Entsprechende Behandlung der threo-Form von I*a* lieferte N-Acetyl-*cis*-threo-1,3-dihydroxy-2-amino-4-octadecen (III*a*), Smp. 97–99°, bzw. die freie Base III*b*, Smp. 42–44° (Triacetylderivat Smp. 40–41°). Damit sind alle vier stereoisomeren Racemate mit Sphingosinstruktur zugänglich geworden.

Es ist bemerkenswert, dass die obigen beiden *cis*-Formen des Sphingosins III*b* kristallisierbar sind, während die beiden *trans*-Formen II bisher nur wachsartig erhalten werden konnten[1]. Die eingehende Beschreibung dieser Versuche soll an anderer Stelle erfolgen.

C. A. GROB und F. GADIENT

Organisch-chemische Anstalt der Universität Basel, den 26. Juni 1956.

Summary

The synthesis of *cis*-erythro- and *cis*-threo-1,3-dihydroxy-2-amino-4-octadecene, two further stereoisomers of sphingosine, is described.

Thermodynamics of the *cis-trans* Interconversion of Dichlorobis-(ethylenediamine)-cobalt (III) Chloride

The *cis-trans* interconversion between the praseo and violeo complexes was discovered by JORGENSEN[1]. The authors have reported on the rate of this interconversion elsewhere[2].

Trans-$[Co(en)_2Cl_2]Cl$[3] was prepared as described by BAILAR[4]. The green *trans* form is spontaneously converted into a violet *cis* form on standing in aqueous solution. The conversion was followed with a Beckman D. U. spectrophotometer using 1·00% by weight (0·035 *M*) solutions of the *trans* form in all cases. It was found from a study of the spectrum of the *cis* and *trans* forms that a wave length of 6000 Å was suitable for following the reaction. The temperature was controlled to ± 0·2°.

The system was allowed to come to equilibrium at the desired temperature and the equilibrium concentrations of the *cis* and *trans* forms were calculated from the measured transmittances. Then,

$$K_c = \frac{[cis]}{[trans]} .$$

The results are summarized in the Table.

t (°C)	K_c
1·5	0·129
23·0	11·60
36·3	87·40

The heat of conversion, ΔH, was found to be 31·4 kcal/mole from a plot of log K_c versus $1/T$.

D. T. HAWORTH, E. F. NEUZIL, and S. L. KITTSLEY

Department of Chemistry, Marquette University, Milwaukee, Wisconsin, June 7, 1956.

[1] S. M. JORGENSEN, J. prakt. Chem. *39*, 18 (1889); *41*, 449 (1890).
[2] D. T. HAWORTH, E. F. NEUZIL, and S. L. KITTSLEY, J. amer. chem. Soc. *77*, 6198 (1955).
[3] Ethylenediamine is designated as en.
[4] J. C. BAILAR, *Inorganic Syntheses*, vol. II (McGraw-Hill Book Co. New York, 1946), p. 223.

Zusammenfassung

Trans-$[Co(en)_2Cl_2]Cl$[5] wird in wässriger Lösung in die *cis*-Form umgewandelt. Die Konzentrationen der beiden Formen, die miteinander im Gleichgewicht stehen, wurden gemessen und bei verschiedenen Temperaturen die Gleichgewichtskonstanten nach der Formel

$$K_c = \frac{cis}{trans}$$

berechnet.

[5] en = $H_2NCH_2CH_2NH_2$.

Sterol from *Aegle marmelos*

In a previous communication[1], aegelin, isolated from the leaves of *Aegle marmelos* Correa (N. O. Rutaceae) by CHATTERJEE and BOSE[2], has been shown to be a neutral alkaloid and not a sterol. Recently, an attempt was made to isolate the real sterol constituent of leaves of *Aegle marmelos* following the normal procedure for isolation of sterols from plants. For this purpose the ethereal extract after separation of aegelin by the method of CHATTERJEE and BOSE[2] was saponified with strong alcoholic potash and then distilled in steam to remove volatile oils. The non-volatile, non-saponifiable fraction was obtained by extraction with ether. The product was then chromatographed following the procedure adopted by CHAKRAVARTI and DUTTA[3] for isolation of stigmasterol from *Enhydra fluctuans*. From the petroleum ether–benzene (1:1) fraction a crystalline product was obtained which after proper purification crystallized from alcohol in shining plates, m. p. 144–145°, $[\alpha]_D^{18} = -40°$ ($CHCl_3$), yield, 0·05%. The product has the molecular formula $C_{29}H_{50}O$, and has been identified with γ-sitosterol [acetate, m. p. 140–141°, $[\alpha]_D^{16} = -47°$ ($CHCl_3$); benzoate, m. p. 150–151°, $[\alpha]_D^{16} = -17°$ ($CHCl_3$)].

R. N. CHAKRAVARTI and B. DASGUPTA

Department of Chemistry, School of Tropical Medicine, Calcutta, India, May 15, 1956.

Zusammenfassung

γ-Sitosterol wurde aus Blättern von *Aegle marmelos* Correa isoliert.

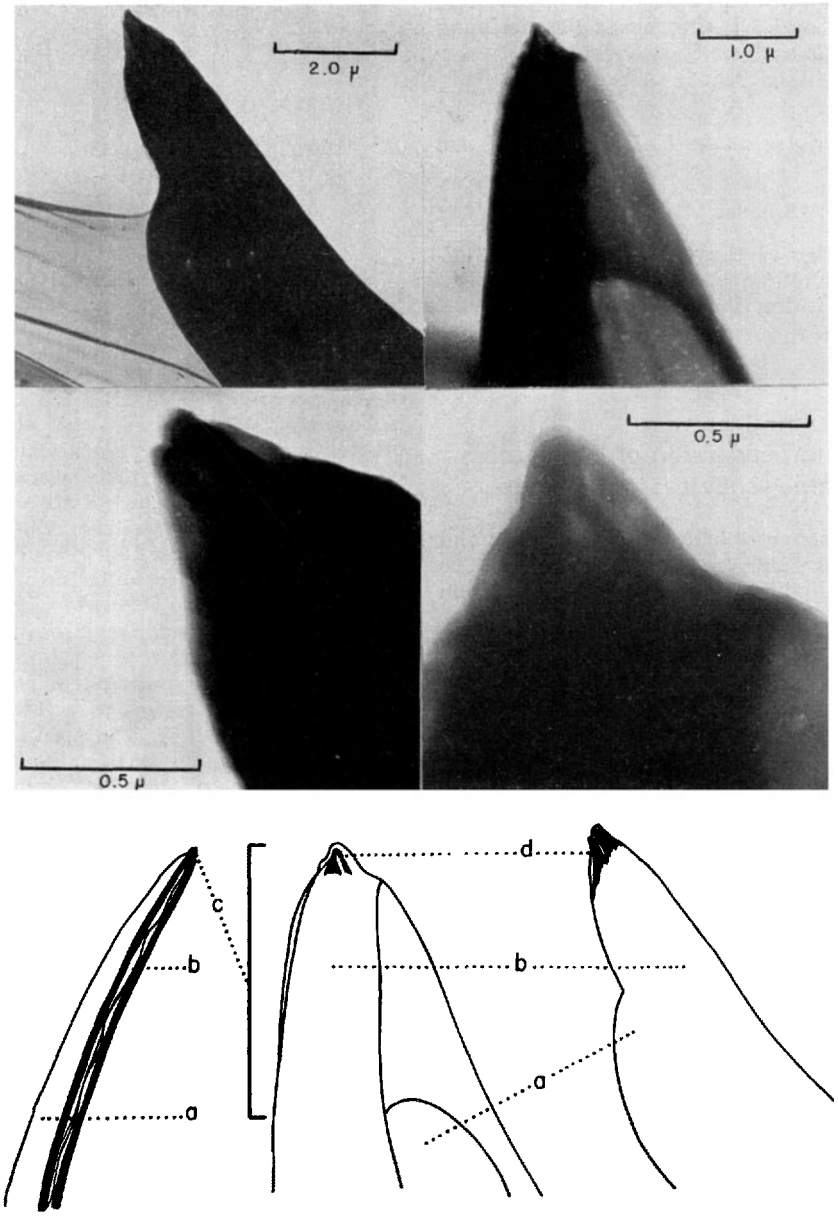
[1] R. N. CHAKRAVARTI and B. DASGUPTA, Chem. and Ind. *1955*, 1632.
[2] A. CHATTERJEE (nee MOOKERJEE) and S. BOSE, J. Indian chem. Soc. *29*, 125 (1952); Chem. Abstr. *47*, 10544 (1953).
[3] R. N. CHAKRAVARTI and A. DUTTA, J. Indian chem. Soc. *29*, 374 (1952).

The Electron Microscopy of Chemosensory Hairs

One of the most sensitive sugar receptors known is that occurring in chemoreceptive hairs on the mouthparts and legs of flies. By means of these receptors flies are able to discriminate between water and sucrose solutions as dilute as 1×10^{-8} to 1×10^{-7} *M*. Such low threshold values prompt the question of how sensitive the receptors actually are in terms of the minimum number of mole-

cules required to effect stimulation. Recent preliminary studies of the receptor with the electron microscope have revealed details of the site at which the stimulating molecules join the biological system. On the basis of this information it is possible to place some limitations on the number of molecules taking part in the interaction at threshold.

portion sensitive to chemical stimulation[1]. Furthermore, it is known with reasonable certainty that of the 2 fibers terminating here one is sensitive to certain sugars while the other mediates responses to a wide variety of compounds which have in common only the characteristic of being repellent to the insect.



Electronmicrographs of the tip of a chemoreceptive hair from the labellum of the blowfly *Phormia regina* Meigen: *a* thin-walled cavity; *b* thick-walled cavity containing the distal fibers of the neurons; *c* terminal papilla; *d* receptor area of the hair (photographed through the courtesy of E. KAFIG, U. S. Naval Medical Research Institute).

The hairs which contain the sugar receptors of the blowfly *Phormia regina* range in length from 30 to 300 μ. Each is characterized by the presence of 2 lumina, a thin-walled one continuous with the body of the hair-generating cell (trichogen), and a thick-walled one containing 2 fibers from 2 of the 3 subhypodermal bipolar sensory neurons. It has been shown that these fibers terminate in the tip of the hair and that the extreme tip is the only

The light microscope does not reveal any of the structure of the terminus of the hair other than the existence of a small papilla which reacts selectively to silver stains and is more permeable than other portions of the hair surface.

[1] V. G. DETHIER, Quart. Rev. Biol. *30*, 348 (1955).

Electron microscopy of unfixed whole mounts reveals that the papilla is actually a prolongation of the thick-walled portion beyond the thin-walled portion (Fig. *c*). The large lumen of the thin-walled section clearly ends some 1 to 2·6 μ below the tip in the particular hairs examined here. There is very little likelihood of the large lumen having any direct connection with the process of stimulation.

The continuing portion of the hairs gradually begins to taper and then forms a small plateau on which is perched a minute cone-like papilla the base of which is 0·7 μ in diameter (Fig. *d*). 2 features of the tip of this cone are particularly noteworthy. First, the cone is clearly invested in a membrane approximately 200–300 Å thick. Second, there are 2 stable structures within the tip. Even in hairs which have been allowed to dry for 2 months the structures are discernible in whole mounts. Each ranges in diameter from 500–700 Å. In location and topographical relationships these structures correspond to the 2 nerve fibers predicted from behavioral and electrical studies and actually observed histologically farther down the shaft. The terminal structures are smaller in diameter than the fibers at more proximal locations. It is probable, though not yet demonstrable, that the fibers are structurally modified at the tip. Studies now in progress on sectioned material are expected to reveal more details of the tip.

The terminal process is, however, functionally specialized. Under normal circumstances only the extreme tip of the hair is sensitive to stimulation by sugar. When the tip is amputated chemical stimulation is no longer possible. On the other hand, stimulation by cathodal current is possible at both the intact tip and the cut end. Electrical stimulation is even possible through the shaft of the intact hair, although considerably higher voltages than normal are required. By contrast, recording of action potentials is possible only through the tip or cut end. The shaft is a nearly perfect insulator at the voltage level represented by action potentials. These findings support the idea that the tip owes its sensitivity not only to its high degree of permeability but to special physiological characteristics. It is probable that a highly specific interaction between sugar molecules and receptor molecules is restricted to this site and that depolarization is initiated here. Whether the propagated action potential originates at this point or originates in the region of the cell body following a catelectronic spread from the tip is being investigated.

By making certain assumptions, we can estimate the number of molecules which might take part in the stimulating reaction at threshold. In the limiting case the concentration gradient would be from zero at the receptor site to the test concentration at the outer surface of the enveloping membrane of the tip. This implies that during the utilization time the molecules arriving at the receptor site are chemically or otherwise altered, and that the test solution is well mixed and has a large volume in relation to the volume of the tip. Free diffusion through a surface equal in area to that of the terminal papilla is assumed, since no basis exists for making an estimate of pore size. The effective number of molecules can be found from the equation,

$$\Delta n = \frac{DactA}{x},$$

where Δn is the amount transported in moles, A is Avogadro's number ($6{\cdot}03 \times 10^{23}$), D is the diffusion coefficient ($0{\cdot}43 \times 10^{-5}$ cm^2/s at 20°C), a is the effective area ($8{\cdot}0 \times 10^{-7}$ cm^2), c is the concentration in moles/cm^3 ($1{\cdot}0 \times 10^{-10}$), t is the time in seconds (0·1), and x is the thickness of the membrane (200 Å). The values given in parentheses are for sucrose and the hair pictured on the right hand side of the Figure. 1×10^9 molecules of sucrose will diffuse to the receptor site. The assumptions are such as to make this a maximum value, but it appears obvious that the sugar receptor does not possess by many orders of magnitude the sensitivity of the olfactory receptor.

V. G. Dethier and M. L. Wolbarsht

Department of Biology, The Johns Hopkins University, Baltimore 18, Md., May 22, 1956.

Zusammenfassung

Die chemorezeptorischen Haare am Labellum von *Phormia regina* wurden im Totalpräparat mit dem Elektronenmikroskop untersucht. Die Anzahl der Moleküle, die an der schwellenwertigen Stimulationsreaktion teilnehmen, wurde abgeschätzt. Es zeigte sich, dass die Empfindlichkeit des olfaktorischen Rezeptors bei weitem die Grössenordnung des Zuckerrezeptors übertrifft.

Cytologie comparée des Muridae. L'origine des Ellobii

Poursuivant notre enquête sur la cytologie comparée et l'évolution chromosomique des Muridae[1], nous avons obtenu les résultats suivants:

Sous-famille	Genre et espèce	Nombre 2N	Digamétie
Murinae	*Rattus concolor otteni* Kopst.	42	X–Y
	Rattus rattus diardi Jentink	42	X–Y
	R. rattus brevicaudatus H. et R.	42	X–Y
	Bandicota bengalensis Gr. et H.	42	X–Y
	B. indica setifera Hors.	42	X–Y
	Golunda ellioti Gray	52	X–Y
	Millardia meltada Gray	50	X–Y
Microtinae	*Phenacomys ungava* Merriam	56	X–Y
	Microtus (Chilotus) oregoni Bach	17 (!)	X–O
Gerbillinae	*Lemmus lemmus* L.	50	X–Y
	Meriones blackleri Th.	72	X–Y

Je me contenterai de souligner quelques points importants, remettant à plus tard une discussion détaillée.

Murinae. Makino[2] a compté 46 chromosomes chez un Rongeur de Formose qu'il nomme *Nesokia nemorivaga taiwanus* Tokuda, appellation qu'Ellerman et Morrison-Scott[3] placent dans la synonymie de *Bandicota indica*. La formule chromosomique de ce Rongeur lui a paru insolite en raison de l'existence de 11 paires d'éléments métacentriques dont 6 au moins sont de grande taille: en effet, chez les *Rattus* et les genres voisins, les grands autosomes sont de type acrocentrique, des V ne se rencontrant que parmi les constituants petits et moyens (Guénin[4]; Makino et Hsu[5]; Tjio et Levan[6]).

[1] R. Matthey, *Les chromosomes des Vertébrés* (Éd. Rouge, Lausanne 1949); Rev. suisse Zool. *1953*, 60; Caryologia *1954*, 6; Rev. suisse Zool. *1955*, 62; Chromosoma *1956*, 7.

[2] S. Makino, Cytologia *1944*, 13.

[3] J. R. Ellerman et T. C. S. Morrison-Scott, *Checklist of palaearctic and indian Mammals* (Ed. British Museum, London 1951).

[4] H. A. Guénin, J. Genet. *1948*, 49.

[5] S. Makino et T. C. Hsu, Cytologia *1954*, 19.

[6] J. H. Tjio et A. Levan, Hereditas *1956*, 42.