as a rule have a smooth intercostal film of the floats and the eggs resembling more Dutch messeae as a rule a striated one. We presume that in Italy both types are often identical because: 1°. HACKETT (1934) himself doubts the possibility of separating both in a number of localities. 2°. DE BUCK c.s. (1934) observed that females, reared from dark eggs, laid afterwards dark and more barred eggs and the reverse. 3°. The curves of the different characters of the eggs and the adults of dark barred and dark + dark barred eggs from Italy run greatly parallel (VAN THIEL, 1933).

differ so little that in nature sexual affinity in the borderlands may be assumed.

It is certain that the two biotypes do not belong to the first named circle: 1°. They do not vicariate with the other three biotypes (everywhere in the North of Europe messeae occurs mixed with atroparvus and very probably melanoon occurs in the South of Europe mixed with labranchiae or elutus). 2°. DE BUCK c.s. found that crosses of ♂ atroparvus × ♀ messeae produced dead embryos or hardly viable larvae which soon died. It is true, only once or twice we obtained adult hybrids, but these must have been sterile[1]), as crosses of ♂ atroparvus × ♀ melanoon gave DE BUCK c.s. many viable larvae and adults, which were much more sterile than the hybrid mosquitoes of atroparvus × labranchiae. 3°. Morphologically and physiologically messeae and melanoon differ more from atroparvus, labranchiae and elutus than they differ mutually.

Crosses of the type fallax (described by ROUBAUD from Normandy, 1934) ♂ × messeae ♀ were fertile; this seems to indicate that fallax may also belong to the same circle.

In fig. 2 the presumed spread of messeae and melanoon mentioned above

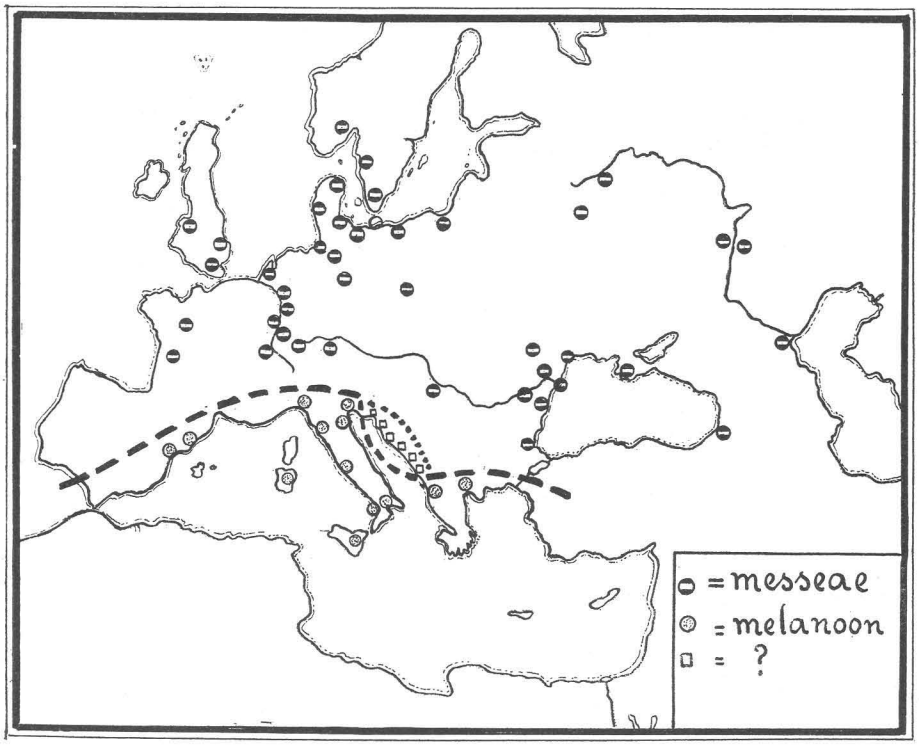

Fig. 2

[1]) This was not examined, as these experiments were made at a time when we were not yet aware of the significance of that examination.

is indicated. Where the identity of the local biotype with messeae or melanoon is very uncertain, this is indicated by "?".

Typicus remains, which from a physiological point of view is also a biotype, but does not belong to the two geobiotype-circles mentioned. Typicus stands alone. Although it is reckoned by MISSIROLI c.s. to the messeae-group — from a morphological point of view rightly —, it should not be reckoned to the two geobiotype-circles mentioned, because: 1°. Typicus is spread over the whole of Europe and lives by the side of all biotypes mentioned (Fig. 3). 2°. all hybrids, obtained by DE BUCK c.s. from crosses of ♂ atroparvus × ♀ typicus were sterile (crossbreeding

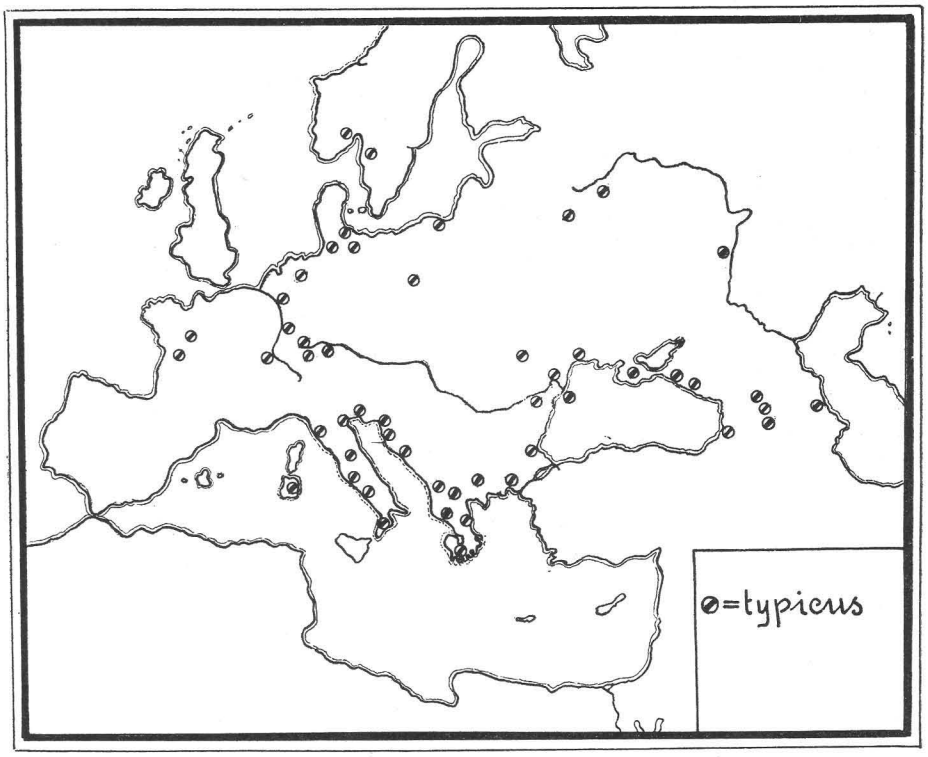

Fig. 3

experiments could not be made here owing to the eurygamy of typicus, of messeae and of melanoon).

B. *The nomenclature of the biotypes.*

FALLERONI (1926) distinguished in Italy within Anopheles maculipennis the variety messeae with the dark type of egg and the variety labranchiae with the grey type of egg. In 1927 VAN THIEL separated in the Netherlands the variety atroparvus (as the small-winged race) from the long-winged "type" of the species Anopheles maculipennis, described by MEIGEN (1818).

In his opinion this variety had very probably nothing to do with the two varieties described by FALLERONI.

Besides messeae and labranchiae FALLERONI (1926) observed a third type of egg, grey with only two transverse bands (simple banded). In that year he did not give a name to that type, but did so in 1932, viz. the variety basilii Falleroni. Previously MARTINI c.s. (1931) had mentioned this variety as the variety maculipennis Falleroni. They were of opinion that FALLERONI left for the type with the simple banded eggs the name of the species, maculipennis, because he had not given it a name in 1926. We do not think that this is right, because, as is obvious from the article of FALLERONI (1926) and is clearly said by him in 1932, "Nel 1926 ne feci un tipo a sè considerando.....", but after having made breeding experiments now "mi confermo nell'idea che possa formare una razza a sè, come *ritenni* [1]) nel 1926". He then proposed the name of basilii. So at first he had not in mind an identification with the type-species of MEIGEN.

Now VAN THIEL (1927) called the long-winged mosquito (with the dark-barred eggs, as became evident afterwards) in the Netherlands the systematic type, which was named by him (1933) "typicus Meigen", to distinguish it from messeae in Italy. As the Committee of Experts (1935) declared the mosquito with the simple banded eggs as the type, this was not done according to the law of priority.

Still we advise to follow the proposal of that Committee, because the biotype with the simple banded eggs is most spread (MISSIROLI c.s. 1933) and may have been described by MEIGEN (1818) for the following reason: As MEIGEN worked in Aix-la-Chapelle and as a rule collected there, we caught there July 1934 anophelines. We obtained 2 batches of messeae and 4 batches of ova of the simple banded type. So it is not clear whether MEIGEN described the mosquito with the simple banded or with the dark barred type of egg.

The spread of the mosquito with simple banded eggs will have been the main reason why the Committee of Experts accepted for that biotype the name "type", however without using the name "typicus". After COLLIER (1924) in such a case formerly the name typicus was added behind the name of the species, but nowadays the last name is repeated. Consequently the mosquito should be named variety maculipennis, but in order to prevent confusion we prefer to use the name "typicus". So it is obvious that this "typicus" has nothing to do with "typicus van Thiel (1933)", for which at present the name of messeae is definitively fixed.

On the nomenclature of messeae and melanoon we should like to remark the following: HACKETT (1934) separated the mosquito with dark eggs as the variety melanoon from the mosquito with dark barred eggs, viz. variety messeae. Both should occur in Italy side by side. However, we cannot accept this opinion, because the arguments to do so are not

[1]) Our italics.

convincing (see under *A* and VAN THIEL, 1933; ROUBAUD, 1934). We believe that in Italy one has usually to do with one biotype, which however is different from the mosquito with dark barred eggs from the Netherlands. The last named one is not named messeae by VAN THIEL, but other authors did so. It would have been better if the name messeae Falleroni was maintained for the mosquito with dark barred and often dark eggs and smooth or nearly smooth intercostal films of the floats, such as found in Italy, and if the North-European mosquito with dark barred eggs and usually strongly striated floats had got another name.

In order to prevent confusion, however, we accept the nomenclature proposed by the Committee of Experts. In connection with what is said under *A* on the spread of messeae and of melanoon, it is clear that future research must demonstrate if our presumption is right that the North-European messeae is not found in South Italy.

If a certain compromise is made between the nomenclature from a consequent morphological and from a consequent physiological point of view, then we believe that the following nomenclature is most desired:

1. Anopheles maculipennis typicus Martini, Missiroli and Hackett, 1931.
2. ,, ,, messeae Falleroni 1926.
3. ,, ,, melanoon Hackett 1934.
4. ,, ,, labranchiae Falleroni 1926.
5. ,, ,, atroparvus van Thiel 1927.
6. ,, ,, elutus Edwards 1921.

In this nomenclature the geobiotype-circle is not expressed, the morphological species name is maintained and the name of the (geo)biotype is mentioned. The term "variety" is omitted, as is done more and more in systematics ("the term variety which is often used in connection with mosquitoes is so ill-defined that it has not been adopted"; GATER, 1934).

Summary.

1. Anopheles maculipennis MEIGEN is not one "Rassenkreis" (HACKETT), but is composed of two circles (geobiotype-circles), each comprising a few (geo)biotypes, and of one biotype which stands apart. The distinction of these circles is of importance for the insight in the spread of the biotypes and in the sexual affinity with respect to one another.

2. Some remarks are made on the spread and the nomenclature of the different biotypes (= varieties, Committee of Experts, League of Nations).

Leyden, August 1935.

REFERENCES.

DE BUCK, A., SCHOUTE, E and SWELLENGREBEL, N. H., Crossbreeding experiments with Dutch and foreign races of Anopheles maculipennis. Riv. di Malariol. **13**, 1934, N°. 3.

CHRISTOPHERS, R., c.s., Courte instruction pour la détermination des variétés d'Anopheles maculipennis. Bull. Trimestr. Org. d'Hyg. Soc. d. Nations III, 1935, N°. 20.

COLLIER, W. A., Allgemeine Methoden des zoologisch systematischen Arbeitens; die Nomenklatur. Handb. d. Biol. Arbeitsmethoden, **9**, 1924, T. **1**, H. **4**, Lief. **144**, p. 590.

CORRADETTI, A., Richerche sugli incroci tra le varieta di Anopheles maculipennis. Riv. di Malariol. **13**, 1934, p. 707.

DIEMER, J. H., Over biotypen van Anopheles maculipennis Meigen, in het bijzonder in Westelijk Nederland, een taxonomisch onderzoek. Thesis, Leiden 1935.

DIEMER, J. H. and VAN THIEL, P. H., Investigations on the racial purity of Anopheles maculipennis atroparvus and messeae in the Netherlands. To be published in the Acta Leidensia X.

FALLERONI, D., Fauna anofelica italiana e suo habitat. Riv. di Malariol. **5**, 1926, fasc. 5—6.

———— Zooprofilassi e sua applicazione in Ardea, Roma, 1932.

GATER, B. A. R., Aids to the identification of Anopheline larvae in Malaya, Singapore, 1934.

HACKETT, L. W., The present status of our knowledge of the subspecies of Anopheles maculipennis. Transact. Roy. Soc. Trop. Med. and Hyg. **28**, 1934, p. 109.

MARTINI, E., MISSIROLI, A. and HACKETT, L. W., Versuche zum Rassenproblem des Anopheles maculipennis. Arch. f. Sch. u. Tropenhyg. **35**, 1931, p. 622.

MISSIROLI, A., HACKETT, L. W. e MARTINI, E., Le razze di Anopheles maculipennis e la loro importanza nella distribuzione della malaria in alcune regioni d'Europa. Riv. di Malariol. **12**, 1933, N°. 1.

ROUBAUD, E., Un type racial nouveau de l'Anopheles maculipennis. Bull. Soc. Path. Exot. **27**, 1934, p. 737.

———— Variété nouvelle de l'Anopheles maculipennis au Maroc. Bull. Soc. Path. Exot. **28**, 1935, p. 107.

VAN THIEL, P. H., Sur l'origine des variations de taille de l'Anopheles maculipennis. Bull. Soc. Path. Exot. **20**, 1927, p. 366.

———— Investigations on the range and differentiation of Anopheles maculipennis races and their bearing on the existence or the absence of malaria in Italy. Riv. di Malariol. **12**, 1933, N°. 2.

———— Insuffisance des caractères de l'oeuf pour la distinction des races trophiques et biologiques de l'Anopheles maculipennis ? Bull. Soc. Path. Exot. **27**, 1934, p. 154.

Mathematics. — *Beiträge zur Topologie der Deformationen.* III. *Klassen und Homologietypen von Abbildungen* [1]). Von Dr. W. HUREWICZ. (Communicated by Prof. L. E. J. BROUWER).

(Communicated at the meeting of December 21, 1935).

Die Ergebnisse der vorigen Mitteilung bilden eine Grundlage für weitere Untersuchungen über die Beziehungen zwischen den Homologie- und den Homotopieeigenschaften von Räumen und Abbildungen.

Die stetigen Abbildungen eines Raumes X in einen anderen Raum Y

[1]) Die ersten zwei Noten dieser Serie (im Folgenden als D I und D II zitiert) finden sich in diesen Proceedings **38**, S. 112 u. 521. Ausführliche Darstellung erscheint später in den Ann. of Math.