KING'S College LONDON

INSTITUTE OF PSYCHIATRY,
PSYCHOLOGY & NEUROSCIENCE

Module:
Biological foundations of mental health

Week 1:
Introduction to brain anatomy

Prof Sarah Guthrie

Topic 1
Overview of CNS development

Part 1 of 3

Introduction

The levels of neural development

- The systems level: changes in size and shape in the development of nervous system – 'morphogenesis'
- The cellular level : 'differentiation' from progenitors to mature neurons

Figure 1: Morphogenesis

Developmental disorders that affect mental health

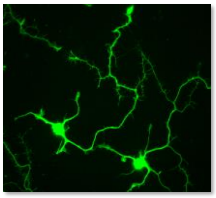
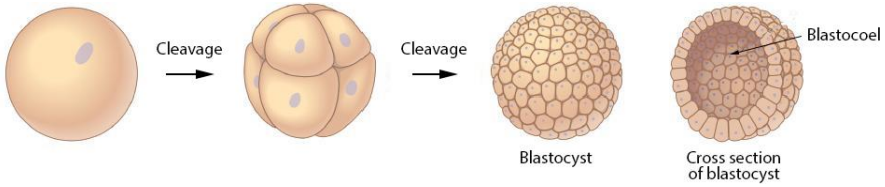


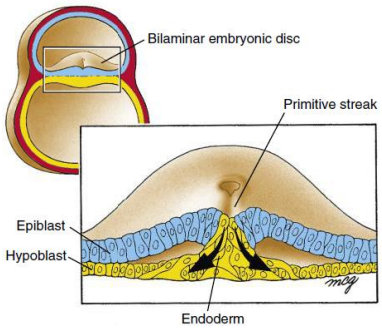
Figure 2: Differentiation

Overview of human development (1)

Day 0
Fertilisation, Cleavage



Day 7
Blastocyst, implantation – formation of the embryonic disk with 2 layers, epiblast and hypoblast



Day 14
Gastrulation – transformation of the 2-layered disk into 3 'germ' layers – ectoderm, mesoderm and endoderm give rise to all tissues

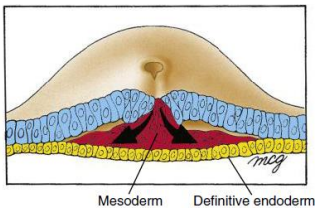


Figure 3: Overview of human development

Overview of human development (2)

Day 21

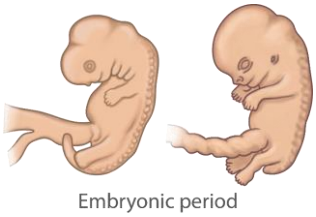
Neurulation – creation of the embryonic nervous system from the ectoderm

Week 4-5

Embryo recognisable with a head and tail – 'tailbud' stage

Week 4-8

Embryonic Period
Organogenesis occurs
Main tissue and organ systems develop
Major features of body form develop



3rd Month – Birth

Foetal Period
Maturation of tissues and organs
Rapid growth of the body
Cell proliferation

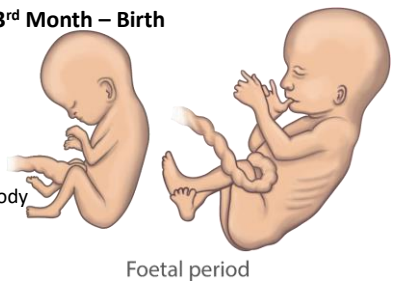


Figure 4: Overview of human development

Neural induction

Ectoderm is induced to become neural tissue by the underlying mesoderm.

In the process of neurulation, morphogenic and genetic changes transform section of the ectoderm into the neural tube.

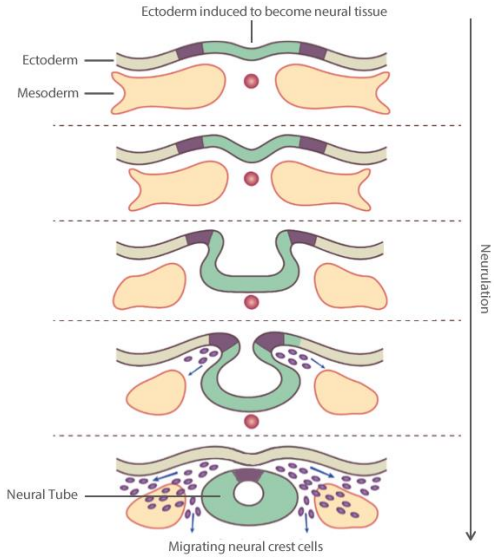


Figure 5: Neural induction

Early neurulation

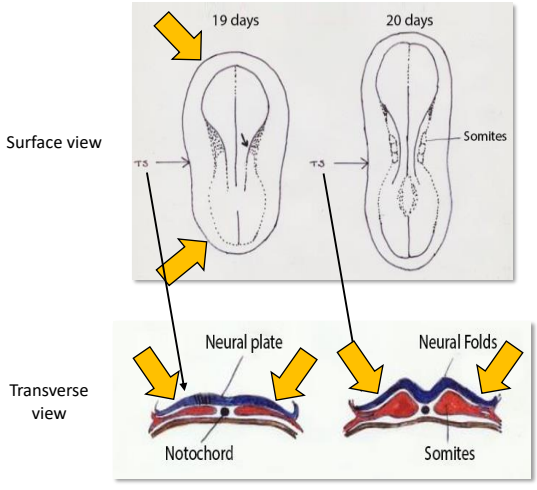


Figure 6: Early neurulation

Figure 7: Scanning electron micrograph of human embryo

Late neurulation

Surface view

Transverse view

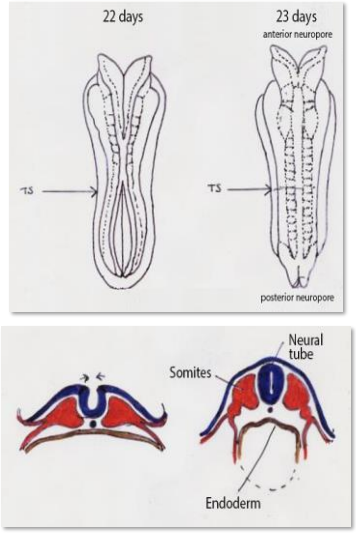


Figure 8: Late neurulation

Figure 9: Scanning electron micrograph of human embryo

Morphogenesis

Cranial and caudal folding arches the embryo into a “comma” shape.

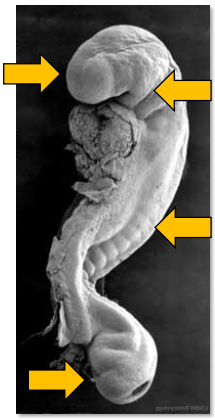


Figure 10: Tailbud stage (4-5 weeks)

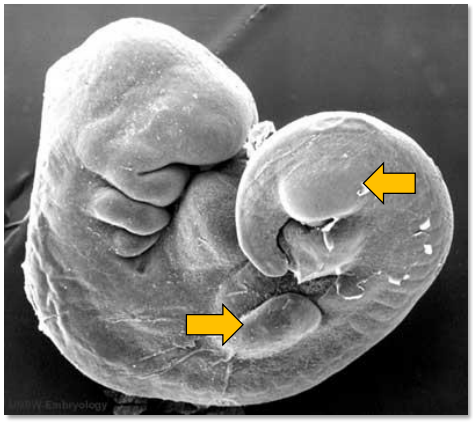


Figure 11: 5-week old embryo

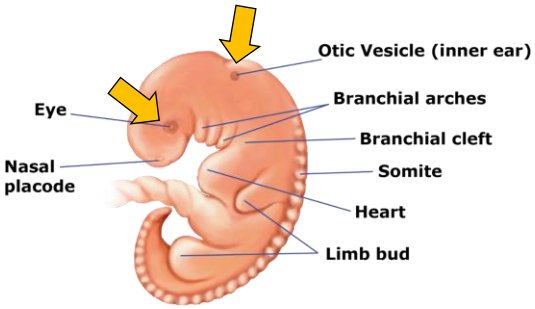


Figure 12: 5-week old embryo

Many organisms look similar at the tailbud stage

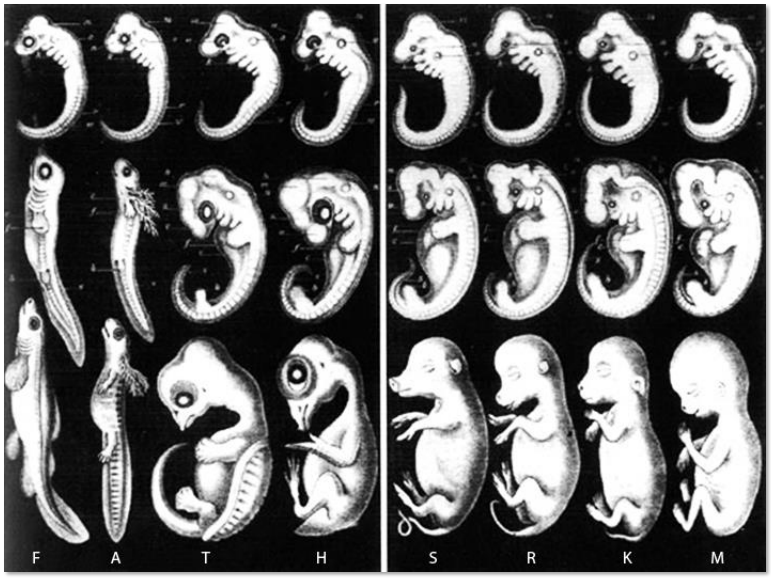


Figure 13: Double Plate Illustration Showing Embryos of fish (F), Salamander (A), Turtle (T), Chick (H), Pig (S), Cow (R), Rabbit (K), and Human (M)

Formation of the flexures and subdivisions in the neural tube

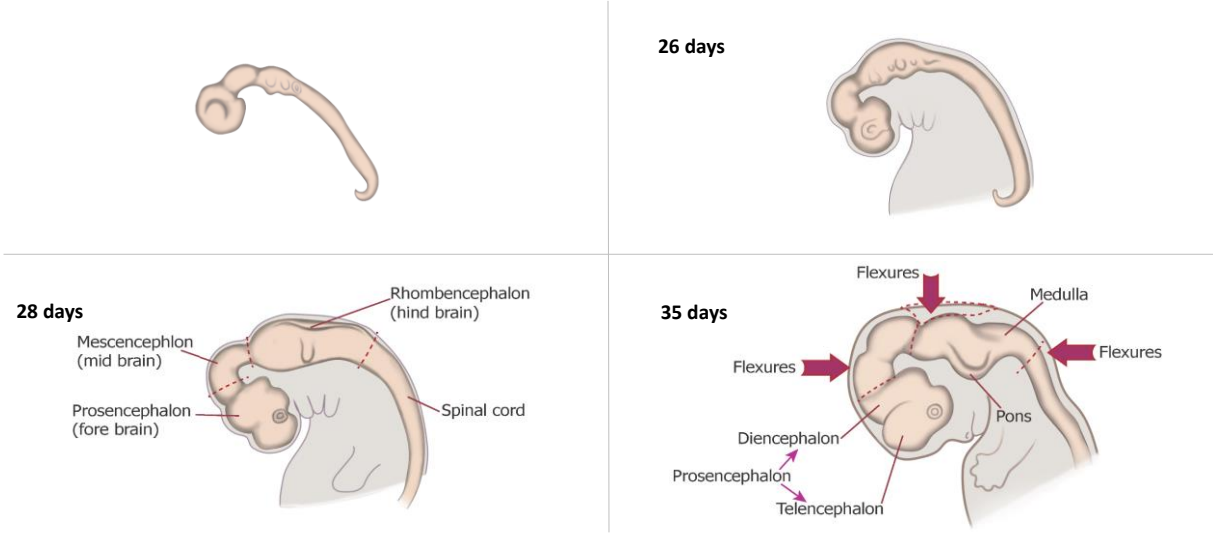


Figure 14: Formation of the flexures and subdivisions in the neural tube