

DEVELOPMENTAL ZOOLOGY

II B.Sc ZOOLOGY

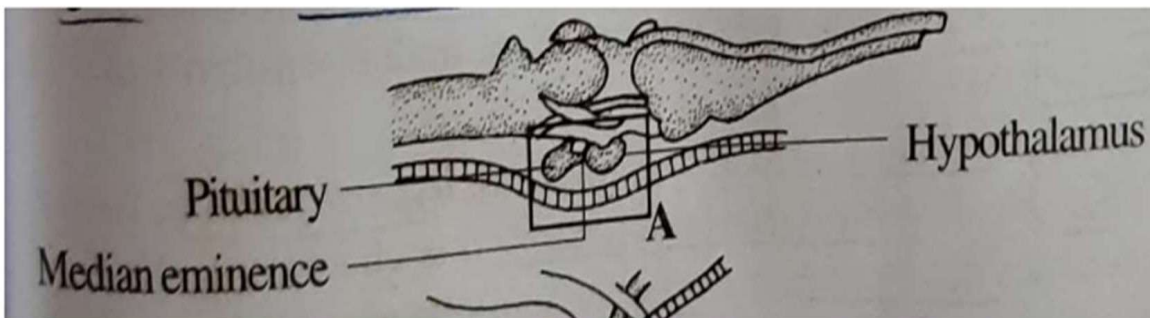
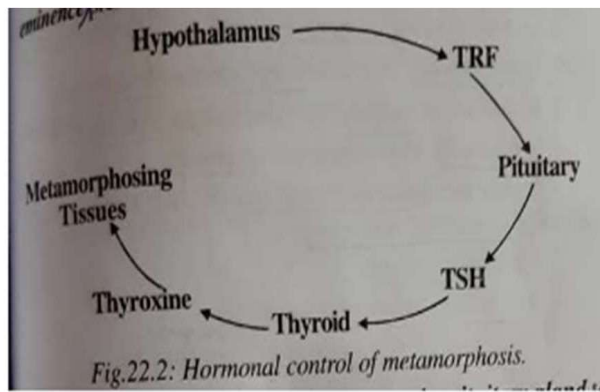
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UNIT 4

- Hormonal control of Amphibian metamorphosis
- Extra-Embryonic membrane in Chick-Development , Type and Physiology
- Placenta in Mammals-Types and Physiology

HORMONAL CONTROL OF METAMORPHOSIS IN AMPHIBIANS

- The initial signal for metamorphosis is given by **hypothalamus** present in the brain
- It contains certain specialized nerve fibres called **neurosecretory nerve fibres**
- The nerve fibres secrete a chemical substance called **neurosecretions**
- It contains a factor called **thyrotropin releasing factor (TRF)**
- It is transported to the **pituitary gland** through the **median eminence**
- The TRF of neurosecretion stimulates the pituitary gland to secrete another hormone called **thyroid stimulating hormone (TSH)**
- This hormone acts on the thyroid gland to secrete another hormone called **thyroxine**
- This hormone stimulating the growth and differentiation of cells



THYROXINE

Thyroxine

It is an Iodine containing thyroid hormone, secreted by thyroid gland.

It is a protein hormone. Chemically it is an iodinated tyrosine.
It has the following functions:

1. In amphibians, thyroxine brings about metamorphosis.
2. In the case of reptiles, thyroxine induces moulting.
3. In mammals, thyroxine improves growth.
4. It increases basal metabolic rate (BMR). Hence it stimulates the production of more energy.
5. It improves growth.
6. It stimulates protein synthesis.
7. It increases the absorption of monosaccharides.
8. Deficiency of this hormone in children causes cretinism.

Cretinism is characterized by retarded growth, disproportionate sizes of the various parts of the body, extremely low mentality and under development of secondary sexual characters. A cretin affected man of 30 years looks like a boy of 4 or 5 years.

9. In an adult deficiency causes myxoedema (myxa = mucus; oedema = swelling). It is characterized by swelling of certain parts of skin, low BMR, low body temperature, undue sensitivity of cold, anaemia, etc.

10. Over activity of thyroid gland or hyperthyroidism leads to a disease called exophthalmic goitre. It is characterized by considerable enlargement and protrusion of the gland below the chin; increased pulse rate and nervousness, bulging of the eyes, etc.

About 90% of the hormone secreted by the thyroid gland is thyroxine and 10% is tri-iodothyronine. However, a considerable portion of the thyroxine is converted into tri-iodothyronine (The functions of these hormones are qualitatively the same) Tri-iodothyronine is about 4 times as potent as thyroxine.

The importance of the thyroid gland and thyroxine in metamorphosis is proved by the following experiments:

1. When frog tadpoles are fed with dried and powdered thyroid glands of sheep, they metamorphose precociously (Gudernatsch, (1912).

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2. (When a thyroid gland is removed from young tadpoles, they fail to metamorphose.) Allen, (1918). (The thyroidless tadpoles continue to grow and attain a much greater size and form "giants".) (The maximum length of a normal tadpole is about 60 mm. But a thyroidectomized tadpole grows to a length of about 123 mm.)
thyroidless

3. (When a thyroidless tadpole is fed with dried thyroid gland, it proceeds to metamorphosis.) Allen, (1918).

4. (Similarly, a thyroidless tadpole can be stimulated to undergo metamorphosis by rearing the tadpole in water containing powdered thyroid gland.) Allen, (1938).
Culture

5. (The urodele) Ambystoma mexicanum (is in a permanent larval stage.) (It does not undergo metamorphosis under normal conditions.) (But it may be induced to metamorphose by thyroid treatment) Marx, (1935).

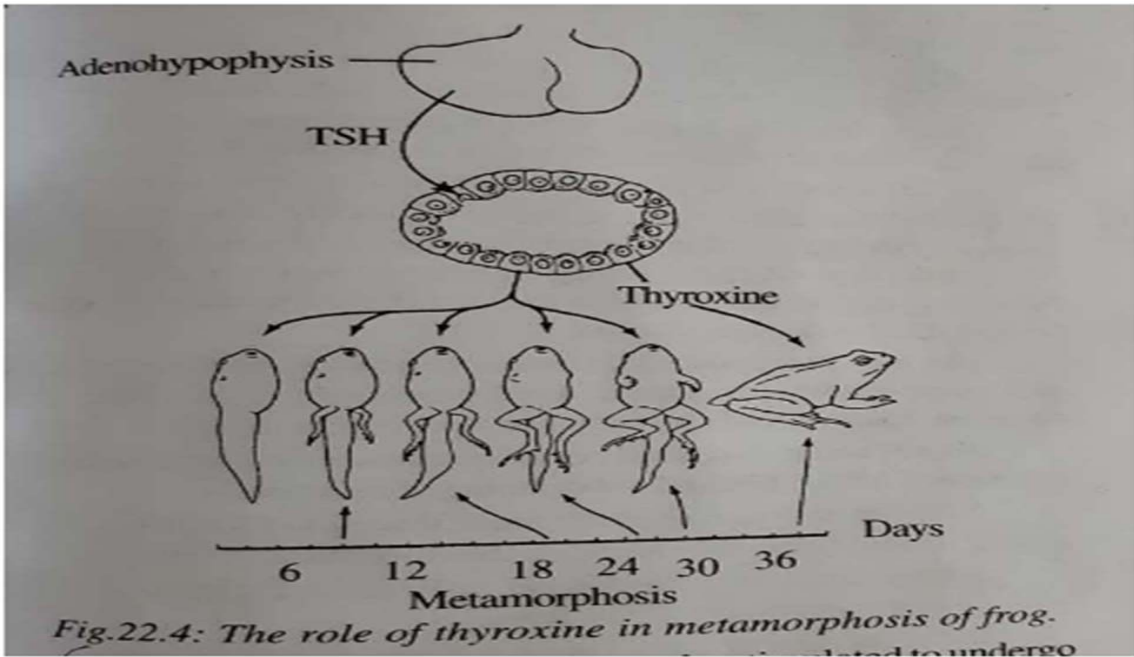


Fig.22.4: The role of thyroxine in metamorphosis of frog.