

PRACTICAL CLASS PROGRAM:

- Weekly Quiz + revision (15 minutes)
- Practical class activities (45 minutes)
- Guest Lecture by Professor Sally Dunwoodie (45 minutes)
- Practical Class Revision (15 minutes)

PRACTICAL CLASS ACTIVITIES (45 minutes):

1. Virtual human embryo dissections and human embryo histology
2. Playdough modelling of neural, craniofacial and heart development
3. Embryo models of craniofacial development and heart development
4. Human developmental abnormalities

LEARNING OBJECTIVES:

- Understanding development of the gastrointestinal and respiratory tracts
- Understanding neural crest development
- Understanding head development
- Understanding of heart development
- Understanding of musculoskeletal development
- Understanding human birth disorders relevant to these organ systems
- Understanding research into how the environment can influence the genetic processes driving heart and musculoskeletal development

PRACTICAL CLASS ACTIVITIES

In this practical class we will work in small groups of 4 students.

There will be 3 optional activities of which you can choose one or more. These activities will give you an improved understanding of system development in 3D.

Secondly, I would like you to investigate with your group human birth defects associated with the organ systems relevant to this practical. This will give you an improved understanding of these disorders and how they develop.

Optional Activity 1: Virtual human embryo dissections and histology:

In this activity you will perform digital embryo dissections and in parallel investigate the histology of human embryos that will give you improved insights into system development in 3 dimensions.

Please open the 3D-PDF files representing Carnegie stages 9 to 23 of the [3D Atlas of Human Development](#) that are freely available through [this link](#). Please download this 84Mb file at home before the practical classes. Also open the online [Virtual Human Embryo](#) resource.

Identify the following features in the [3D-PDF files](#) and in the [VHE](#) histology sections, and track how they develop over time in human embryos:

Neural development:

- Neural plate
- Neural folds
- Neuropores
- Prosencephalon
- Mesencephalon
- Rhombencephalon
- Telencephalon
- Diencephalon
- Metencephalon
- Myelencephalon
- The cervical, cephalic, and pontine flexures
- Spinal cord
- Spinal ganglia
- Spinal nerves
- Cranial nerves

Gastrointestinal and respiratory tract development:

- Foregut
- Midgut (notice the herniation, and the rotations!)
- Hindgut
- Cloaca
- Allantois
- Stomach (notice the rotations)
- Liver
- Pancreas (notice how the dorsal and ventral anlagen fuse)
- Gall bladder
- Duodenum, jejunum and ileum
- Cecum, appendix, colon and rectum
- Lung buds
- Bronchial tree
- Mesenteries, intraembryonic coelom, peritoneum and pleural cavities

Head development:

- Branchial arch derivatives (skeletal, arteries, cranial nerve)
- Pharyngeal pouch derivatives
- Pituitary gland
- Laryngeal cartilages
- Thyroid and thymus

Heart development:

- Fusing primary heart tubes
- Looping of the heart tube
- Atria
- Ventricles
- Outflow tract
- Ductus venosus
- Ductus arteriosus
- Dorsal aortae: note how these fuse over time
- Pericardial cavity

Musculoskeletal system:

- Somites: note an increase in somites over time
- Notochord: what role does it play in somite development?
- Somite differentiation (note that cranial somites are ahead in development)
- Development of the axial skeleton
- Development of the appendicular skeleton
- Development of the skull
- Intervertebral disks

Optional Activity 2: Embryo models

Embryo models will be on display relevant to craniofacial and heart development. Please investigate them and identify the structures and processes that have been discussed in the lectures.

Optional Activity 3: Playdough modelling of neural, craniofacial and heart development

Model the various stages of [heart](#), [neural](#) and/or [craniofacial](#) development in 3D using playdough. Make photos, annotate the structures discussed in the lectures, and upload the annotated photos in [the Padlet app](#).

Activity 4: Human developmental abnormalities

Please select and investigate with your group one of the developmental abnormalities listed below. A number of these will be on display as specimens provided the Museum of Human Disease. Understand which systems are affected, and how these abnormalities arise during embryonic development. Write this up 250 words, and [upload with your names in the forum on Moodle](#).

- Gastroschisis:
- Meckel's diverticulum:
- Klinefelter syndrome:
- Cleft lip/palate syndrome:
- Patent foramen ovale:
- Patent ductus arteriosus:
- Achondroplasia:
- Polydactyly:
- Syndactyly:
- Scoliosis:
- Limb reduction:
- DiGeorge Syndrome:
- Treacher Collins syndrome:
- Hirschsprung's disease:

GUEST LECTURE BY PROFESSOR SALLY DUNWOODIE

[Professor Sally Dunwoodie](#) is an internationally renowned biomedical researcher at the Victor Chang Cardiac Research Institute. She has dedicated her life's work to understanding how babies develop and to finding out why some 3-6% have birth defects.

REVISE PRACTICAL CLASS ACTIVITIES

In the last 15 minutes we will collectively revise the activities with the entire class to wrap up this prac.