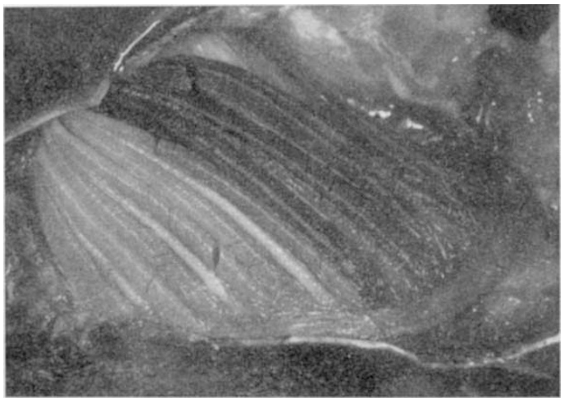
Absorption of Silver on the Gills of a Freshwater Crab

The presence in freshwater arthropods of organs capable of absorbing and reducing silver salts has long been recognized. Koch[1,2] has brought forward evidence that these structures are probably sites of chloride absorption from the water. We have examined the silver-reducing properties of the gills of the two freshwater crabs, *Potamon* (*Potamonautes*) *sidneyi* Rathbun and *P.* (*Potamonautes*) *depressus* (Krauss). Each crab was washed in five changes of distilled water and then placed in a 0·05 per cent solution of silver nitrate for five minutes. The animal was then washed once again in distilled water and killed in 70 per cent alcohol. The branchiostegite was cut away and the gills exposed to sunlight for about fifteen minutes. The result obtained, which was similar in both species, is illustrated in the accompanying photograph. It will be seen that while the four anterior gills absorb and reduce the silver salt, no such effect is shown by the three posterior gills.



P. sidneyi. Branchial cavity showing gills after treatment with silver nitrate

The gills as they lie in the branchial cavity are triangular in section with the apex of the triangle ventral. Almost the whole surface of each lamella is blackened by absorbed silver. Near the middle of the lower face of each lamella is a small area where no absorption occurs. In the entire gill, these latter regions appear as white streaks running along the length of the gill, one on each side of the main gill axis. Similar areas may be recognized on the posterior gills. A detailed examination of the anterior gill lamellæ shows that the silver granules lie in large areas of irregular polygonal shape up to 40 μ in maximal breadth. The boundaries between these areas are sharply defined. Though they have the appearance of pavement epithelial cells, there is no evidence that they, in fact, correspond in any way to cellular structures in the hypodermis.

After exposure to sunlight for several days, the posterior gills also turn brown. The effect is never so intense as with the anterior gills, and the pigment is unevenly distributed. The posterior gill lamellæ do not show the polygonal areas of silver deposit typical of the anterior gills. It seems probable that the silver pigmentation in the posterior gills is to be attributed to small traces of silver which were not washed off the gills after treatment with the silver solution.

Schlieper and Herrmann[3] have shown that in *Potamon* (*Potamonautes*) *potamois* (Olivier) (= *Telephusa fluviatilis* Latr.) the urine is isotonic with the blood, and no special chloride-absorbing zone is found in the green gland. Nor is there such a zone in the green gland of *P.* (*Potamonautes*) *sidneyi*[4]. The occurrence of areas specialized for chloride absorption from the exterior will therefore be expected in this genus. Among other freshwater decapods, Maluf[5] has found silver reduction by all the gills of *Cambarus clarkii* Girard, and we have observed the same effect with the freshwater prawn *Caridina nilotica* (P. Roux), though here there are also chloride-absorbing areas on the inner surface of the branchiostegite, as Koch[1] found in *Palæmonetes varians* (Leach) and *Leander serratus* (Fabr.).

The localization of the silver-absorbing areas to certain gills which we have found in *Potamon* provides an exception to Koch's statement that "tous les organes décrits comme branchies chez les Crustacés . . . absorbent l'Ag"[1]. The significance of this localization has yet to be determined.

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Oct. 11.

[1] Koch, H., *Ann. Soc. sci. Brux.*, **54**, 346 (1934).
[2] Koch, H., *J. Exp. Biol.*, **15**, 152 (1938).
[3] Schlieper, C., and Herrmann, F., quoted in Krogh, A., "Osmotic Regulation in Aquatic Animals" (Camb. Univ. Press, 1939).
[4] Dandy, J. W. T. (unpublished observations).
[5] Maluf, N. S. R., *J. Gen. Physiol.*, **24**, 151 (1940).

Possible Biological Significance of the Action of Ionizing Radiations on Nucleic Acids

It is now widely recognized that the biological effects of ionizing radiations (X-rays, γ-rays, etc.) are due to chemical changes induced by the radiations. *In vitro* doses of the order of 10,000 r. or more are required to produce even relatively small chemical changes, whereas it is well known that 50 r.–100 r. are often sufficient to bring about marked biological effects. To account for this it has been suggested[1] that one may be dealing with the destruction of an enzyme which is present only in very low concentration, or that the radiations produce a very powerful cell poison; although in the latter case relatively large doses should be required to produce an effective amount, except perhaps in 'whole-body' irradiations where this substance may be produced in a relatively large volume, and where it is conceivable that its effect may be enhanced by being afterwards concentrated in the much smaller volume of an 'organ'.

However, there appears to be another possible mode of the biological action of ionizing radiations, which is suggested by some recent work on nucleic acids[2–4]. It has been shown that irradiation of nucleic acids by X-rays in aqueous systems leads to definite chemical changes which manifest themselves in a liberation of ammonia and of inorganic phosphate, and in the formation of other low-molecular fragments[3,4].

A more detailed study, including nucleotides, nucleosides and the constituent bases, has led to the following conclusions regarding the mechanism of these processes[4].