trary, man in a temperate climate is approaching the extreme range of adaptation to cooler conditions —that is, maximum adaptation to cold. It follows that it is fruitless to attempt to demonstrate profound physiological changes in temperate man on exposure to severe cold because, the greater part of the possible adaptation in this direction having already been made in a temperate climate, any further changes must necessarily be small.

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[1] Mackworth, N. H., *J. App. Physiol.*, **5**, 535 (1953).
[2] Martin, C. J., *Lancet*, ii, 561 (1930).
[3] Erikson, N., Krog, J., Lange Andersen, K., and Scholander, P. F., *Acta Physiol. Scand.*, **37**, 35 (1956).
[4] Macintyre, J., *J. Inst. Heat. Vent. Eng., Lond.*, **4**, 570 (1937).
[5] Hellon, R. F., Jones, R. M., Macpherson, R. K., and Weiner, J. S., *J. Physiol.*, **132**, 559 (1956).
[6] Adam, J. M., Ellis, F. P., and Lee, T. S., Royal Naval Personnel Research Committee, Med. Res. Coun., Lond., Report No. 53/749 (1953).
[7] Adam, J. M., Collins, J. A. G., Ellis, F. P., Irwin, J. O., Jack, J. W., John, R. T., Jones, R. M., Macpherson, R. K., and Weiner, J. S., Royal Naval Personnel Research Committee, Med. Res. Coun., Lond., Report No. 55/831 (1955).

Extra-Regional Oocytes in Teleosts

The occurrence of extra-regional oocytes has been described by several authors in many species of vertebrates[1,2]. Most of these cases related to the genital and the caudal region.

We have observed extra-regional oocytes in the following species: *Phenacogrammus interruptus*, *Chaetodon capistratus*, *Abramites microcephalus*, *Ballistes undulatus*, *Botia modesta*, *Cottus gobio* and *Barbus gelius*. These cases are summarized in Table 1. In general, the cells had the characteristic oocyte structure, namely, granular cytoplasm, oolemma, nucleus with several nucleoli.

The presence of extra-regional oocytes is closely related to the migration of the primordial germ cells. Obviously certain cases may provide important data on the mechanism of the migration.

For the three major theories relating to the migration of the primordial germ cells we refer to the publication of Johnson[2], who observed an amœboid movement in the germ cells of the black bass. Newth[3] stated that in Lacertilians the migration of the primordial germ cells to the gonadal ridges occurs by a definite route. This type of migration has already been known for a long time in lizards and in *Sphenodon*.

Concerning our case of extra-regional oocytes in the brain of *Abramites* it may be difficult for the primordial germ cells to reach the brain (mesencephalon) by Johnson's[2] first two types of migration, for this would involve crossing a great number of obstacles and carrying the cells a long distance. Like the extra-regional oocytes in the brain of *Cirrhina reba*[4], it is therefore very likely that in this case the migration of the germ cells takes place via the vascular route as in *Sphenodon*, the Lacertilians and the birds. These oocytes might have been lost while they traversed the brain region during their migration, after which they could settle in the brain tissue.

The case of the lordotic *Botia* suggests that the presence of the extra-regional oocytes and the degeneration of these cells are a consequence of the embryological disturbances in the caudal region. It is possible that these processes have passed to abnormal places.

It is noteworthy that in the case of *Ballistes* nucleolar extrusion was observed. The tumour in *Barbus* shows that migrated extra-regional oocytes which have migrated can proliferate under certain circumstances.

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Aug. 29.

[1] Humphrey, R. R., *J. Morph.*, **41**, 1 (1925).
[2] Johnson, P. M., *J. Morph.*, **88**, 471 (1951).
[3] Newth, D. R., *Nature*, **173**, 517 (1954).
[4] Sathyanesan, A. G., *Science and Culture*, **22**, 341 (1956).

Table 1. Cases of Extra-Regional Oocytes in Teleosts

Species	Localization of the oocytes	Extra-regional oocytes	Nuclei of the extra-regional oocytes	Remarks
Phenacogrammus interruptus (length 69 mm.)	Intermuscular connective tissue of the caudal region	Small, medium-sized and large types; infiltration of some large oocytes by strands of connective tissue	Several nucleoli	Externally no peculiarities
Chaetodon capistratus (length 78 mm.)	Intermuscular connective tissue of the caudal region	Medium-sized and large types; some oocytes degenerated	Several nucleoli	Externally no peculiarities
Abramites microcephalus (length 53 mm.)	Brain (mesencephalon)	Small and medium-sized types, sometimes attached to the brain tissue; infiltration of some medium-sized oocytes by strands of nervous tissue	Several nucleoli	Externally no peculiarities
Ballistes undulatus (length 83 mm.)	Intermuscular connective tissue of the caudal region	Small, medium-sized and large types	Several nucleoli, sometimes nucleolar extrusion	Externally no peculiarities
Botia modesta (length 89 mm.)	Intermuscular connective tissue of the caudal region	Small and medium-sized types; some oocytes degenerated but not infiltrated by strands of connective tissue	Several nucleoli	Lordosis
Cottus gobio (length 241 mm.)	Intermuscular connective tissue of the caudal region	Small, medium-sized and large types	Several nucleoli	Externally no peculiarities
Barbus gelius (length 70 mm.)	Caudal region	No true extra-regional oocytes, probably developed to granulosa cell tumour	—	Irregular, nodular tumour

Conversion of Carbon-14 Dioxide to Starch Glucose during Photosynthesis by Spinach Chloroplasts

The distribution of carbon-14 in the glucose moiety of sucrose, glucose phosphate and starch formed from carbon-14 dioxide during short-time photosynthesis in *Chlorella* and the leaves of higher plants has been shown to be asymmetric[1]. It was proposed that either glucose was not formed by the condensation of two