B. Sc. Part II Paper IV A

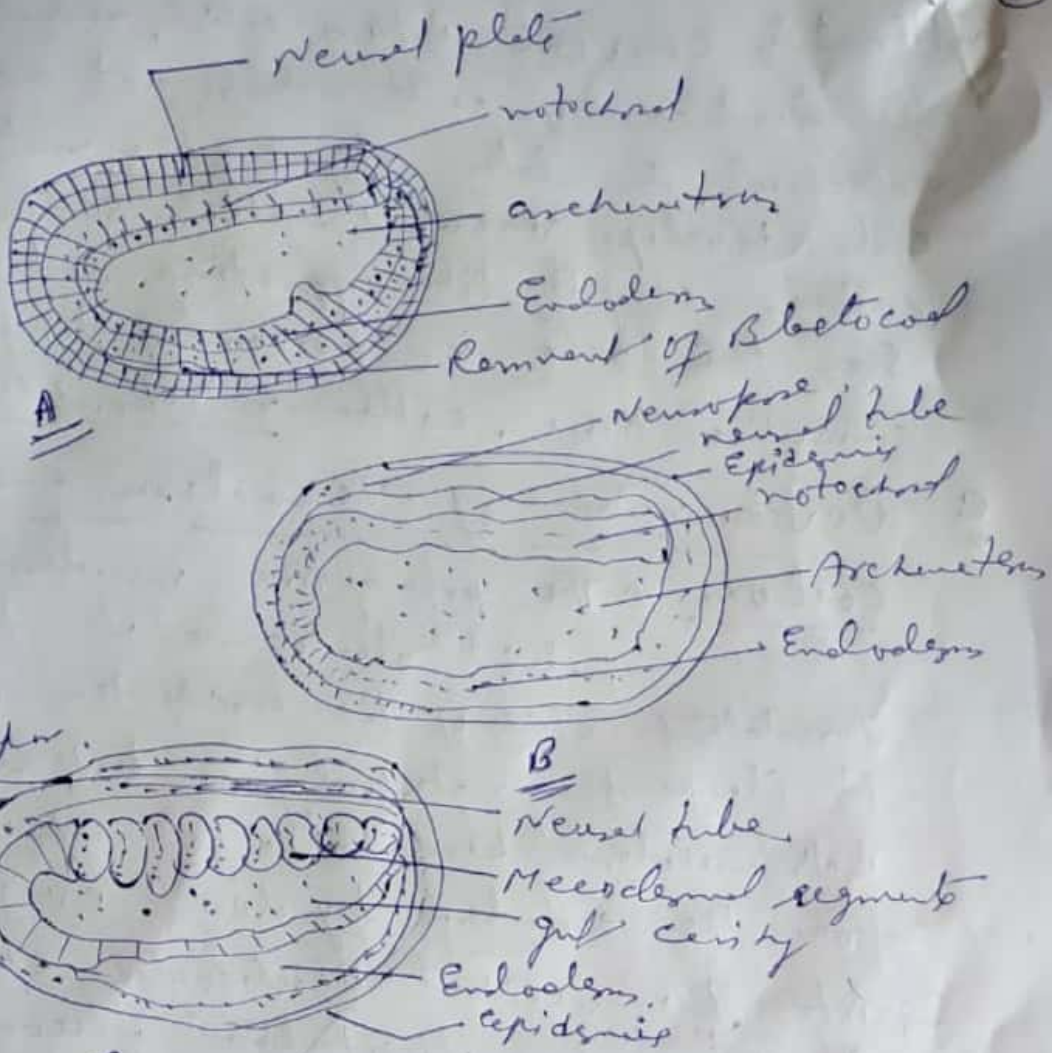
Development of Amphioxus (Part IV)

(Contd)

III Tubulation & Organogenesis →

The germinal layers formed as a result of gastrulation are the source of material for the development of all organs of adult animal. The organs of adult Amphioxus are not formed directly from the germinal layers, but they develop in a synchronous and gradual manner.

a Formation of Neural Tube → The beginning of development of the Central nervous system is the flattening and thickening of the prospective neural ectoderm cells of dorsal region of the elongated gastrula. Later on, these neural ectodermal cells become separated from the cell of epidermal ectoderm in the form of an elongated plate, the neural plate. The neural plate sinks below the level of remaining ectoderm and is then covered by the free edges of the epidermal epithelium. This neural plate is then rolls itself into a tube, forming neural tube. This encloses a longitudinal canal, the neural canal or neurocoel. The neural tube doesn't close completely at the anterior end but leaves an opening, the neuropore, which remains open until it is closed later in age of development.



Neurulation in Amphioxus

b Formation of Notochord — As the neural tube develops, the presumptive material of the notochord, the mesoderm and the gut become separated from each other by crevices appearing along the boundary line of each. The notochordal cells occur mid-dorsally in the roof of the archenteron, so, to form the notochord these cells evaginate dorsally at the anterior end of the embryo and become separated from the endoderm. This separation of notochordal material by dorsal evagination from the endoderm proceeds slowly in the caudal direction

ultimately convert into a solid, round and cylindrical cord of cells which act as a notochord. In later stages, the notochordal cells develop vacuoles which seem to contain a jelly like supporting substance. Soon, this rod is surrounded by fibrous connective tissue, called notochordal sheath.

2. Development of Mesoderm and Coelom - The presumptive mesodermal material also occurs at the dorsolateral side of the archenteron roof and it flanks the notochord from both sides. Both mesodermal bands also get separated from the endoderm by dorsal evaginating into the residual blastocoelic space. Anyhow, two longitudinal mesodermal grooves are formed, which lie at both sides of notochord and at dorsal side of endodermal tube. Beginning at the anterior end these longitudinal mesodermal grooves soon become transversely divided into distinct segments or somites, which are roughly cuboidal masses of cells lying on each side of the notochord, one behind the other along the length of the animal's body. Some of these somites (anterior two) retain within themselves a portion of the archenteron or enterocoel. The rest form mesoderm. They also become entirely cut off from

the rest of the endoderm.
Soon each somite grows ventrally and becomes differentiated into following part — (i) Some portion of each somite continues to grow around notochord and neural tube. It becomes thickened to become the myotome.
(ii) The portion of each somite, which remains near the epidermal ectoderm, is called the somatic parietal mesoderm.
(iii) The portion of each somite, which remains closely associated with the endoderm, is called visceral or splanchnic mesoderm.
(iv) The space occurring in between the somatic and visceral layer of mesoderm is called enterocoelic coelom, because it is originally derived from the archenteron.

A Further Development of myotome — Each myotome consist of a median muscular portion and the laterally placed, thin walled, parietal part which surrounds the coelomic space or myocoel. The muscular portion of each myotome enlarges rapidly and forms a shaped muscle plate or myotome of the Adult Amphioxus. The myocoelic portion become contributes important connective or skeletal tissues to the

framework of the body, so, in each segment it gives rise following three diverticula:

(i) A lower sclerotomic diverticulum - extends up between the myotome and the medially placed notochord and nerve cord. It is well differentiated into two parts -

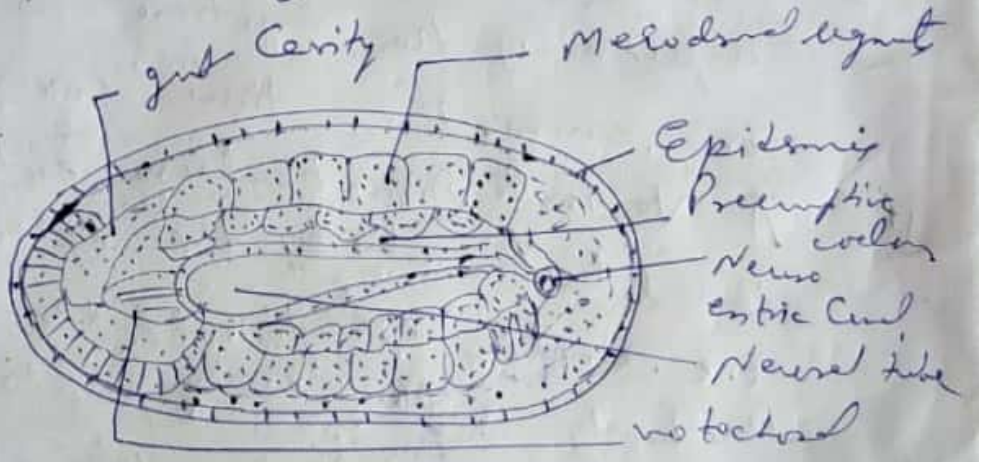
a An inner layer, which together with a similar contribution from the somite on the opposite side; wraps around the notochord and nerve cord and subsequently gives origin to a skeletogenous sheath of connective tissue which encloses these structures.

b An outer layer which covers the inner aspect of the myotome with a fascia or connective tissue covering.

(ii) A Ventral Diverticulum extends between the lateral walls of the splanchnocoel i.e. coelom and the epidermal layer of the body wall and separates the somatic mesoderm of the splanchnocoel from the epidermal wall.

B Further Development of Coelom - The spaces enclosed by somites on the forerunners of the coelom of Adult Amphioxus. While it differentiates into myotome, and splanchnic mesoderm, the

portion of coelom occurring in between somatic and splanchnic mesodermal layers is called ventro-lateral coelom or splanchnocoel. As the myotomes enlarge, the splanchnocoelic space becomes more and more displaced ventrally and most of it comes to lie on either side of the intestine. Thus, in Amphioxus coelom has dual origin- the anteriormost part of coelom is enterocoelic in origin, while the rest of coelom is schizocoelic in origin, like the other chordates i.e. the mesoderm is initially solid and becomes split into two layers with an intervening coelom or schizocoel.



Development in Amphioxus with neural tube, coelom and gut Canal and mesodermal divisions