and an inked pen recorder. A second set of observations was obtained by the more laborious counting of beta-emission with a mica window counter.

Identification of the activity as radon products was obtained by tracing the decay through periods longer than two hours, and indicated that the majority of activity was of this origin, although a tail of activity of longer life, probably thoron, could also be traced. No attempt was made to identify the type of dust collected; but its density was measured by comparing the light transmitted to that of a clean filter paper by a photoelectric densitometer. Although variations in radon over this period were considerably less (under a 20 to 1 maximum) than instances quoted by Anderson *et al.*, the correlation with dust present was strikingly evident. The correspondence with visibility was observed but less amenable to exact quantitative check.

These observations were taken in Morgantown, West Virginia, where coal is a common domestic and commercial fuel. Observations with improved apparatus are now in progress.

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[1] *Nature*, **174**, 424 (1954).

Control of Diurnal Rhythms of Activity in *Periplaneta americana* L.

In a previous communication[1] it has been shown that a secretion carried in either the blood or tissues is involved in the production of a diurnal rhythm of activity in *Periplaneta americana* L.

It has now been found that the sub-œsophageal ganglia can in certain conditions evoke a diurnal rhythm of activity. The normal diurnal rhythm, consisting of a burst of activity in the first hours of darkness followed by a decrease in activity and finally a very low level of activity in the light, is disrupted by the removal of the head of a cockroach. Implantation of sub-œsophageal ganglia into headless cockroaches is found to be followed, in constant light or darkness, by an activity rhythm closely similar to that of the donor cockroach. The presence of neurosecretory cells in the sub-œsophageal ganglion has been demonstrated by Scharrer[2], and it would seem reasonable to suppose that they are concerned in the above effect.

Further experiments suggest that the ocelli are the sensory receptors acting as overall timekeepers or governors for the rhythm. Cutting the ocellar nerves, or destroying or covering the ocelli, results in a gradual loss of the normal rhythm, and in the production of a new active phase during the light period. There is a higher activity during this phase than was shown in the light period by beheaded and implanted cockroaches; the increase is probably the result of stimulation of the compound eyes, since it is eliminated if these are blackened.

After a period in constant darkness, cockroaches with cut ocellar nerves will not take up a rhythm of activity under new light conditions, provided that the compound eyes are covered. If the eyes are normal, then the cockroach is active in the light period but shows no carry-over of the rhythm in constant darkness. It is therefore not showing a true diurnal rhythm, which implies an ability to carry over the old rhythm under uniform environmental conditions rather than a simple reaction to immediate environmental effects. Covering the compound eyes alone and leaving the ocelli normal does not affect the rhythm.

Implanting a sub-œsophageal ganglion from a cockroach which has a normal rhythm into an intact cockroach which has been kept in constant darkness or light and has lost its rhythm causes the implanted cockroach to take up a normal rhythm. On the other hand, implanting a sub-œsophageal ganglion into an intact cockroach having the same rhythm as the donor does not cause any change in rhythm but is followed by a depression in the level of activity in the dark period.

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[1] Harker, J. E., *Nature*, **173**, 689 (1954).
[2] Scharrer, B., *J. Comp. Neurol.*, **74**, 93 (1941).

Digestion and the Production of Sulphuric Acid by Mollusca

While investigating the food of aquatic Mollusca in Uganda, it was observed that cellulose in the gut contents was being digested. *Caelatura hauttecoeuri ruellani* (Bgt.), a bivalve, was selected for detailed study and also *Melanoides tuberculata tuberculata* (Müll.), a snail, which belongs to the Prosobranchia, some members of which possess a crystalline style[1].

Preliminary experiments showed that cellulase contained in the crystalline styles of both *Caelatura* and *Melanoides* was more active at *p*H 5·5 than at *p*H 7·0, and that the alimentary canal in both species had an acid reaction.

Style material, obtained from several specimens of *Caelatura*, was dissolved in a citric–phosphate buffer solution at *p*H 5·5 and its effect observed on a uniform suspension of precipitated cellulose[2,3]. Aliquot portions of the cellulose suspension and style solution were dispensed into duplicated series of small test-tubes and incubated at 24° C. for 36 hr. At the end of this period, the amount of cellulose remaining was determined by turbidity methods, and any soluble sugars produced were estimated by means of alkaline picric acid. The results showed a reduction of cellulose and a rise in sugar content in those tubes containing style material. Similar results were obtained using style material from *Melanoides*.

A small amount of a commercial preparation containing penicillin and streptomycin was added to one set of tubes; this did not prevent hydrolysis of the substrate. Another set of tubes was boiled and immediately cooled. No cellulase activity was observed after this treatment. It seems, therefore, that the cellulase enzymes present in the styles of these two molluscs are similar to those found in the oyster and mussel[3].

Experiments were carried out to determine whether style solution was active against the cell walls of algae. Phytoplankton from Lake Victoria and two species of filamentous alga were used as a source of cellulose in experiments similar to the above. Breakdown of the cell walls of many of the Green and Blue-Green Algae present was observed. It seems that these molluscs are able to utilize sources of food largely unexploited by other groups of aquatic