is part of a process of excretion into the cytoplasm where it is evidently disintegrated and perhaps converted into the ribose form. Extrusion seems to be due to a breakdown, through overloading, of the normal conversion and transfer of nucleic acid from the heterochromatin of the nucleus to the cytoplasm. The nucleic acid appears as drops in which there is probably an admixture of the ribose form which Brachet[8] finds in heterochromatin. Some admixture in the excretion drops and in the heterochromatin is no doubt responsible, at once, for the rounded outline, such as the highly polymerized desoxyribose form alone does not normally assume, and for the lower availability.

Our temporary pre-prophase dumps are something quite different from the excretion drops. They seem to represent a third type of aggregation of desoxyribose nucleic acid in the nucleus, in addition to those found associated with the euchromatin and the heterochromatin, a type giving maximum availability. It may be that this availability depends on the absence of admixture. Their condition and function are unique. on this view, in consisting of desoxyribose nucleic acid, free and relatively pure, which is going to the chromosomes and not coming from them.

In tracing this development it seems that we can detect certain necessary steps of cause and effect. The transfer of nucleic acid to the undivided chromosomes is followed by the formation of specific chromomeres of different sizes at different distances apart. This change in turn is followed by the pairing of the corresponding chromomeres in homologous chromosomes. The series of changes which will lead to crossing-over, segregation and the whole course of meiosis is thus fully initiated. What sets the series of changes in motion seems to be the premature priming of the chromosomes with nucleic acid (premature with respect to their reproduction).

The reproduction of the chromosomes is connected, no doubt, with the protein-formation of the chromomeres, and in this regard it will be seen that our observations agree very well with the view of Caspersson[9] that the chromomeres are formed owing to the stretching of the fibre between genes by the accumulating proteins produced by the genes themselves. On this view the chromomere represents both a physiological and a mechanical unit. So far as the prophase of meiosis is concerned, it is the effective unit. Mechanically this is all that matters, but physiologically, of course, the effective unit or gene need not be the same in all the cells of an organism[10].

These observations thus throw light on the two complementary aspects of the beginning of meiosis, and of mitosis as well, those concerned with the nucleic acids and with the proteins. It must be our concern to translate the movements and activities of chromosomes into terms of these two components.

C. D. DARLINGTON
L. F. LA COUR

John Innes Horticultural Institution,
London, S.W.19.
June 14.

[1] Darlington, C. D., and La Cour, L. F., "The Handling of Chromosomes" (London, 1942).
[2] Darlington, C. D., and Janaki Ammal, E. K., "Chromosome Atlas of Cultivated Plants" (London, 1945); La Cour, L. F., John Innes Horticultural Institution Report for 1944 (1945).
[3] Darlington, C. D., *Biol. Rev.*, **15**, 307 (1940); Darlington, C. D., *Nature*, **149**, 66 (1942).
[4] Stowell, R. E., *Stain Tech.*, **20**, 45 (1945).
[5] La Cour, L. F., *Proc. Roy. Soc. Edin.*, B, **62**, 73 (1944).
[6] Bauer, H., *Z. Zellforsch*, **18**, 254 (1933).
[7] Painter, T. S., and Taylor, A. N., *Proc. Nat. Acad. Sci.*, **28**, 311 (1942).
[8] Brachet, J., "Embryologie Chimique", p. 224 (Paris, 1944).
[9] Caspersson, T., *Naturwiss*, **29**, 33 (1941).
[10] Mather, K., *Sci. J. Roy. Coll. Sci.*, **16** (in the press).

Spectrophotometric Assay of Vitamin A and the Conversion Factor

WE have undertaken a new determination of the 'conversion factor' relating the extinction factor to the biological activity of vitamin A. For the spectrophotometric and biological investigations, vitamin A concentrates of widely varying activity as well as crude liver oils were used. They were first submitted to purification according to the chromatographic method described by one of us[1]. The adsorbing material used consists of different layers of aluminium oxide, the activities of which had been accurately standardized[2]. We came to the following conclusions.

When comparing the activity of the international vitamin A standard (β-carotene) and of vitamin A preparations on rats, it was found that the growth produced by β-carotene or by equivalent quantities of vitamin A is subject to great variations, depending on: (*a*) the diet used, (*b*) the amount of carotene or vitamin A administered per dose, (*c*) the test animals, (*d*) the season of the year. The growth obtained is not proportional to the amount of vitamin A fed. Small doses produce a considerably stronger growth (calculated per unit of vitamin A fed) than the larger doses. To obtain reproducible results, comparable to those obtained with β-carotene, under the conditions prevailing in our laboratories, the best daily dose was found to be 4–5·6 I.U. Under the conditions of the Laboratory for Vitamin Control of the Institute for Physiological Chemistry of the University of Basle, the most suitable daily dose lay between 2 and 3 I.U. These conditions are largely dependent on the food and the quantity of oil given with the vitamin A (or β-carotene). By adapting our food conditions, etc., to those of the Laboratory for Vitamin Control at Basle, similar results were obtained at both places. We have to thank Prof. S. Edlbacher, head of the Institute for Physiological Chemistry, for his figures.

Observing the best conditions mentioned above, we obtained for the preparations we tested a conversion factor of 1,691. From the results of the Basle Institute for Physiological Chemistry a conversion factor of 1,712 was calculated. The mean value is thus approximately 1,700. In tests carried out without observing the precautions described, conversion factors between 1,000 for high daily doses and 3,600 for low daily doses of vitamin A were obtained. The above-mentioned average factor of about 1,700 was found with concentrates and liver oils of widely varying vitamin A activity, provided the vitamin A preparations had been submitted to chromatographic purification before the spectrophotometric determination. When, however, samples were tested without previous chromatographic purification, very low conversion factors were obtained (below 1,000, some even so low as 400–800). This was due to the presence of impurities which interfere with the spectrophotometric determination of vitamin A and which are quantitatively eliminated by the chromatographic method described[1].

Within the limit of error, no difference in the conversion factor of vitamin A-ester and of vitamin A-alcohol was found. Thus biological equivalence between vitamin A-esters and vitamin A-alcohol exists.

Since vitamin A is now available in crystallized and fully characterized form, it is to be hoped that the old international standard of vitamin A (crystallized β-carotene) will soon be replaced by an equally well-defined vitamin A preparation. Such a standard substance would be absorbed and utilized better by the test animals than β-carotene and would be therefore preferable for the comparative assay of vitamin A by biological tests. In addition to crystallized vitamin A, a highly purified and accurate working standard could easily be prepared in practically unlimited amounts from appropriate concentrates (molecular distillates) by the use of the chromatographic method described.

The suggestion of Metcalf to compare the spectrophotometric extinctions of unknown materials with that of crystallized vitamin A eliminates for general work the complications mentioned above. The physico-chemical method of determination will, however, not completely dispose of the biological evaluations. For special problems it will now and again be necessary to ascertain whether the quantity of vitamin A determined by the physical method actually corresponds biologically to analogous quantities of pure vitamin A.

PAUL MÜLLER
MARC REINERT

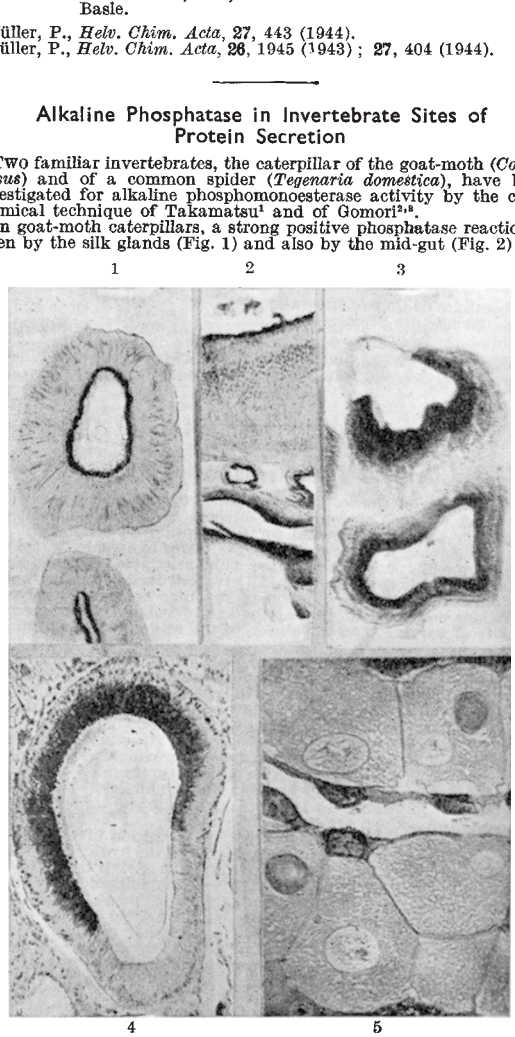
Analytical Laboratory and
Pharmacological Laboratory,
F. Hoffmann-La Roche, Ltd.,
Basle.

[1] Müller, P., *Helv. Chim. Acta*, **27**, 443 (1944).
[2] Müller, P., *Helv. Chim. Acta*, **26**, 1945 (1943); **27**, 404 (1944).

Alkaline Phosphatase in Invertebrate Sites of Protein Secretion

TWO familiar invertebrates, the caterpillar of the goat-moth (*Cossus cossus*) and of a common spider (*Tegenaria domestica*), have been investigated for alkaline phosphomonoesterase activity by the cytochemical technique of Takamatsu[1] and of Gomori[2,3].

In goat-moth caterpillars, a strong positive phosphatase reaction is given by the silk glands (Fig. 1) and also by the mid-gut (Fig. 2) and



PHOTOMICROGRAPHS WITH ALKALINE PHOSPHATASE DEEP BLACK. Figs. 1–3: Caterpillar (*Cossus cossus*). 1, Trans. section of silk gland (× 54). 2, Long. section of wall of mid-gut (× 57). 3, Trans. section of Malpighian tubes (× 120), also seen in 2. Figs. 4–5: Spider (*Tegenaria domestica*): 4, Long. section of silk gland (× 73). 5, Long. section of ovary (× 90).