Movements for the purpose of changing the visual field are of three main types, horizontal, vertical and "peering." For the sake of simplicity I shall confine myself to the first two.

Horizontal movements, well illustrated by doves, pigeons and fowl when walking, and by coot and gallinules while swimming on a still pond, consist of an apparent movement of the head backward and forward. It was suggested by Mikesh and demonstrated by Dunlap and Mowrer that the only real motion is forward; that although the head appears to be drawn back after each forward thrust it is really maintained in the same relation to the visual field, while the body moves forward. There is therefore an alternation of short maintenance of and sudden change in the visual field.

Vertical head movement is seen in many shore birds, which, while standing still, bob their heads up and down with a greater or lesser pause at the uppermost and lowermost positions.

Undoubtedly a number of different causative factors enter into this head movement on the part of birds—indeed, several have been suggested. But whatever the causative factors may be there is one resultant of the head movement of much importance that appears to have been overlooked.

The vision of most birds is monocular, the visual fields of the two eyes being quite independent of each other. Monocular vision with two eyes, each having a short focus wide angle lens, has the advantage of giving a sharp and distinct retinal image of everything within two large visual fields. But it has the disadvantage of recording two independent single images each in a single focal plane, resulting in more or less inability to judge accurately the distance of any given object from the fixed point of the single eye bearing upon the object.

This disadvantage is overcome by the horizontal head movements of such birds as the doves, pigeons, coots and gallinules and by the vertical head movements of the shore birds. Such head movements provide a base line from which distances may be measured, and the blotting out of the image between the extremes of this base line, assuming a retinal lag, results in a stereoscopic effect.

Thus the birds, under the apparent physical handicap of monocular vision, in reality, as a resultant of the movements of the head, possess all the advantages of binocular vision, in addition to the advantages inherent in double monocular vision.

Although it is believed that the attainment of the advantages of binocular vision is an important factor in the head movements of birds, it is not assumed that it is the only factor, or that it explains its origin.

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AN INFECTIOUS DISEASE CAUSING WIDESPREAD NECROSIS IN THE LIVER OF THE MEXICAN AXOLOTL

AN inbred colony varying from 400 to 800 white and black axolotls (*Amblystoma mexicanum*), raised from four pairs of breeders brought from Europe, has been maintained at the Morris Biological Farm of the Wistar Institute since 1931. About a year ago a disease appeared which has since spread through the entire colony and has destroyed most of the animals.

The disease develops so insidiously that it is usually not recognized until well advanced. Commonly, though not in all cases, the earlier external signs are similar to those of approaching metamorphosis and consist in partial reduction of the gills and the tail-fin and in wasting of the arms and legs, which gradually lose their well-rounded, fleshy appearance. The white axolotls often become faintly flushed because of congestion of cutaneous capillaries; occasionally blood blisters form in the fin. In the black variety these vascular phenomena are masked by the cutaneous pigment cells.

The axolotls lose their appetite and finally refuse food altogether. However, the resulting emaciation may not be obvious, because in many animals considerable quantities of fluid accumulate in the coelomic cavity, leading to a bloated appearance. This, indeed, is the most striking sign of the disease, though it is not always present. If withdrawn with an aspirating needle, fluid reaccumulates within a few days. It is slightly turbid and contains many wandering cells and fine granules from broken-down chromatophores. Micro-organisms have not been demonstrated by various aerobic and anaerobic culture methods, nor by direct smears, though the granules mentioned may readily be mistaken for bacteria.

At autopsy the most conspicuous lesions are found in the liver, which is usually enlarged, often to over twice its normal size, and coated with a film of fibrinous exudate. Frequently the surface is very irregular, due to the presence of projecting coarse nodules, which are white, solitary or multiple, and vary from a few millimeters to over a centimeter in diameter; they contrast sharply with the more normal gray liver (especially in the black variety). The nodules vary much in consistency, depending on the stage of the disease; some are quite firm, while others are soft, with obviously necrotic centers. Usually they are well circumscribed and surrounded by a zone of congestion. Histologically the nodules are found to consist of necrotic liver cells, which in the ventral parts have fused into a structureless mass; at the periphery the area is usually invaded by wandering cells, which, together with fibroblasts, may form a zone of considerable extent. The liver cells beyond these localized lesions exhibit various stages of degeneration.

While the hepatic lesions dominate the picture, less conspicuous degenerative changes are present in other organs, particularly the gonads and the spleen. Transmission experiments conducted with axolotls brought from other laboratories indicate that the disease is infectious.

The authors would appreciate hearing from any one who has encountered similar disease in axolotls or related cold-blooded forms.

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SPECIAL ARTICLES

SOME OXIDATIVE PROPERTIES OF ISOLATED AMPHIBIAN GERMINAL VESICLES

THE classical opinion which considers the nucleus as a center of respiratory metabolism has been recently questioned by several investigators. The rH measurements of Rapkine and Wurmser[1] and of Chambers[2] and his collaborators failed to indicate any considerable oxidizing or reducing ability in the nucleus; likewise, experiments in which the metabolic rate of non-nucleated and nucleated fragments of Arbacia eggs (obtained by ultracentrifugation) was compared show no particular respiratory activity in the nucleus (Shapiro,[3] Navez and E. B. Harvey[4]).

In view of these divergent opinions, it was of interest to study the respiration of isolated amphibian germinal vesicles; the removal of the nucleus in full-grown oocytes is a rather easy task (Duryee[5]) and a sufficient amount of material can be obtained in a short time.

Some preliminary tests carried out on *Rana fusca* isolated germinal vesicles indicated that the nuclear sap and the nucleoli are able to reduce methylene blue; leuco-methylene blue is specially oxidized by the nucleoli. On the other hand, chemical tests for indophenoloxidase, peroxidase and glutathione were entirely negative.

In order to get quantitative data, the CO_2 elimination of *Rana fusca* germinal vesicles was measured by a microtitrimetric method and the oxygen consumption of Triturus pyrrhogaster isolated nuclei was followed in a modified Gerard-Hartline microrespirometer, kindly placed at my disposal by Dr. Herbert Shapiro. The metabolism of full-grown oocytes deprived of their follicular epithelium was estimated at the same time. The Qo_2 (mm^3 O_2 per gr wet weight per hour) of the isolated nuclei was found to be about 13, while the Qo_2 of the oocyte is around 37. In both cases, the metabolism remained constant during several hours. If the respiration of one single nucleus is compared to the metabolism of one oocyte, it is found, both for oxygen consumption and for carbon dioxide elimination, that the gas exchange of the nucleus represents from 1 to 1.5 per cent. of the metabolism of the whole intact cell. It is often possible in *Rana fusca* to remove the nucleus from the oocyte without much loss of cytoplasm; if this enucleated egg-cell is allowed to heal and CO_2 elimination is measured, it is found that the loss of the nucleus does not induce any considerable drop of the metabolism during many hours.

In order to check the possibility that the low respiration of the isolated nuclei might result from an insufficient amount of oxidizable substrate, either glucose or cytoplasm removed from an oocyte by means of a micropipette was added to the germinal vesicles; no definite increase in the metabolic rate could be detected in such conditions.

The influence of calcium on the physical properties of the chromosomes in isolated germinal vesicles has been demonstrated by Duryee; but the presence or absence of Ca ions did not affect significantly the oxygen consumption or the carbon dioxide elimination in these experiments.

These observations indicate that the nucleus is probably not a center of high metabolism in the growing oocyte, although the importance of the germinal vesicle in other respects must not be overlooked.

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COBALT AS AN ESSENTIAL ELEMENT IN ANIMAL NUTRITION

NATURAL conditions have been encountered in west Australia, New Zealand and Florida (the latter probably extending over the coastal plains of the Gulf and Atlantic coasts) in which cobalt must be supplied for the well-being of sheep and cattle. General observations indicate that the effects of the deficiency may affect other animals and even people on a "live-at-home" diet.

Filmer and Underwood[1] reported in 1934 the preparation of an iron-free filtrate from a limonite effective

[1] J. F. Filmer and E. J. Underwood, *Australian Vet. Jour.*, 10: 83–92, 1934.