Neoteny in Amphibia

Reproduction is a common phenomena of animals. They start reproducing while they become adult. But certain animals begin to reproduce when they are in larval stage. This phenomena is called neoteny. It is a reare phenomena. It is not only exhibited by invertebrates but also by few vertebrates.

The retention of larval characters by the adult is called neoteny i.e. larva become sexually matured. Hence these animals are called permanent larvae. In extreme cases, the animal is able to breed while maintaining its larval form. This phenomenon is called Paedogenesis or paedomorphogenesis. The neotenous animal is said to be young but old or old but young.

In Amphibians, neoteny is seen in the following animals:

1) Axolotal larval
2) Necturus
3) Proteus
4) Typhlomolge
5) Siren, etc.

Types of Neoteny:

There are six type of neoteny. They are the following:

1) Total neoteny
2) Partial neoteny
3) Permanent neoteny
4) Obligatory neoteny
5) Facultative neoteny and
6) Artificial neoteny.

① Total Neoteny:

In total neoteny the larva attains sexual maturity and it breed like the adult. Ex Necturus, Proteus, Triton, Amphiuma, Siren, Axolotl, etc.

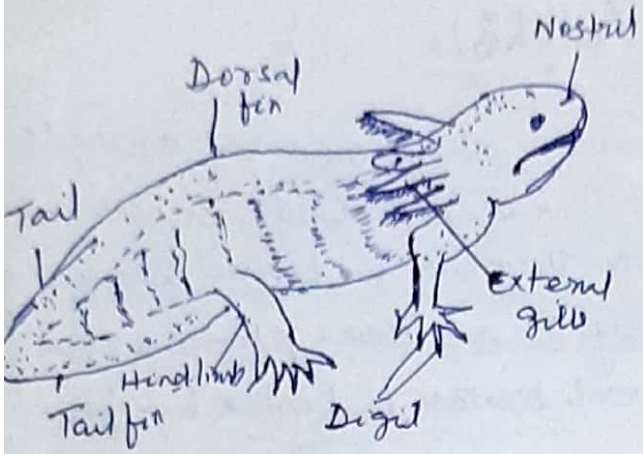

Fig. Axolotl

Fig. Necturus

② Partial neoteny:

In partial neoteny, the larva attains sexual maturity but it does not breed. Here the metamorphosis is postponed. Eg. Tadepole of anuran amphibians like Bufo vulgaris, Hyla arborea, Rana esculenta etc.

The tadpoles of midwife toad and the tadpoles of edible green frog can reach extra-ordinary length and never acquire faculty to reproduce.

③ Permanent neoteny:

In permanent neoteny, the adult type displaces larval characters. The larval characters include gills, fore limbs and rudimentary eyes. Eg Proteus, Typhlomolge, Necturus, Siren etc.

④ Obligatory neoteny:

In some amphibians, neoteny is the rule. Metamorphosis can not be induced. Such a type of neoteny is called obligatory neoteny. Eg. Necturus, Proteus, Siren, etc.

Facultative Neotony:

In some cases, neotony is only optional. Sometimes the animal may undergo metamorphosis losing all its larval characters. Eg. Axolotl.

⑥ Artificial Neotony:

The neotony produced in the laboratory by preventing metamorphosis is called artificial neotony. Artificial neotony is induced by removing the pituitary gland or the thyroid gland or by subjecting the animals to chemical with anti-thyroid or anti-pituitary effects. By this method giant larvae can be obtained. Eg Toads, frogs, etc.

Factors Causing Neotony:

The larva becomes neotenous, when metamorphosis is prevented. It is brought about the following agents:

① Pituitary gland: The pituitary gland produced a hormone called Thyroid Stimulating hormone (TSH). This hormone stimulates the thyroid gland to secrete thyroxin which induced metamorphosis. When the TSH is produced in lesser amount, the thyroid gland can not be stimulated and metamorphosis is prevented. Hence the animal becomes neoterous.

② Thyroid gland: when the thyroid gland does not produced sufficient amount of thyroxine, metamorphosis is prevented and the animal become neoterus.

③ Sensitivities of tissues: In Axolotl, the tissue is less sensitive or loss the faculty to respond to the effect of the thyroid hormone (Bytenski and Saez).

④ Low temperature: Low Temperature prevents metamorphosis and makes the animal neoterus. For example, Ambystoma tigrinum remain in the larval stage indifinetly in the cold water of rocky mountain, while in warm plains metamorphosis is takes place.

⑤ Lack of Iodine: when an amphibian embryo live in water deficient in iodine, the larva becomes neoterus.

⑥ Availability of food: Gadow (1903) stated that when there is plenty of food and water, the larva fail to metamorphose and remains as a neoterous form.

⑦ Salinity: Weissmann stated that the retardation of metamorphosis of the Axolotl is due to the saline nature of the water in which they live.

⑧ Heterochrony: Heterochrony refers to the quickening or slowing of development of a part of body. In neoterus form, the reproductive organs faster than the other organs.

Evolutionary Significance of Neotony:

Notony is one of the basic processes which bring about the origin of new species and origin of higher catogories. Neotony played it role in the evolution of chordates.

Gregory believed that all the present day Urodela amphibians are neoteric forms.