to the peritracheal glands and the corpus cardiacum arising from the proventricular tracheal system in this, the only species with tracheæ entering the corpus cardiacum.

There are in all species two pairs of nerves from the brain to the corpus cardiacum, as Burtt[4] recorded in *C. vomitoria*. Only one pair issues from the cerebral commissure, the thinner pair identified by Thomsen as the internal nerves of the corpus cardiacum (NCC I), which join the anterior part of the corpus cardiacum. The two thicker nerves which he identifies as the external nerves of the corpus cardiacum (NCC II) issue from the posterior inner faces of the cerebral hemispheres in the location indicated by Possompes for the only NCC he recognizes. Owing to the downward extension of the corpus cardiacum these nerves are shorter and less readily detectable in *C. erythrocephala*. Possompes notes two fine strands in the vicinity of the nerves, joining the brain and the ventral region of the ring, the nervous nature of which is not evident, implying that these may have been wrongly identified as nerves. These may, in fact, be the two fine strands of contractile fibres joining the lateral wall of the aorta above the corpus cardiacum to the connective tissue sheath of the cerebral hemispheres beside the point of entry of the NCC II on each side.

Thus the ring in larvæ of Cyclorrhapha is not, as hitherto published accounts might suggest, invariably a three-component structure, and the corpus cardiacum does not always form an integral part of the ring. There are two pairs of NCC in the Calliphorinae examined so far, and so the general statement of Cazal[5] derived from observations on larvæ and adults and supported by Possompes, that there is total extracerebral fusion of the NCC in all Diptera, is not tenable, though it may be valid so far as adults are concerned. The arrangement of the retrocerebral endocrine organs and their tracheal associations is similar in *C. vomitoria*, *L. sericata* and *L. caesar*, with a variation in the location of the corpus cardiacum in *C. erythrocephala*. The divergence in *P. terrae-novae* is so great as to cast doubt either on its present taxonomic position or on the value of these internal anatomical details as taxonomic features.

Fuller accounts of these investigations will be published elsewhere.

Alastair Fraser

Zoology Department,
University,
Glasgow, W.2.
Dec. 3.

[1] Thomsen, M., *Dan. Biol. Skr.*, **6**, No. 5 (1951).
[2] Possompes, B., *Arch. Zool. Exp. et Gen.*, **89**, 203 (1953).
[3] Weismann, A., *Z. wiss. Zool.*, **14**, 187 (1864).
[4] Burtt, E. T., *Proc. Roy. Soc.*, B, 124, 13 (1937).
[5] Cazal, P., *Bull. biol. Fr. et Belg.*, Supp. 32 (1948).

Putrescine as an Essential Growth Factor for a Mutant of *Aspergillus nidulans*

Nothing is known of the metabolic function of diamines, such as putrescine and cadaverine, in spite of their widespread occurrence in Nature. Putrescine has been reported as a growth factor for certain strains of *Haemophilus parainfluenzae*[1] and of *Neisseria perflava*[2]. There appears to be no report of a fungus requiring it.

Among a series of nutritional mutants of *Aspergillus nidulans* obtained after ultra-violet irradiation by the usual techniques[3], one was found to require putrescine (1 : 4 butane-diamine), 1 mgm./litre allowing full growth. Spermidine can replace putrescine, but is only one-tenth as active at the same molar concentrations. The following compounds structurally related to putrescine were inactive: pyrrolidine; 1 : 4 butane-diol; 1 : 2 ethane-diamine; 1 : 3 propane-diamine; 1 : 5 pentane-diamine (cadaverine); 1 : 6 hexane-diamine; 1 : 7 heptane-diamine; ornithine; citrulline; adipic acid; α-amino-adipic acid; and α-amino-δ-hydroxy-valeric acid.

The activity of putrescine was competitively inhibited by 1 : 3 propane-diamine and by cadaverine, the molar ratios of inhibitor to putrescine for half-maximal growth being about 600 to 1 and 300 to 1 respectively. Ornithine was not inhibitory but lysine weakly so, possibly due to its decarboxylation to cadaverine. In *Haemophilus*, 1 : 3 propanediamine and also cadaverine are reported not to inhibit competitively growth on putrescine[1b].

The hereditary difference between parent strain and mutant of *Aspergillus* is determined by a single gene as shown by appropriate crosses.

P. H. A. Sneath

Department of Genetics,
University of Glasgow,
and
National Institute for Medical Research,
London, N.W.7.

[1] Herbst, E. J., and Snell, E. E., (*a*) *J. Biol. Chem.*, **176**, 989 (1948); (*b*) **181**, 47 (1949).
[2] Martin, W. H., Pelczar, M. J., and Hansen, P. A., *Science*, **116**, 483 (1952).
[3] Pontecorvo, G., Roper, J. A., Hemmons, L. M., Macdonald, K. D., and Bufton, A. W. J., "Advances in Genetics", **5**, 141 (1953).

Extraction of Pigment from Cooked Cured-Meat Products

It is well known in the food trade that the colour of cooked cured-meat products fades rapidly on exposure of the products to air and light, the rapidity of fading increasing with the intensity of the light, and being particularly marked if the proportion of light of shorter wave-lengths is large. A considerable amount of investigation has been carried out in recent years into the chemistry of cured-meat products and of model nitrite–hæmoglobin systems, much of it with this practical problem in mind. Investigations have been rendered more difficult by the fact that denatured globin–nitric oxide myohæmochrome—the pigment to which cooked cured-meat products are generally agreed to owe their colour—is insoluble in most solvents. A method has been developed in these laboratories whereby an important part of the molecule—the highly coloured nitric oxide hæm moiety—can be rendered soluble in some organic solvents by treatment of the cooked cured meat with acetone. This greatly facilitates measurement of its spectroscopic characteristics and its general behaviour towards light, oxygen, etc., measurements from which some inferences may be drawn about the behaviour of the parent pigment.

Haldane[1] obtained a weak solution of coloured material from cooked salted (cured) meat by extraction with alcohol. During experiments in these laboratories, it was found that considerably more pigment