The principle of reversibility was advocated by **L. Dollo** in 1893 and is now known as **Dollo's law**. It states that living organisms do exhibit evolutionary irreversibility (the reappearance of ancestral characteristics). The law has no exceptions and is rather a generalization.

2. EVIDENCES FROM EMBRYOLOGY

Haeckel was much impressed by observing a generalized pattern of development and the general resemblances between the embryos of different groups of animals. **Haeckel** formulated the '**Recapitulation Theory**' or '**Biogenetic Law**'. It says "*Ontogeny recapitulates phylogeny*". Ontogeny is the life history of the individual starting from ovum and phylogeny is the series of adult ancestors of the individual which must have incurred in the evolution of the group of this individual. It means that an individual during its development briefs its ancestral history–

1. Homology in early embphyonic development
2. Homology in the embryos
3. Recapitulation
4. Retrogressive metamorphosis
5. Neoteny.

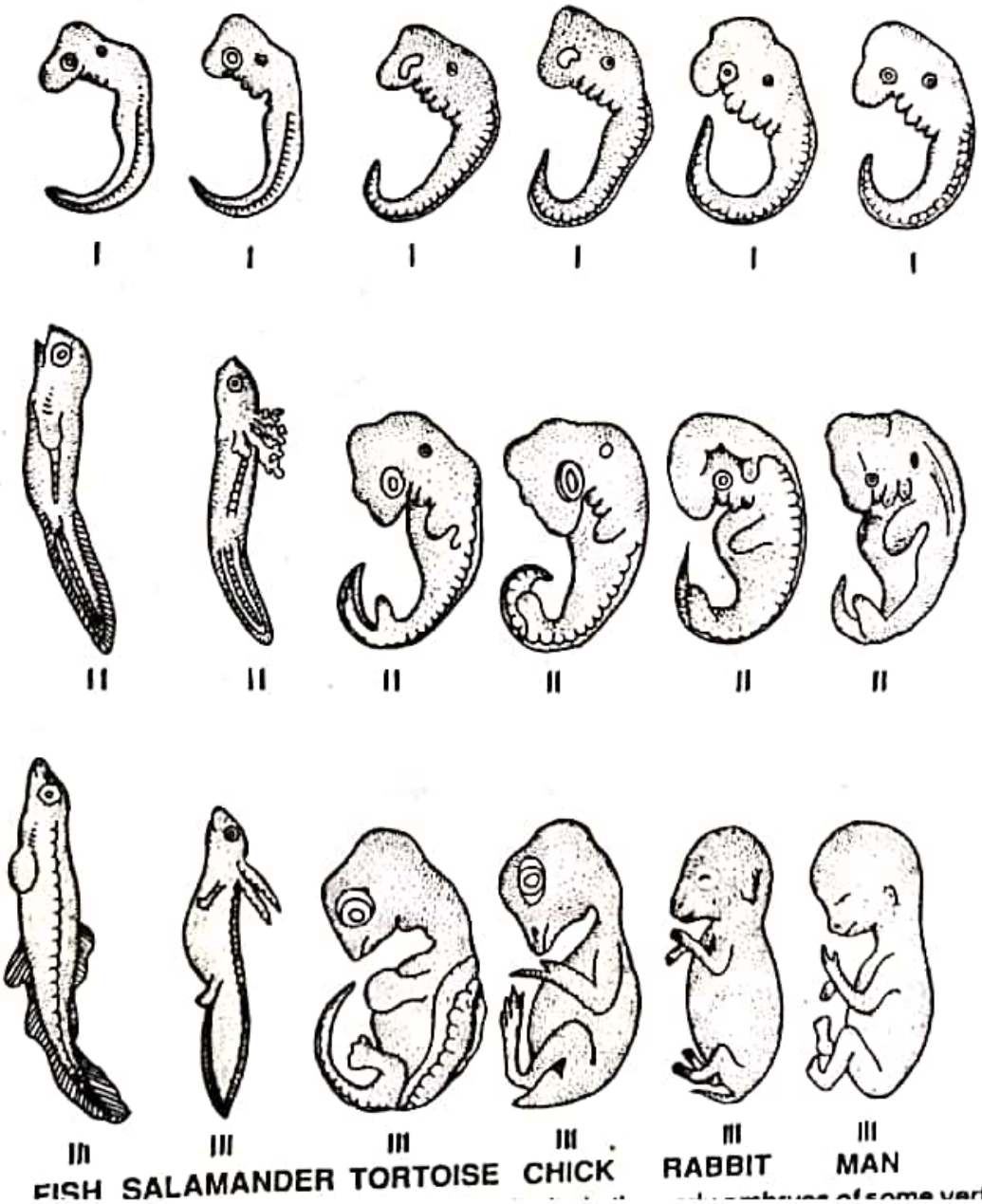

Fig. Embryos of some vertebrates

1. Homology in Early Development

All the multicellular organisms exhibit a common pattern of development. Their development starts from a unicellular **fertilized egg** or **zygote.** The fertilized egg after repeated cell divisions forms **blastula,** which finally develops into a two layered **gastrula.** The outer layer of gastrula represents future **ectoderm** and inner one future **endoderm.**

The cavity lined by endoderm forms the **archenteron,** the future digestive tract. The development after gastrula stage becomes modified in different groups of animals.

2. Homology in the Embryos

The early embryos in all the vertebrates exhibit remarkable similarity and it is not easy to differentiate a human embryo from the embryo of chick, lizard, frog or fish in early stages. The study of Fig. 3.15 reveals the great similarity of early embryonic stages of all the forms.

These similarities in the embryonic stages of different vertebrate groups are–

(i) Similar form and structures, like presence of gill clefts, notochord, tail and rudiments of eyes and ears.

(ii) Replacement of notochord by vertebral column.

(iii) Similarity in the development of limbs in the tetrapod embryos as limb buds.

(iv) Embryos of closely related vertebrates resemble more and for a longer period.

The embryos in the first horizontal row are so similar that only an expert could identify them, if they were misplaced. The stages presented in second row, represent differentiation of embryos of fish and salamander, whereas others could not be identified. Even in the third row their similarities are quite remarkable.

It has also been observed that the early embryos of all individuals are much alike, later those of different classes become, recognizable and still later family and species characters become evident, i.e. the embryos during their development become progressively more and more different from those of other animals.

The common pattern of development or resemblances in the embryos of different animals could be explained as having been inherited from an ancestor common to all the animals possessing similar embryonic developments.

3. Recapitulation Theory and Biogenetic Law

The development of man can be taken as an example to illustrate the theory of recapitulation. The fertilized egg may be compared to the single celled ancestor of all the animals and the blastula to a colonial protozoan of some spherical multicellular form, which might have been the ancestor of all the Metazoa. Gastrula (two-layered cup-shaped mass of cells) represents the coelenterate ancestor and the embryo with the development of mesoderm represents triploblastic stage like a flatworm.

The early human embryo with a dorsal hollow nerve cord, a well developed notochord and a series of gill-slits represents the fundamental chordate characters. With the development of a piscine heart, paired arotic arches, primitive

pronephros and a tail, it resembles a fish embryo. Later on, it resembles reptilian embryo, and finally develops mammalian characteristics. During the seventh month of intrauterine development the human embryo resembles a baby ape, being completely covered with hair and having proportionately longer forelimbs. This provides support to recapitulation theory.

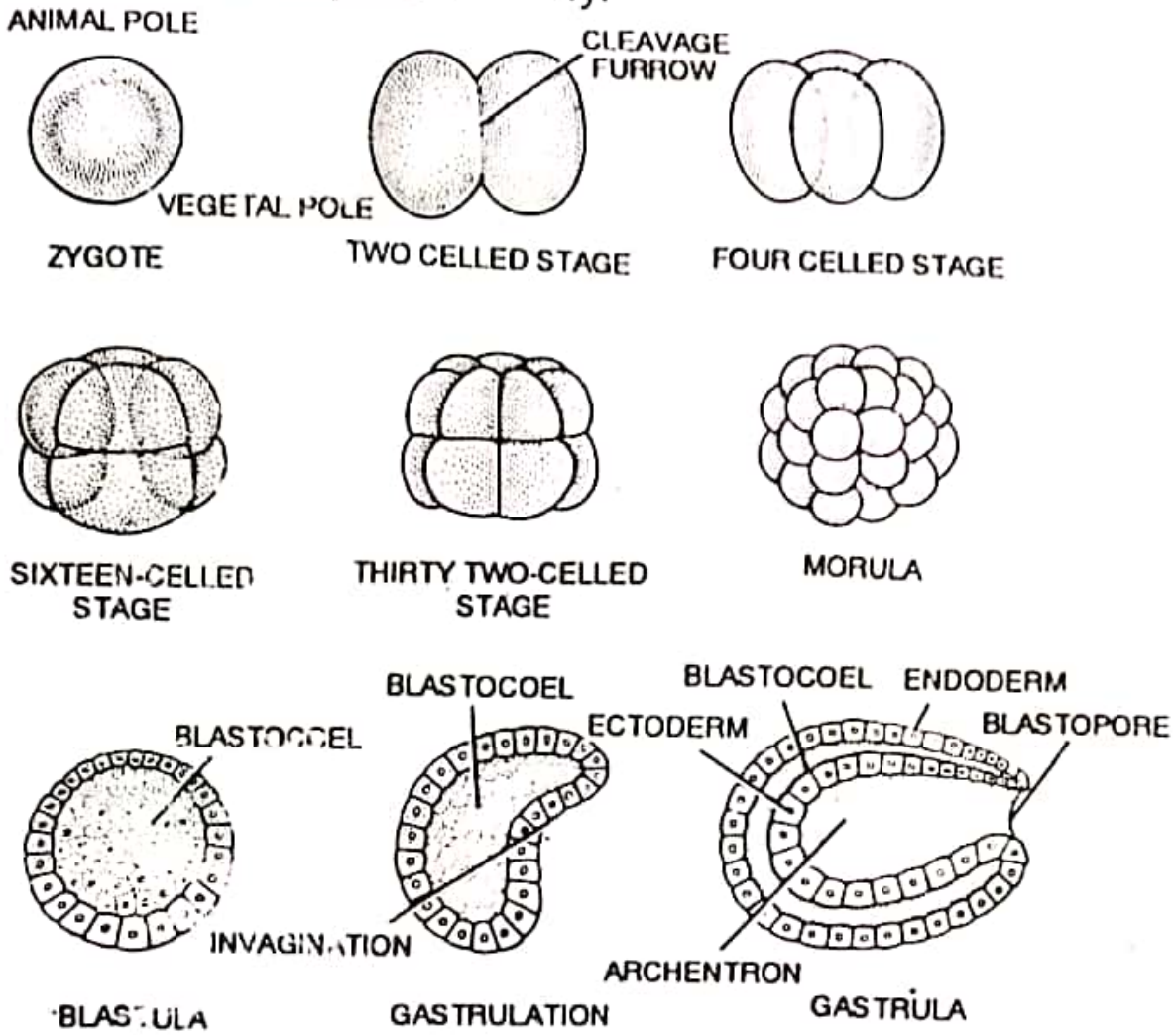

Fig. 3.16. Diagram to illustrate the typical early embryonic development in a multicellular organism.

Other examples of recapitulation are–

(i) Presences of fish-like characters like gills, gill-slits, tail, tailfin, lateral-line sense organs in tadpole larva of frog.

(ii) Presence of flagellated sperm and water dependency for fertilization in both terrestrial plants (Pteridophytes and primitive Gymnosperms) and animals.

(iii) Presence of filamentous protonema during development of moss (*Funaria*).

Von Baer's principles of embryonic differentiation constitute a better guide to embryological evidence for evolution. These principles are as follows –

1. General characteristics appear in the development before specialized characters.
2. From the more general, the less general and finally the specialized characters appear.
3. An animal during development departs progressively from the form of other animals.