

Foundations Lecture - Introduction to Human Development

Embryology (/embryology/index.php/Main_Page) - 9 Apr 2017

[Facebook](#) (/embryology/index.php/File:Facebook_16x16.png) [Pinterest](#) (/embryology/index.php/File:Pinterest_16x16.png) [Twitter](#) (/embryology/index.php/File:Twitter_16x16.png)

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Expand to Translate

Introduction



(/embryology/index.php/File:Foundsmall.jpg)

Human development is one of the most exciting topics to study not only as a medical student, but also for our fundamental understanding of the human body. Of all health issues in Medicine, fertility and reproduction is a topic that

will affect everyone. This lecture is going to take you briefly through key biological concepts in human development, these will later be explored in more detail through the BGD course. I will be using simplified terms in the lecture slides (with developmental term in brackets).



(/embryology/index.php)

Dr Mark Hill



(/embryology/index.php/Human_Fertilization_Movie)

Australian Statistics (/embryology/index.php/Australian_Statistics) On 2 January 2017, the resident population of Australia is projected to be 24,317,037 (2016 - 24,001,781).

(Similar sized countries - Mozambique, Syria, Madagascar, **Romania** (/embryology/index.php/Romania_Statistics), **Australia** (/embryology/index.php/Australian_Statistics), Cote d'Ivoire, Sri Lanka) World (http://www.google.com/publicdata/explore?ds=wb-wdi&met_y=sp_pop_totl&idim)

The lecture will be followed by a practical class introducing online resources for independent study and working through similar embryology concepts.

Links: Printable Lecture Page (http://php.med.unsw.edu.au/embryology/index.php?title=Foundations_Lecture_-_Introduction_to_Human_Development&printable=yes) | 2016 (https://embryology.med.unsw.edu.au/embryology/index.php?title=Foundations_Lecture_-_Introduction_to_Human_Development&oldid=269990) | 2015 (https://embryology.med.unsw.edu.au/embryology/index.php?title=Foundations_Lecture_-_Introduction_to_Human_Development&printable=yes) | 2014 (https://embryology.med.unsw.edu.au/embryology/index.php?title=Foundations_Lecture_-_Introduction_to_Human_Development&oldid=164816) | 2013 (http://embryology.med.unsw.edu.au/embryology/index.php?title=Foundations_Lecture_-_Introduction_to_Human_Development&oldid=125526) | 2012 (http://php.med.unsw.edu.au/embryology/index.php?title=Foundations_Lecture_-_Introduction_to_Human_Development&oldid=117829)

Other Foundations links [Expand]

Aims

1. Purpose of learning embryology
2. Basic facts about early human development
3. Appreciate differences between the conceptus, embryo and fetus
4. General understanding of the term "critical periods" of development

Lecture Concepts: Embryology Education Support, Human Reproductive Cycle, First Trimester, Second and Third Trimester, Postnatal Development, Abnormal Development

Lecture Content

[Collapse]

1. **Embryology Education Support** - UNSW Embryology Online, Glossary Links, Textbooks
2. **Human Reproductive Cycle** - Female. Male, Ovary, Ovulation, Trimesters
3. **First Trimester** - Fertilization, Week 1, Week 2, Abnormal Implantation, Normal Implantation, Detect Pregnancy, Week 3, Gastrulation, Ectoderm, Endoderm, Mesoderm, Somitogenesis, Neuralation, Week 4,

Week 4-8, Placenta

4. **Second and Third Trimester** - Fetal, growth - weight and length
5. **Postnatal Development** - Birth, Maternal Birth Stages, Neonatal, Childhood
6. **Abnormal Development** - Critical Periods of Development, Diagnosis

Links: 2017 Practical (/embryology/index.php/Foundations_Practical_-_Introduction_to_Human_Development) | Embryology Textbooks (/embryology/index.php/Embryology_Textbooks)



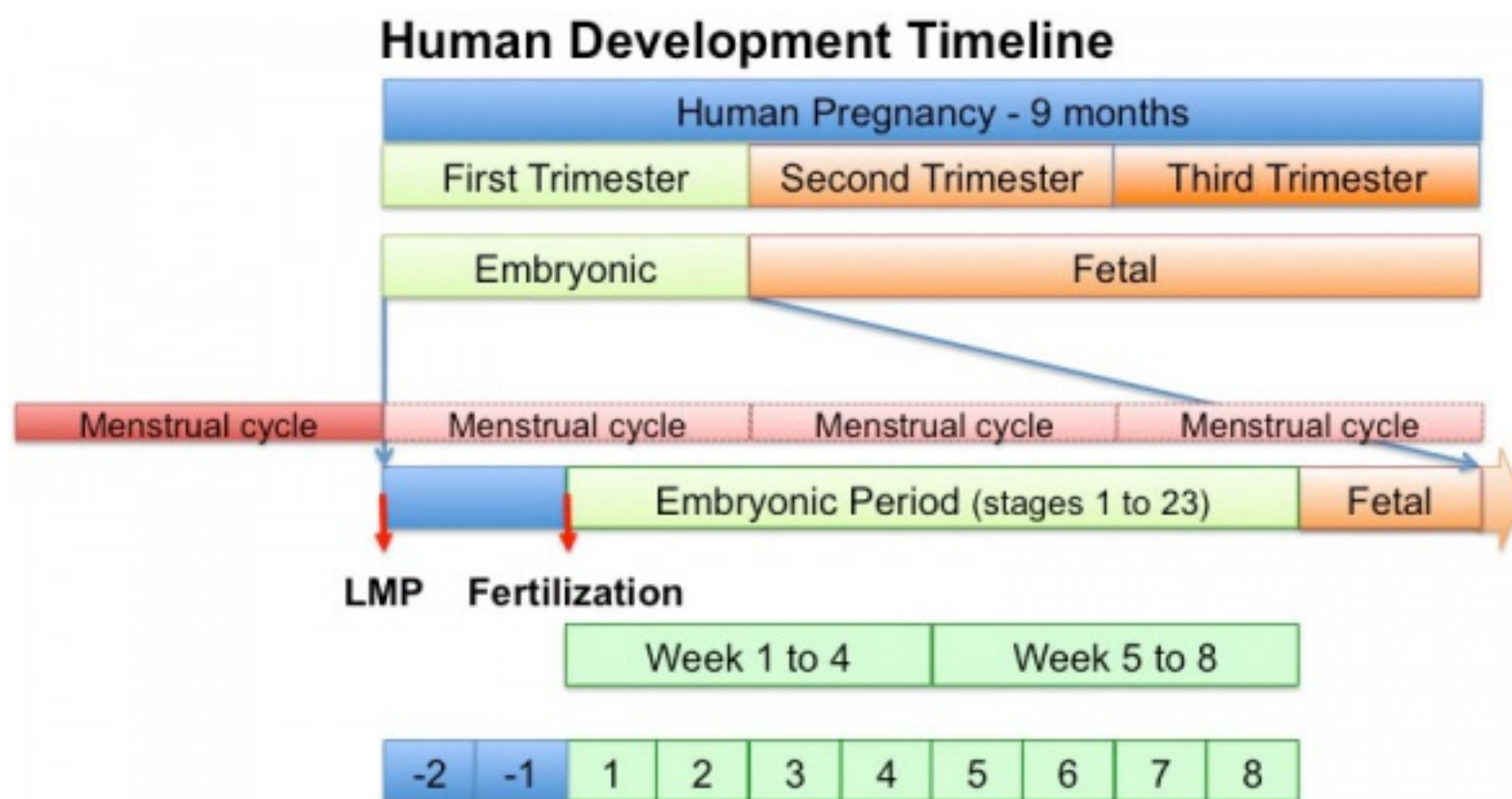
Four Basic Tissue Types

In histology you have heard that tissues and organs of the body consist of combinations of 4 basic tissue organisations:

1. Epithelial
2. Connective
3. Muscular
4. Nervous

- Where do they come from?
- How do they develop?
- What are their relationships with each other?

Human Development Timeline



(/embryology/index.php/File:Human_development_timeline_graph_02.jpg)

concepts animation (/embryology/images/7/7b/Human_development_timeline_01.mp4)

Last Menstrual Period (LMP) first day was today -> Birth Date - January 18, 2018 [Expand]

Embryology Education Support

UNSW Embryology Online



(/embryology/index.php/File:Stomach_histology)
Stomach Wall containing all 4 basic tissues.



(<http://php.med.unsw.edu.au/embryology/>)



UNSW Embryology

(/embryology/index.php/Human_Development_Movie)

Human Development

Page (/embryology/index.php/Human_Development_Movie) |

Play

(/embryology/images/3/3e/Human_development_001.mp4)

Movies (</embryology/index.php/Movies>)



Using these resources (online navigation, organization and printing) will be covered in the introduction to the associated Practical class.

Glossary Links

[A](/embryology/index.php/A) | [B](/embryology/index.php/B) | [C](/embryology/index.php/C) | [D](/embryology/index.php/D) | [E](/embryology/index.php/E) | [F](/embryology/index.php/F) | [G](/embryology/index.php/G) | [H](/embryology/index.php/H) | [I](/embryology/index.php/I) | [J](/embryology/index.php/J) | [K](/embryology/index.php/K) | [L](/embryology/index.php/L) | [M](/embryology/index.php/M) | [N](/embryology/index.php/N) | [O](/embryology/index.php/O) | [P](/embryology/index.php/P) | [Q](/embryology/index.php/Q) | [R](/embryology/index.php/R) | [S](/embryology/index.php/S) | [T](/embryology/index.php/T) | [U](/embryology/index.php/U) | [V](/embryology/index.php/V) | [W](/embryology/index.php/W) | [X](/embryology/index.php/X) | [Y](/embryology/index.php/Y) | [Z](/embryology/index.php/Z) | [Numbers](/embryology/index.php/Numbers) | [Symbols](/embryology/index.php/Symbols)

Textbooks

- There are many different excellent embryology textbooks
- I have included below embryology textbooks accessible online through the UNSW Library that cover the clinical topics as well.
- As an introduction try the chapter in The Developing Human - Introduction to the Developing Human (<http://ebookcentral.proquest.com.wwwproxy1.library.unsw.edu.au/lib/unsw/reader.action?docID=2074364&ppg=23>)

The Developing Human: Clinically Oriented Embryology (10th edn) [Expand]

Larsen's Human Embryology (5th edn) [Expand]

Ebook - Kyoto Collection (1st edn) [Expand]

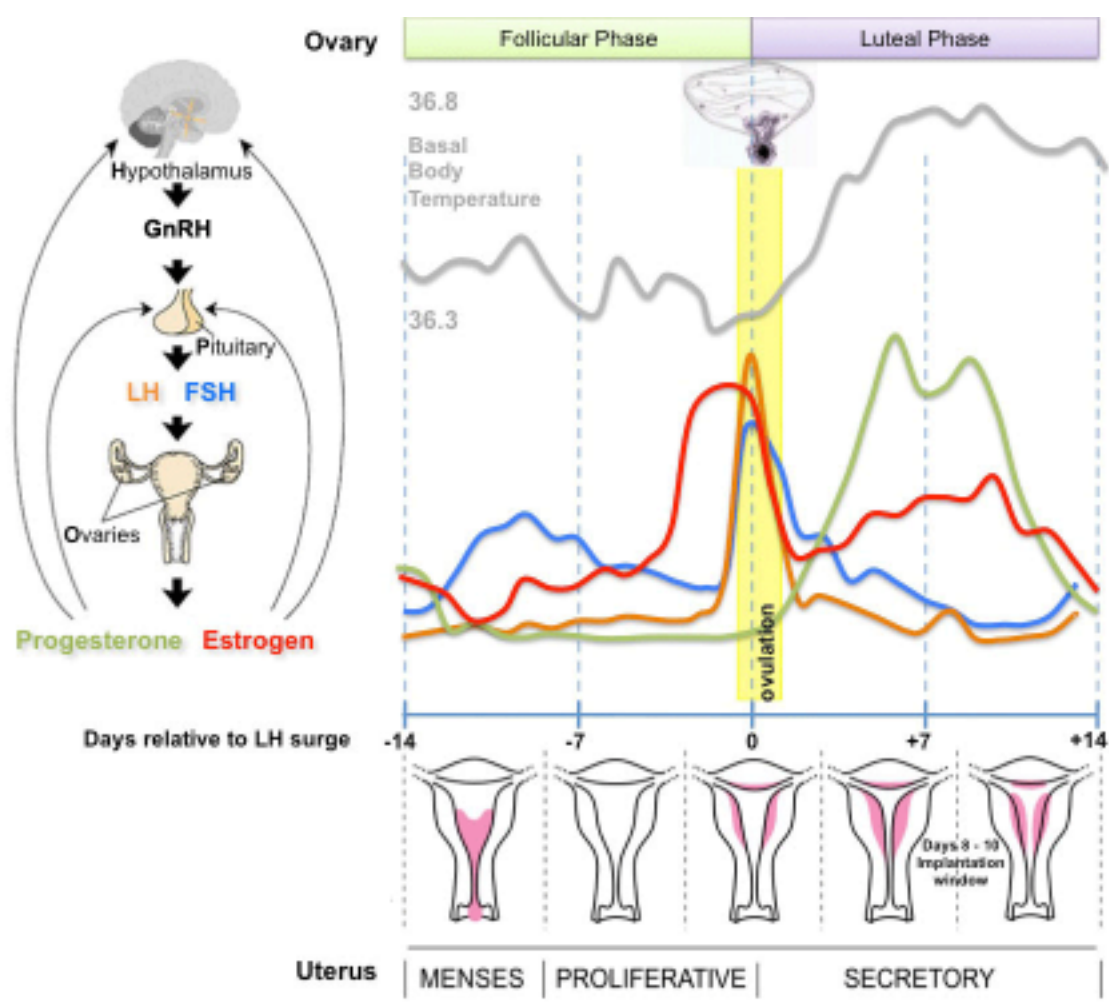
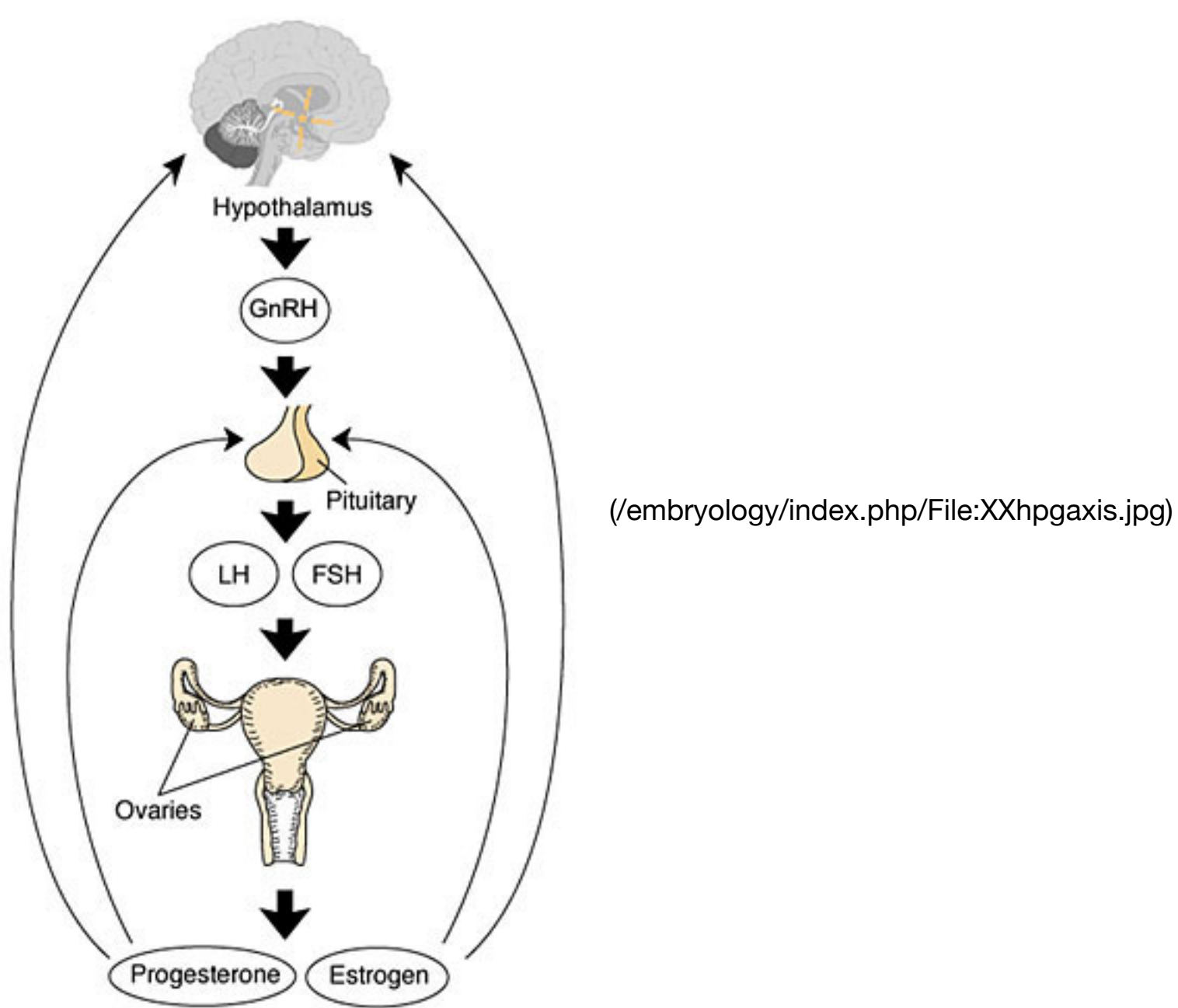
Links: Embryology Textbooks - UNSW (/embryology/index.php/Embryology_Textbooks_-_UNSW) | More Embryology Textbooks (/embryology/index.php/Embryology_Textbooks)

Human Reproductive Cycle

- Meiosis in gonad produces haploid gametes
 - testis the sperm (spermatozoa)
 - ovary the egg (oocyte)
- there are several differences in when and how gametes are formed in the male and female gonad.

Female

- Menstrual Cycle (/embryology/index.php/Menstrual_Cycle) a regular cycle of reproduction (28 days)
- begins at puberty
- release of 1 egg (oocyte) every cycle
- Endocrine controlled (HPG axis)
 - Hypothalamus
 - Pituitary
 - Gonad

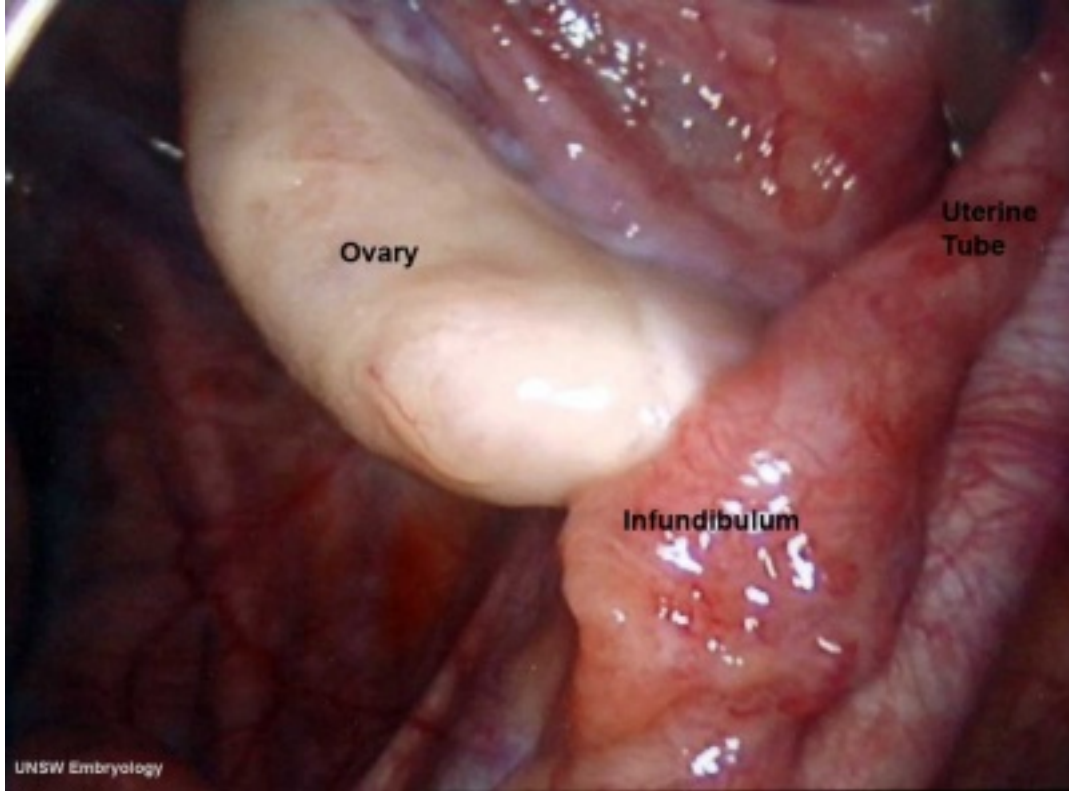


Male

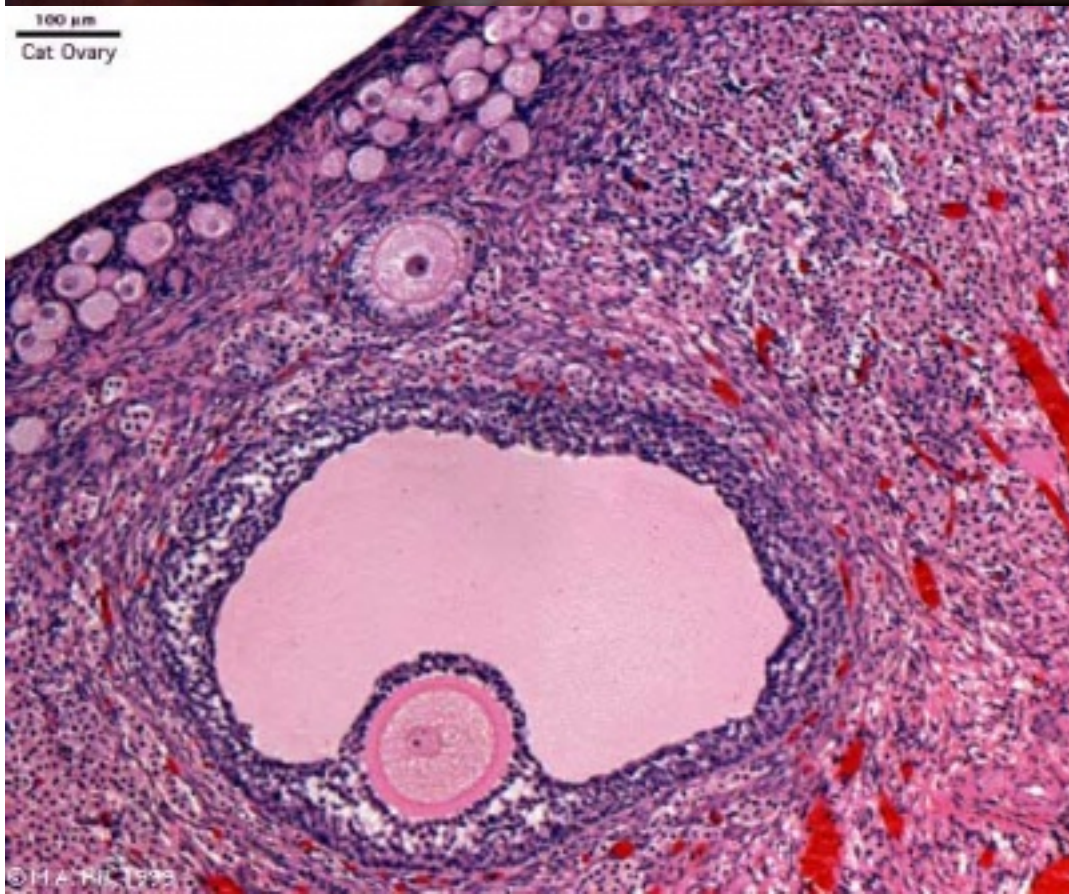
- begins at puberty
- continuous production of sperm (spermatozoa, human male 2,000/second)
- release millions of spermatozoa (require activation, capacitation)

Ovary

- Paired organs
- lying in the peritoneal cavity



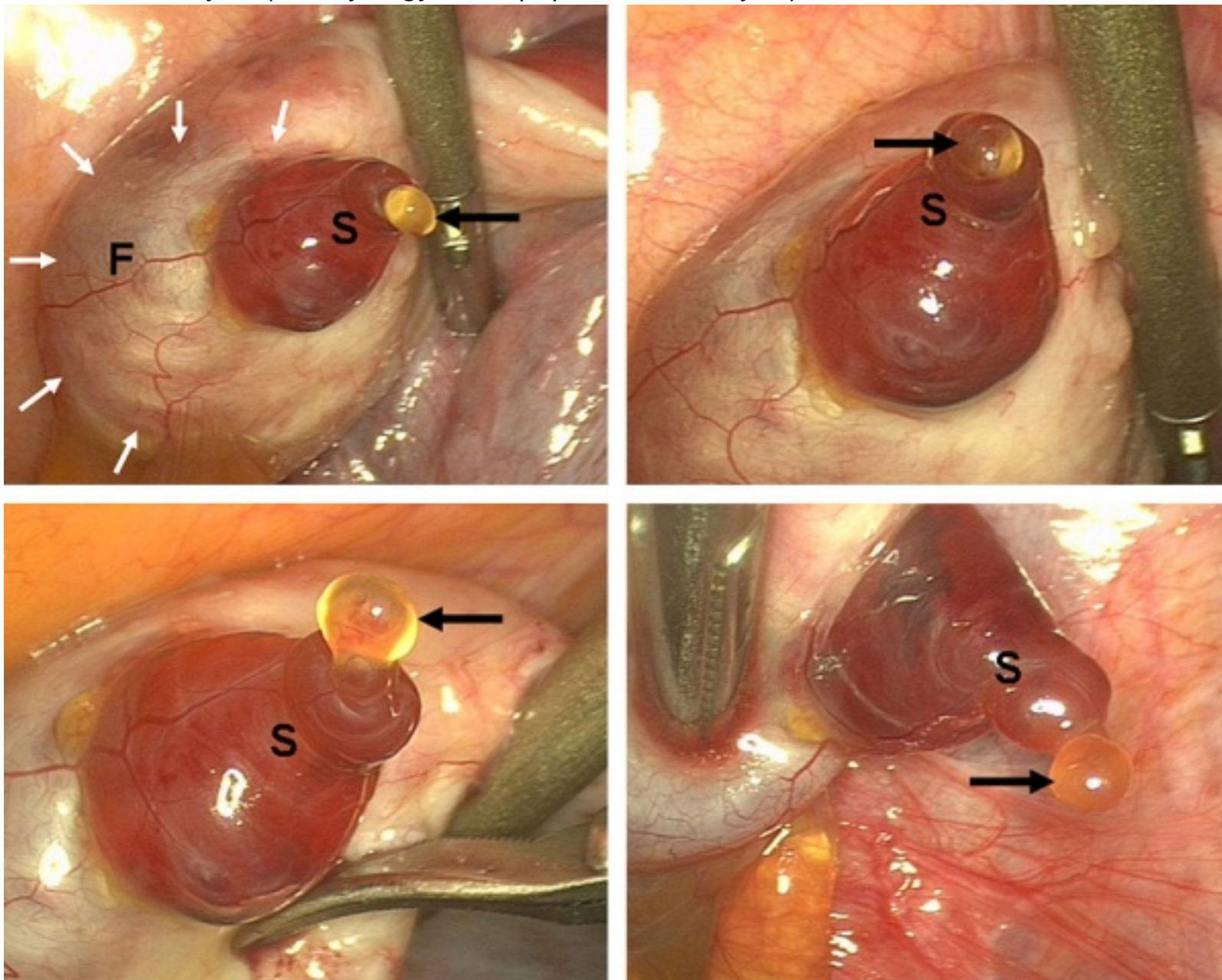
(/embryology/index.php/File:Human_right_ovary_and_tube_1.jpg)



(/embryology/index.php/File:Ovary10x.jpg)

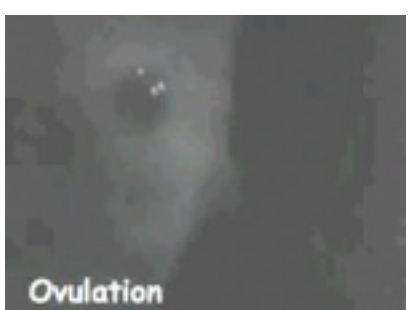
Ovulation

- ovulation (/embryology/index.php/O#ovulation) is the release of the egg (oocyte) at about the middle of the menstrual cycle (/embryology/index.php/Menstrual_Cycle)

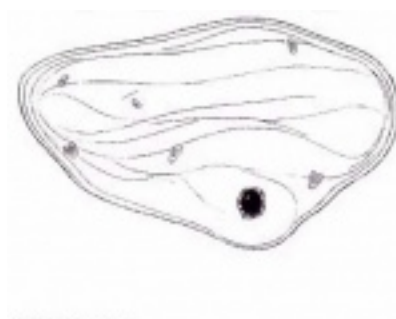


(/embryology/index.php/File:Human_ovulation_01.jpg)

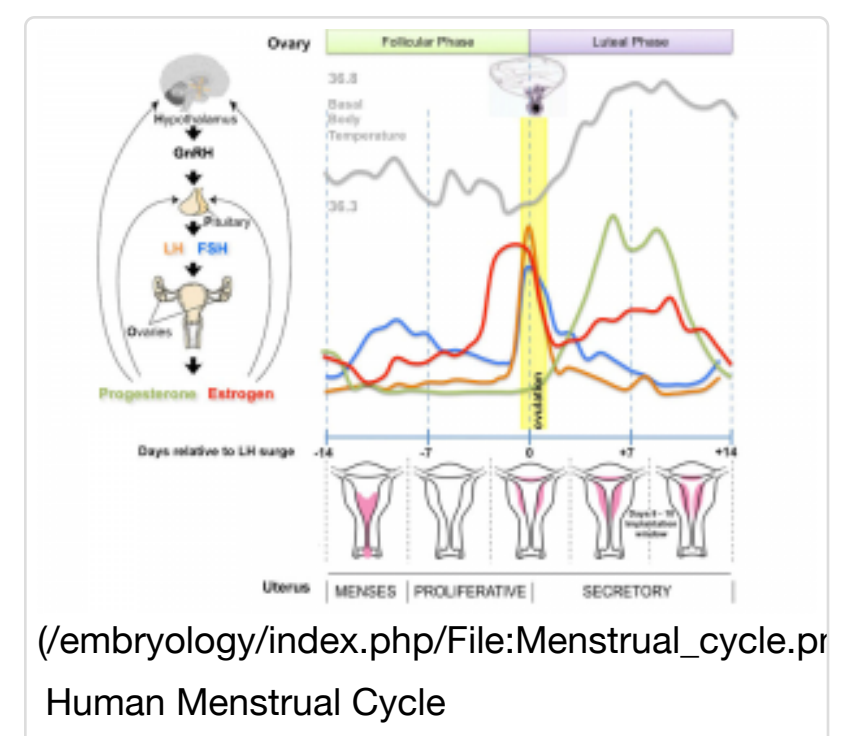
Human ovulation



(/embryology/index.php/Rabbit_Ovulation_Movie)

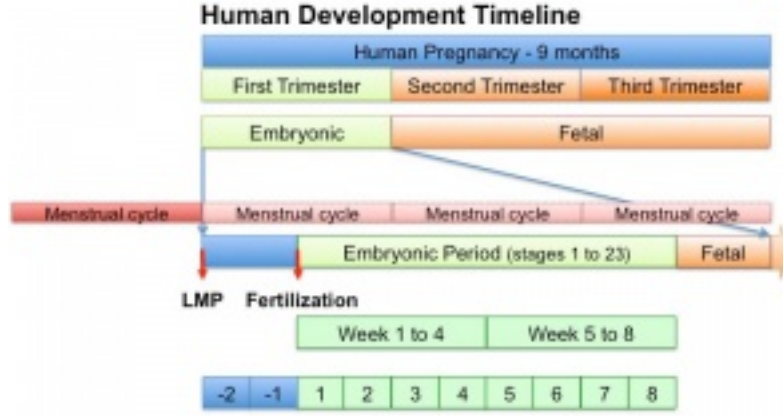


(/embryology/index.php/Ovulation_Movie)



(/embryology/index.php/File:Menstrual_cycle.pr
Human Menstrual Cycle

Trimesters

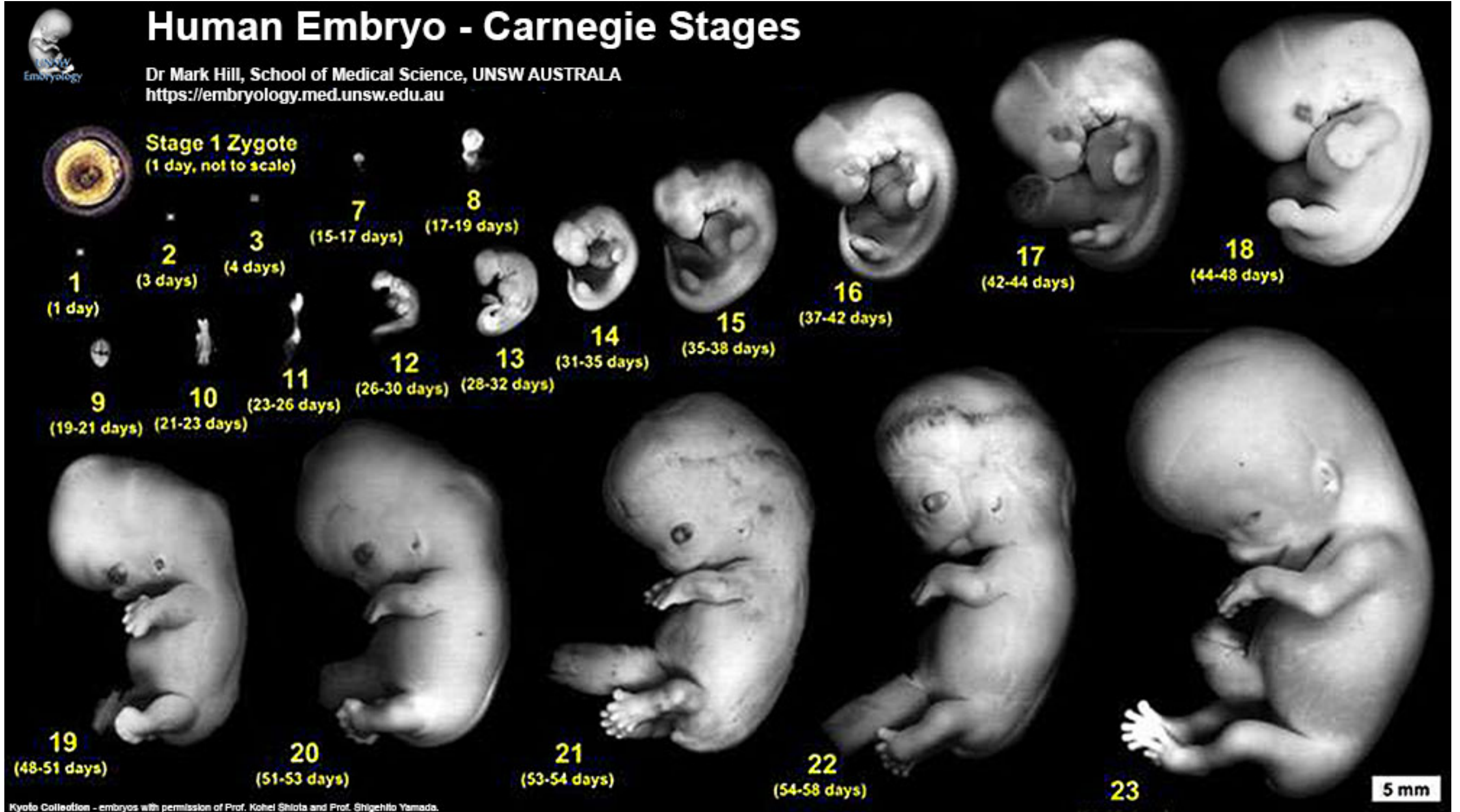


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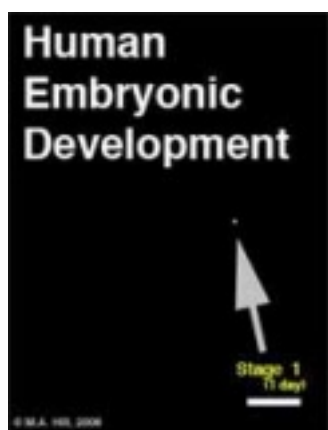
- Divide the pregnancy into 3 "blocks" of about 3 months (trimesters)
- First Trimester - embryonic period (organogenesis)
- Second and Trimester - fetal period (growth)

First Trimester

- Embryonic Period - Week 1 to 8 (first trimester)
- Establish the basic structure of organs and tissues (Organogenesis)
- development and growth of the placenta (Placentation)



(/embryology/index.php/File:Human_Carnegie_stage_1-23.jpg)



(/embryology/index.php/Embryonic_Development)

Fertilization

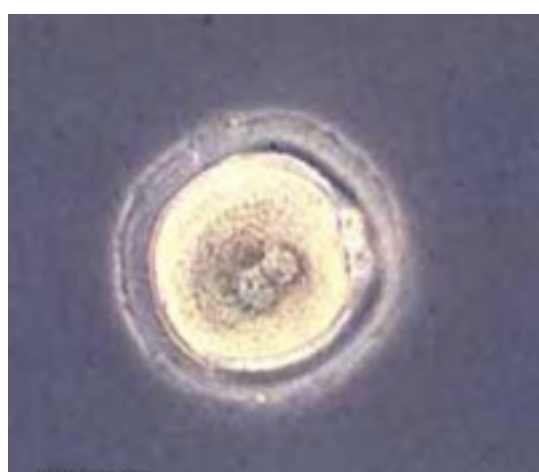
- the process of the 2 haploid (/embryology/index.php/H#haploid) gametes (/embryology/index.php/G#gamete) (egg and sperm) fusing and combining genetic material.
- **conceptus** - the entire product of fertilisation



(/embryology/index.php/Human_Fertilization_Detail_Movie)

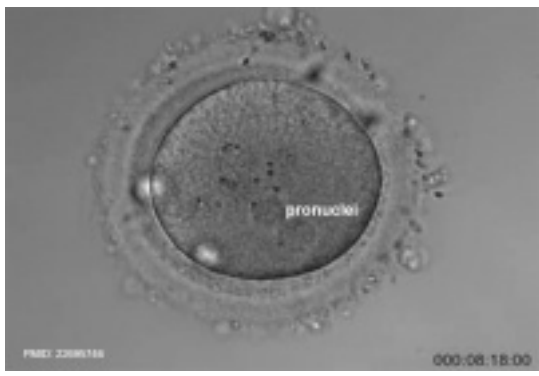


(/embryology/index.php/Fertilization_Movie)



(/embryology/index.php/File:Early_zygote_labelled.jpg)

Week 1

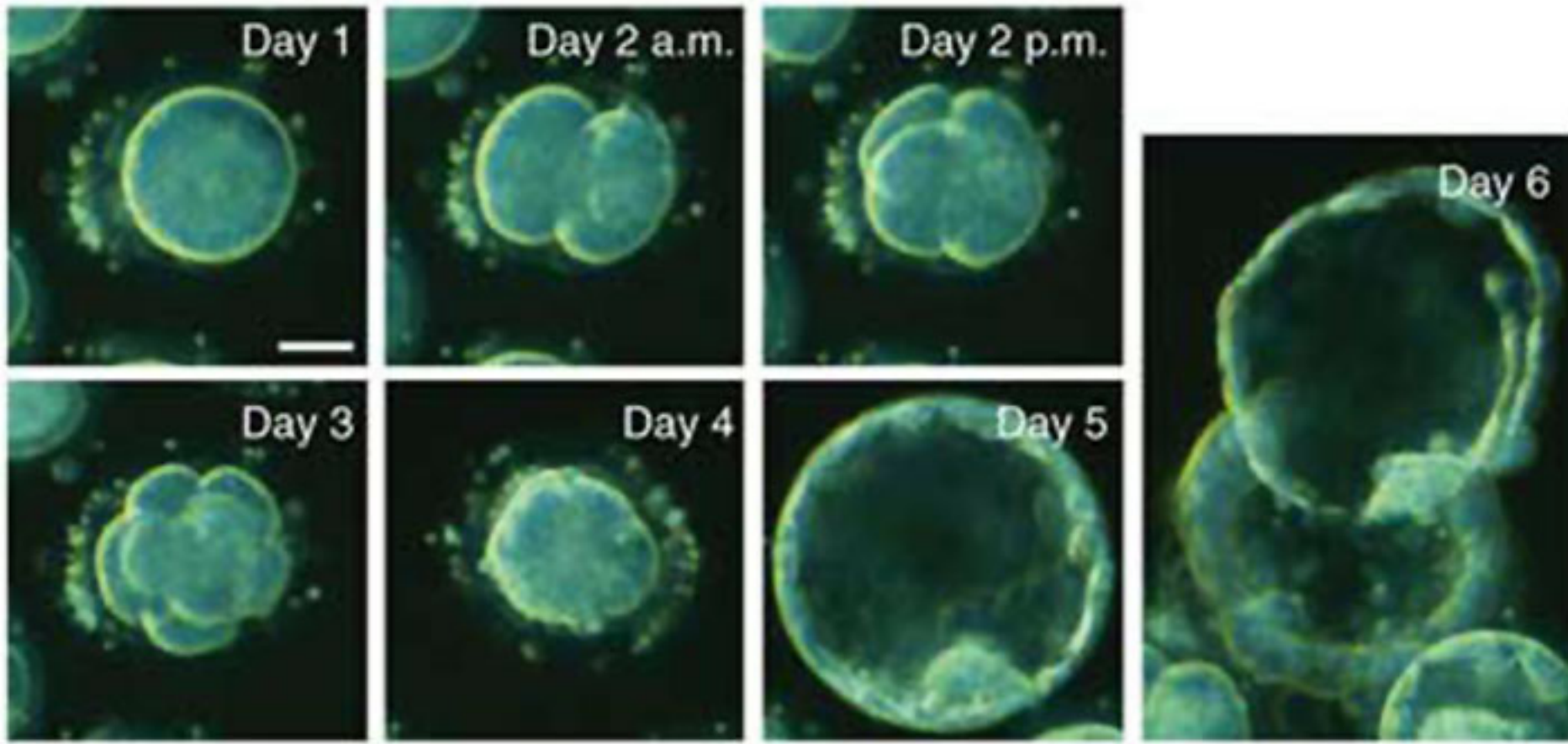


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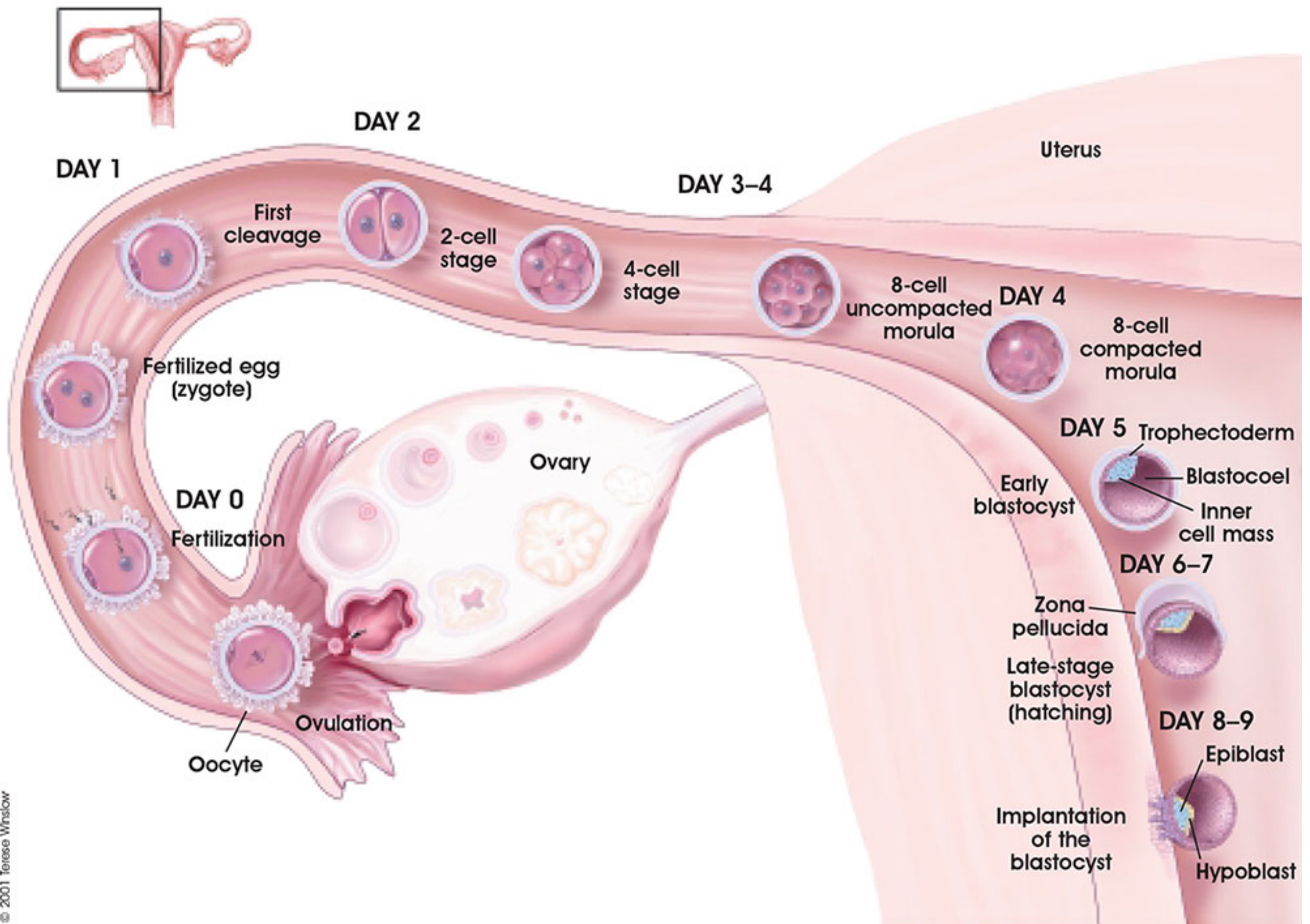
(/embryology/index.php/Week_1_Movie)

- occurs freely floating in uterus
- occurs during week 1 (/embryology/index.php/Week_1) following fertilization
- last menstrual period (LMP) week 3
- mitosis to form solid ball of cells (morula), then hollow ball (blastocyst)



(/embryology/index.php/Blastocyst_Day_3-

6_Movie)



© 2001 Terese Winslow

(/embryology/index.php/File:Week1_summary.jpg)

Week 2

- Implantation - initial attachment to uterine wall, and then invasion of the uterine wall.



Normal Implantation

- Uterine body
 - posterior, anterior, superior, lateral (most common posterior)
 - inferior implantation - placenta overlies internal os of uterus **Placenta Previa**

Abnormal Implantation

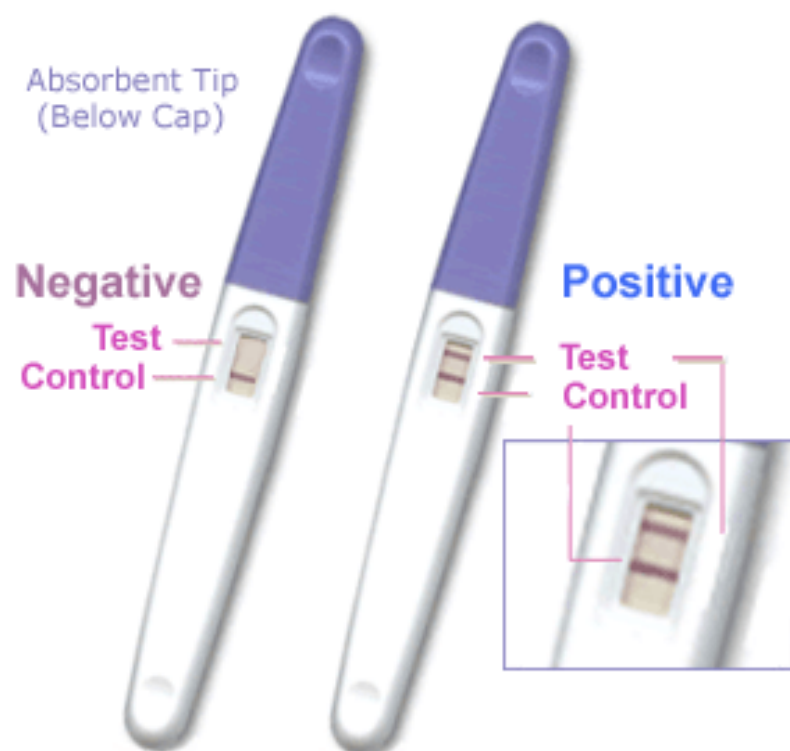
- Ectopic Sites
 - external surface of uterus, ovary, bowel, gastrointestinal tract, mesentery, peritoneal wall
 - If not spontaneous then, embryo has to be removed surgically
- Uterine - tubal pregnancy (most common ectopic)

Detect Pregnancy

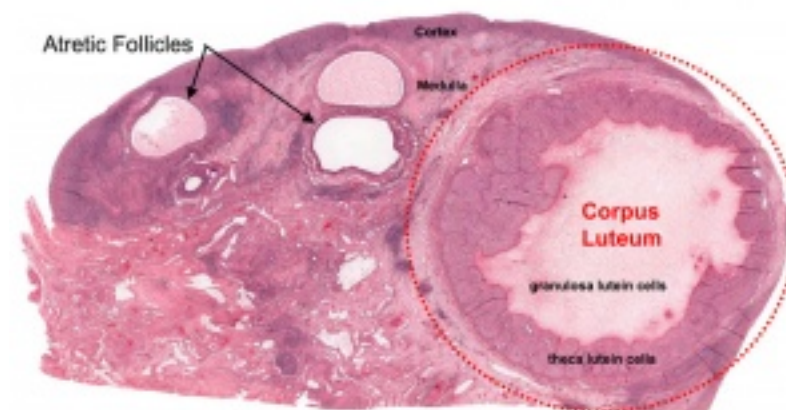
- Clinically can be detected following implantation (week 2)
- Last Menstrual Period (LMP) - today ? Birth Date - January 30, 2014



(/embryology/index.php/File:Tubal_pregnancy.gif)



(/embryology/index.php/File:Pregnancy_test.gif)
Pregnancy test (maternal urine)



(/embryology/index.php/File:Ovary_corpus_luteum.jpg)

Ovary - corpus luteum secretes hormone (hCG) to support pregnancy

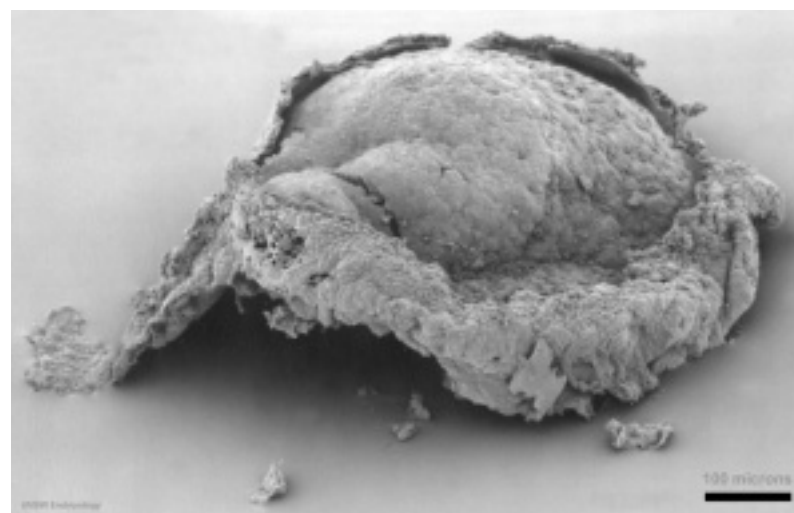
Week 3

- 4 Key processes commence

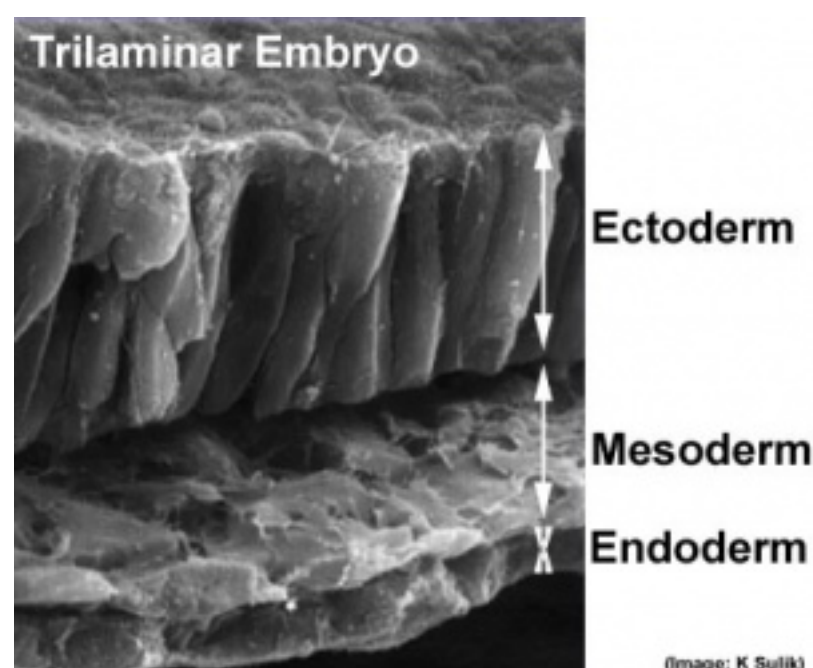
1. Gastrulation

- the formation of the 3 layer embryo (trilaminar embryo)
 - All tissues of the body are formed from these 3 embryonic tissue layers (germ layers)

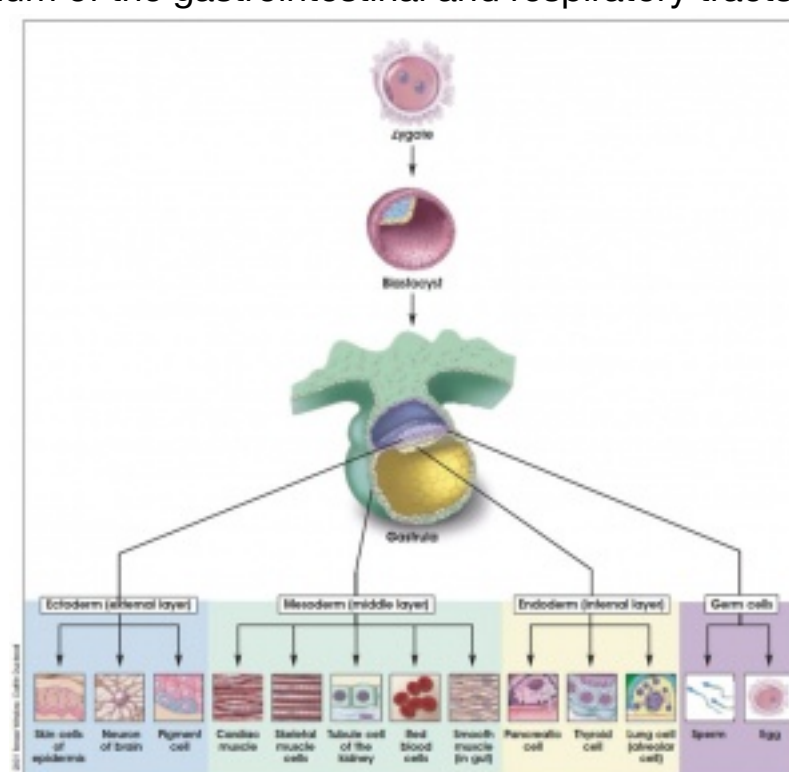
1. **Ectoderm** (epithelium) - forms the central and peripheral nervous system and epithelium of the skin
2. **Mesoderm** (connective tissue) - forms the body connective tissues: blood, bone, muscle, connective tissue skin, gastrointestinal and respiratory tracts
3. **Endoderm** (epithelium) - forms gastrointestinal tract organs and the epithelium of the gastrointestinal and respiratory tracts



(/embryology/index.php/File:Stage7-sem4.jpg)



(/embryology/index.php/File:Trilaminar_embryo.jpg)



(/embryology/index.php/File:Inner_cell_mass_cartoon.jpg)

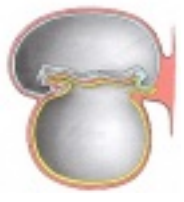
2. Somitogenesis

- segmentation of the mesoderm into **somites**
- forms the axial body plan

3. Neuralation

- segmentation of the ectoderm

- separates the neural tissue from the skin (epidermis)



(/embryology/index.php/Week_3_Development_Movie)

4. Folding

- folding of the whole embryonic disc
- all edges of the disc fold ventrally
 - left and right of the disc come together to form a "tube" of the 3 layers
 - top and bottom of the disc bend to form a "C" shaped embryo.

Week 4

Stage 13 - Left Ventrolateral View



(http://embryology.med.unsw.edu.au/embryology/Slides/Embryo_Stages/Stage13/bf04/Stage13bf04.html)

Mobile

(http://embryology.med.unsw.edu.au/embryology/Slides/Embryo_Stages/Stage13/bf04/leaflet.html) |

Desktop

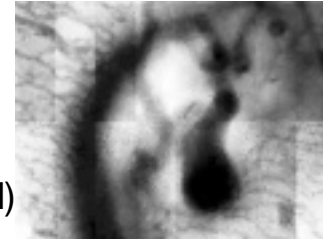
(http://embryology.med.unsw.edu.au/embryology/Slides/Embryo_Stages/Stage13/bf04/Stage13bf04.html)

| **Original** (/embryology/index.php/File:Stage13_bf4.jpg)

- heart formation (cardiogenesis) first functioning organ
- extra-embryonic cavities develop



(/embryology/index.php/Amniotic_Cavity_Development_Movie)



(/embryology/index.php/Movie_-

_Normal_Chick_Heart)

Stage 13 (/embryology/index.php/Carnegie_stage_13) | Embryo Slides

(/embryology/index.php/Embryo_Virtual_Slides)



(/embryology/index.php/Stage_13_MRI_Movie_3)

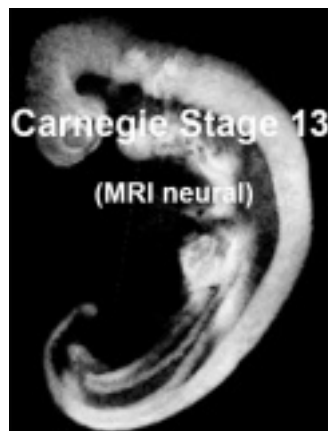
Embryo Stage 13

Page

(/embryology/index.php/Stage_13_MRI_Movie_3) |

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(/embryology/images/c/cf/Stage_13_MRI_3D04.mp4)



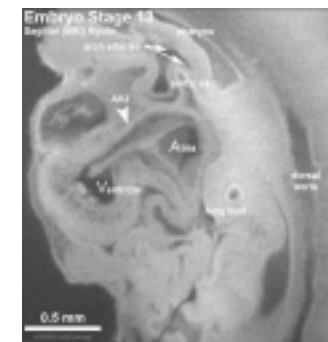
(/embryology/index.php/Stage_13_MRI_Movie_2)

Embryo CNS

Page (/embryology/index.php/Stage_13_MRI_Movie_2)

| Play

(/embryology/images/3/30/Stage_13_MRI_3D02.mp4)



(/embryology/index.php/Stage_13_MRI_Movie_1)

Heart Sag MRI

Page

(/embryology/index.php/Stage_13_MRI_Movie_1) |

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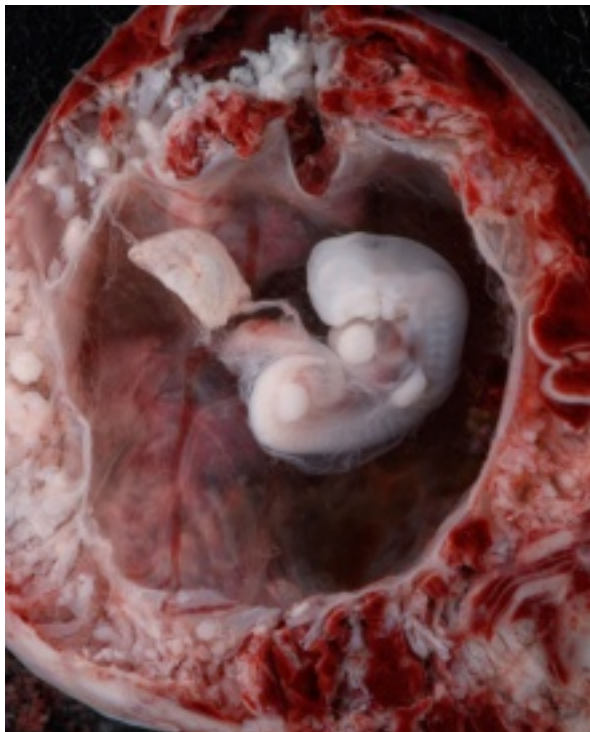
(/embryology/images/6/60/Stage_13_MRI_S02.mp4)

Week 5 to 8

- early development of the other organs, tissues and limbs

Week 5

Stage 14 - Lateral View



(http://embryology.med.unsw.edu.au/embryology/Slides/Embryo_Stages/Stage14/bf18/stage14bf18.html)

Mobile

(http://embryology.med.unsw.edu.au/embryology/Slides/Embryo_Stages/Stage14/bf18/leaflet.html) |

Desktop

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| **Original** (/embryology/index.php/File:Stage14_sem5.jpg)

Week 8

Stage 21 - Left Lateral



Mobile

(http://embryology.med.unsw.edu.au/embryology/Slides/Embryo_

Desktop

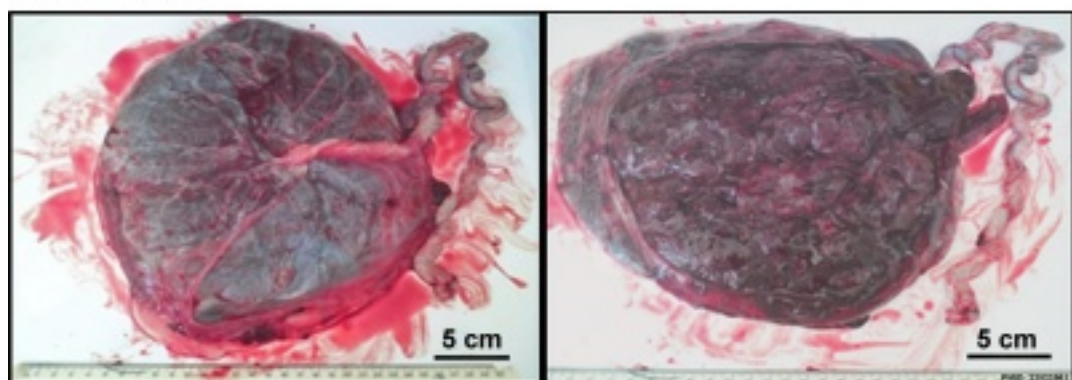
(http://embryology.med.unsw.edu.au/embryology/Slides/Embryo_

| **Original** (/embryology/index.php/File:Stage21_bf11.jpg)

Placenta

- Materno/fetal organ
- No exchange of blood
- Many different roles
 - can be "sampled" as part of a prenatal diagnostic test
- interaction between implanting conceptus and uterine wall (endometrium)
- The uterine lining following implantation (Decidua)
 - forms 3 distinct regions, at approx 3 weeks
 - **Decidua Basalis** - implantation site
 - **Decidua Capsularis** - enclosing the conceptus
 - **Decidua Parietalis** - remainder of uterus
- uterine cavity is lost by 12 weeks

Term Placenta



(/embryology/index.php/File:Placenta_term_anatomy_01.jpg)

Fetal side

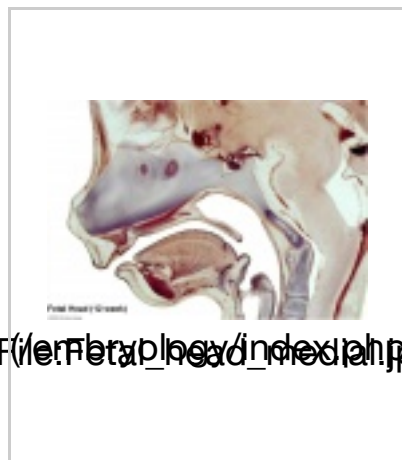
Maternal side

Second and Third Trimester

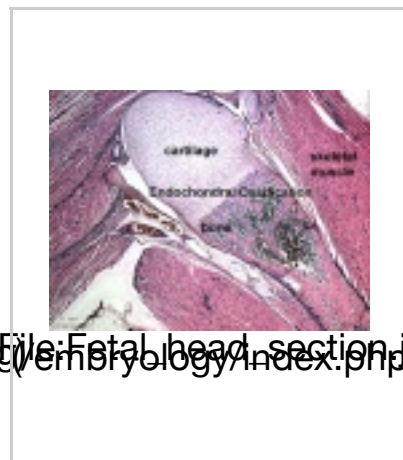
- **Week 9 to 37** - Fetal Development
- Continuing growth and differentiation of organs formed in embryonic period
 - some organs have a later development - neural, genital, respiratory, bones
 - some continue to develop after birth - neural, genital, respiratory, bones
- growth in size, length (Second Trimester)
- growth in weight (Third Trimester)



Fetal Head 12 cartilage and bone formation (12 week)

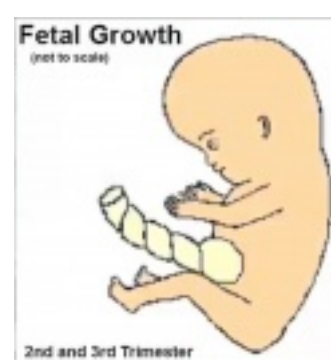


Fetal Head head structures and the brain (12 week)



Fetal knee region

(/embryology/index.php/File:Fetal_head_12_week.jpg) (/embryology/index.php/File:Fetal_head_section.jpg) (/embryology/index.php/File:Endochondral_bone.jpg)



(/embryology/index.php/Fetal_Development)



(/embryology/index.php/Ultrasound_-_Fetus_12_week)



(/embryology/index.php/Ultrasound_-_Fetus_19_week)

Postnatal Development

Birth

- birth (parturition) is a complex physiological process between the fetus and mother
- thought to be initiated by the fetus

Maternal Birth Stages

1. Dilatation
2. Expulsion
3. Placental
4. Recovery

Australian Birth Rate 1998-2007 (/embryology/index.php/File:Australian-births_2007.png)

Newborn

Newborn (perinatal (/embryology/index.php/P#perinatal)) needs to activate many systems and establish independent regulation (homeostasis (/embryology/index.php/H#homeostasis))



- **Lung function** - Fluid drainage, Gas exchange, muscular activity
- **Circulatory changes** - Closure of 3 vascular shunts
- **Thermoregulation** - metabolic rate, fat metabolism
- **Nutrition** - gastrointestinal tract function, peristalsis
- **Waste** - kidney function
- **Endocrine function** - loss of placenta, maternal hormones

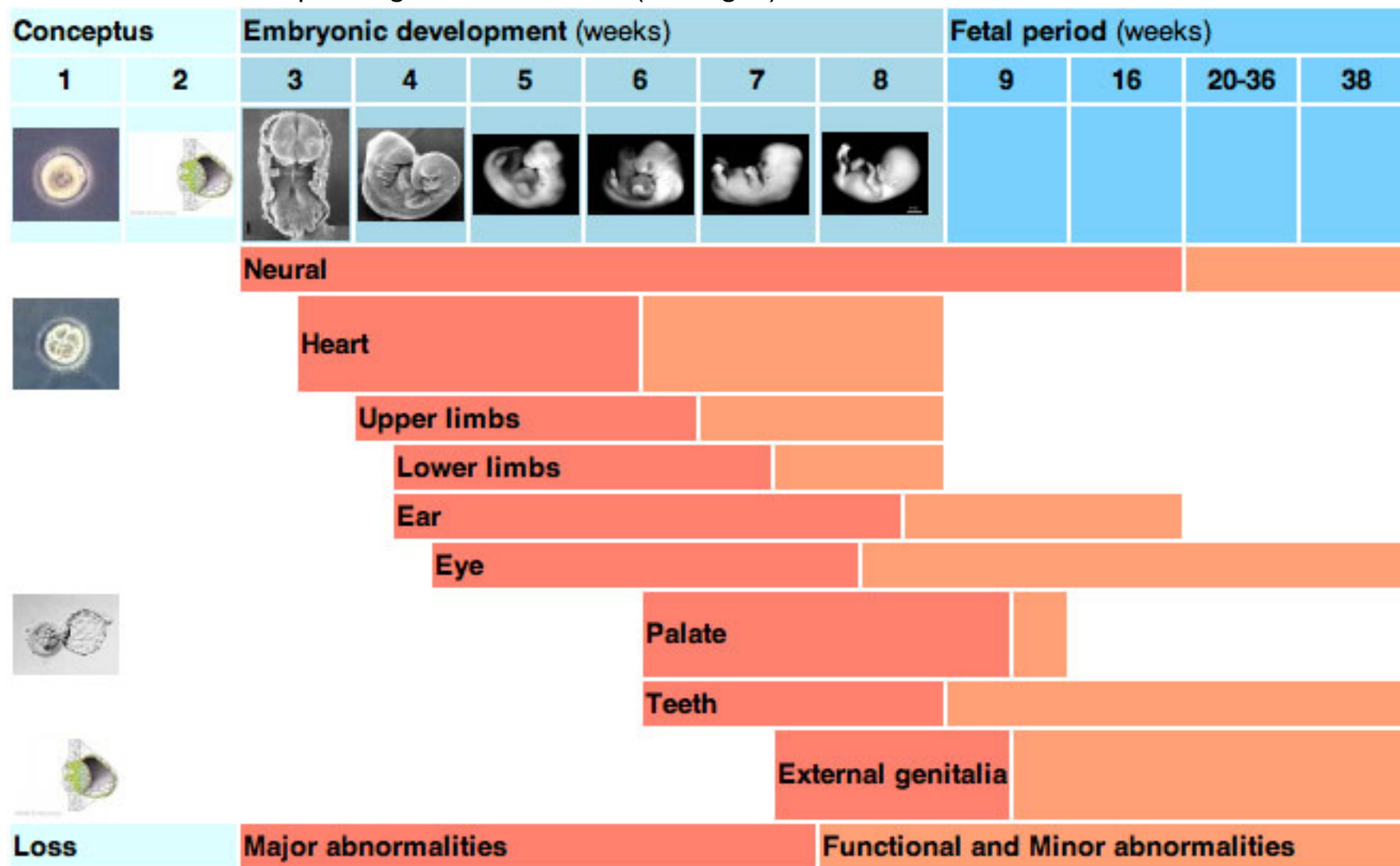
(/embryology/index.php/File:Galletti1770_birth.j
Historic teaching model of birth

Abnormal Development

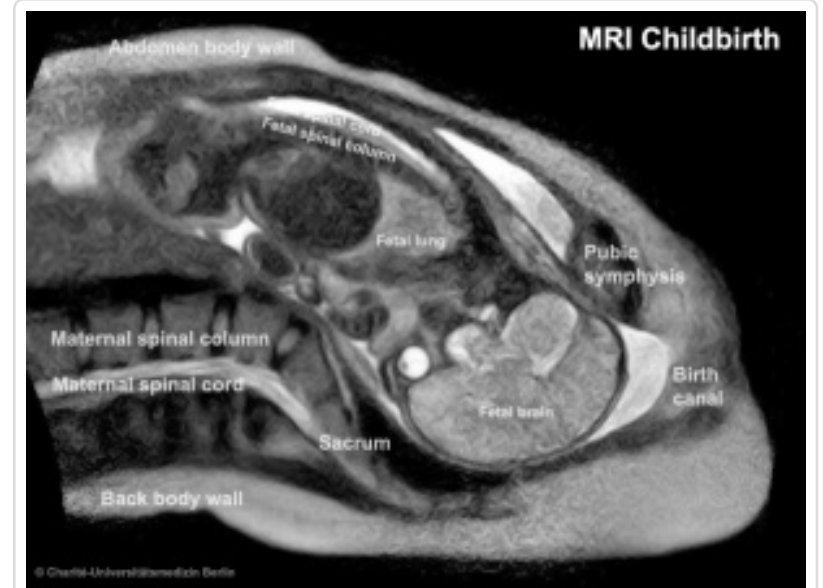
Critical Periods of Development

Three main causes:

1. Genetic
2. Environmental
3. Unknown
 - First trimester most critical
 - Different effect depending on time of insult (teratogen)



(/embryology/index.php/File:Human-critical_periods_of_development.jpg)



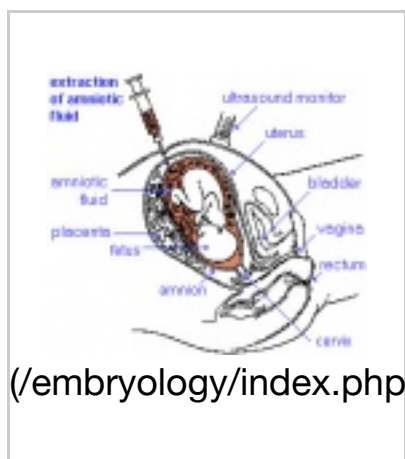
(/embryology/index.php/File:Birth-
_Magnetic_Resonance_Imaging_02.jpg)
MRI Birth



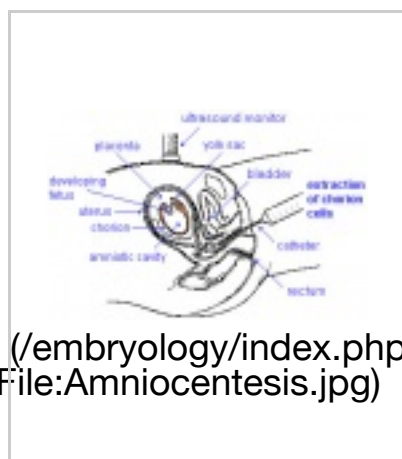
(/embryology/index.php/File:Newborn.jpg)
Newborn infant (perinatal period)

Diagnosis

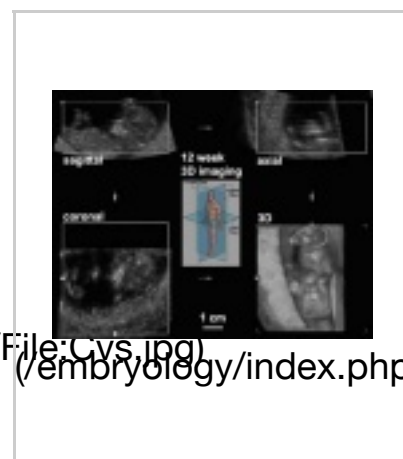
- Prenatal diagnosis - number of different techniques (non-invasive, invasive) for determining normal development
- Neonatal diagnosis (APGAR test (/embryology/index.php/A#APGAR), Guthrie test (/embryology/index.php/G#Guthrie_test))
- Maternal diagnosis - often pregnancy will expose maternal health problems



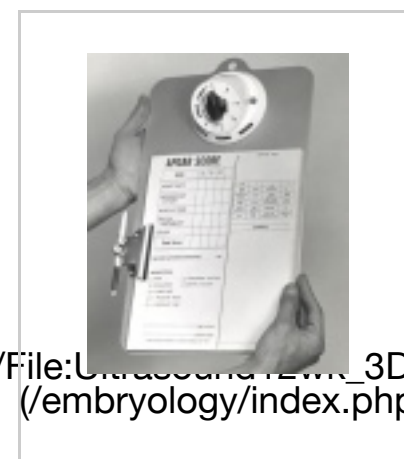
Amniocentesis



Chorionic Villus Sampling



Ultrasound



Apgar scoresheet



Guthrie card



Xray congenital dislocation hip



Newborn hearing test

Finished! (/embryology/images/3/39/Dancing_baby.mp4)

Additional Information

Content shown under this heading is not part of the material covered in this class. It is provided for those students who would like to know about some concepts or current research in topics related to the current class page.

Revision Notes

- You don't need to know everything today, this is an introduction.
- Use the glossary to help understand new terms.
- Don't confuse "germ cell layers" (ectoderm, mesoderm, endoderm) with "germ cells" (egg, spermatazoa).
- Remember the difference between "clinical weeks" (last menstrual period) and "embryonic weeks" (from ovulation/fertilisation, 2 weeks later).
- With abnormalities
 - think about the types of prenatal diagnostic techniques that are now available
 - the 2 major types (genetic and environmental)
 - the effect of maternal age/health/lifestyle.

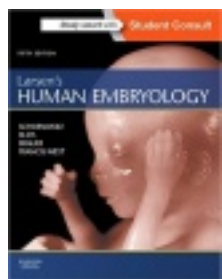
Textbooks



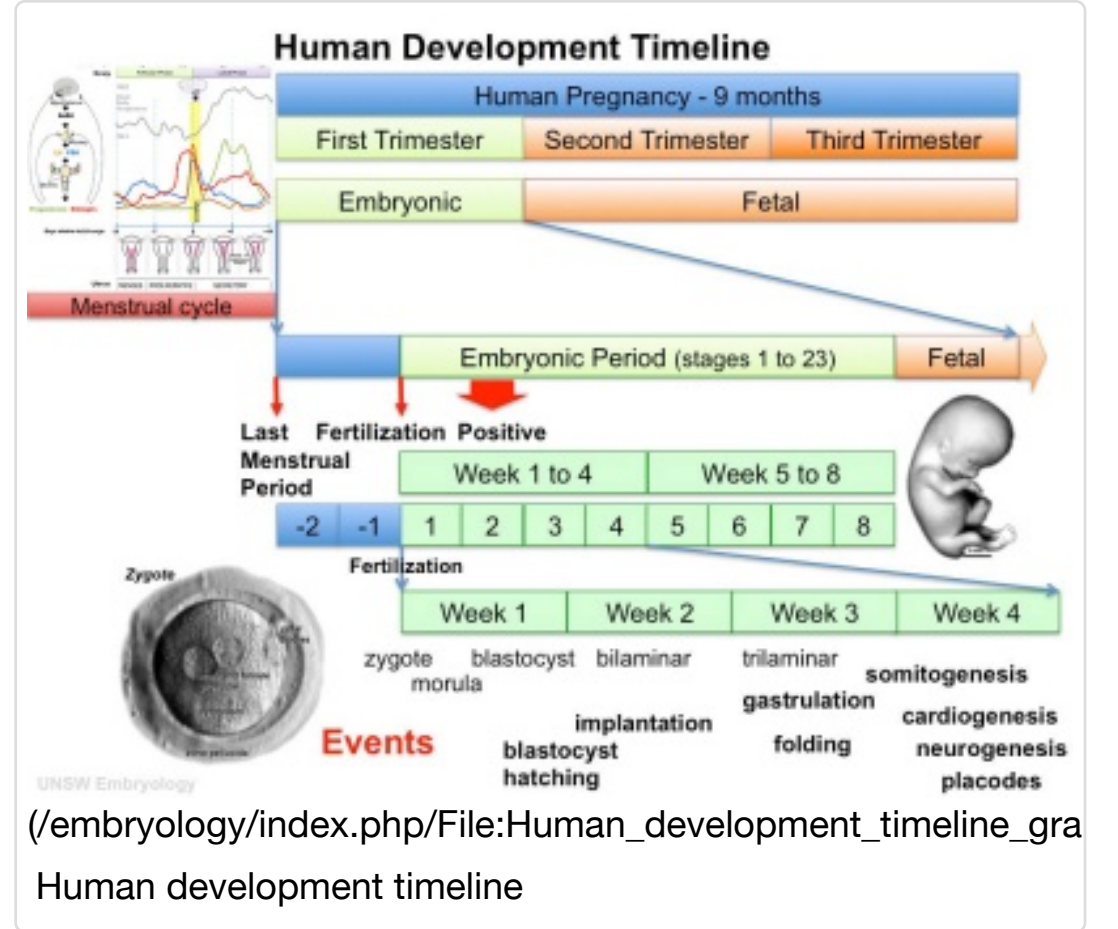
(/embryology/index.php/File:Logo.png)



(/embryology/index.php/File:The_Developing_Human,_10th_edn.jpg)



(/embryology/index.php/File:Larsen%27s_human_embryology_5th_ed.jpg)



Hill, M.A. (2017). *UNSW Embryology* (17th ed.) Retrieved April 9, 2017, from <https://embryology.med.unsw.edu.au> (<https://embryology.med.unsw.edu.au>)

- Menstrual Cycle (/embryology/index.php/Menstrual_Cycle) | Oocyte (/embryology/index.php/Oocyte) | Spermatozoa (/embryology/index.php/Spermatozoa) | Meiosis (/embryology/index.php/Cell_Division_-_Meiosis) | Mitosis (/embryology/index.php/Cell_Division_-_Mitosis)
- Fertilization (/embryology/index.php/Fertilization) | Zygote (/embryology/index.php/Zygote) | Morula (/embryology/index.php/Morula) | Blastocyst (/embryology/index.php/Blastocyst) | Implantation (/embryology/index.php/Implantation)
- Week 1 (/embryology/index.php/Week_1) | Week 2 (/embryology/index.php/Week_2) | Week 3 (/embryology/index.php/Week_3)
- Science Lecture - Fertilization (/embryology/index.php/Lecture_-_Fertilization) | Lecture - Week 1 and 2 (/embryology/index.php/Lecture_-_Week_1_and_2_Development)
- Australian Statistics (/embryology/index.php/Australian_Statistics)

Citation: Moore, K.L., Persaud, T.V.N. & Torchia, M.G. (2015). *The developing human: clinically oriented embryology* (10th ed.). Philadelphia: Saunders.

UNSW Students have online access to the current 10th edn. through the UNSW Library subscription

(<http://www.unsw.eblib.com.wwwproxy0.library.unsw.edu.au/patron/FullRecord.aspx?p=2074364>).

Links: UNSW Library

(<http://www.unsw.eblib.com.wwwproxy0.library.unsw.edu.au/patron/FullRecord.aspx?p=2074364>) | NLM ID: 101649439 (<http://www.ncbi.nlm.nih.gov/nlmcatalog/101649439>)

Chapter 1 - Introduction to the Developing Human

Schoenwolf, G.C., Bleyl, S.B., Brauer, P.R., Francis-West, P.H. & Philippa H. (2015). *Larsen's human embryology* (5th ed.). New York; Edinburgh: Churchill Livingstone.

UNSW students have full access to this textbook edition through UNSW Library subscription (<http://er.library.unsw.edu.au/er/cgi-bin/eraccess.cgi?url=http://www.unsw.eblib.com.wwwproxy0.library.unsw.edu.au/patron/FullRecord.aspx?p=2074524>) (with student Zpass log-in).

(with student Zpass log-in).

Read the introduction before Chapter 1.



(/embryology/index.php/File:Foundsmall.jpg) Foundations Practical - Introduction to Human Development (/embryology/index.php/Foundations_Practical_-_Introduction_to_Human_Development)

Glossary Links

A (/embryology/index.php/A) | B (/embryology/index.php/B) | C (/embryology/index.php/C) | D (/embryology/index.php/D) | E (/embryology/index.php/E) | F (/embryology/index.php/F) | G (/embryology/index.php/G) | H (/embryology/index.php/H) | I (/embryology/index.php/I) | J (/embryology/index.php/J) | K (/embryology/index.php/K) | L (/embryology/index.php/L) | M (/embryology/index.php/M) | N (/embryology/index.php/N) | O (/embryology/index.php/O) | P (/embryology/index.php/P) | Q (/embryology/index.php/Q) | R (/embryology/index.php/R) | S (/embryology/index.php/S) | T (/embryology/index.php/T) | U (/embryology/index.php/U) | V (/embryology/index.php/V) | W (/embryology/index.php/W) | X (/embryology/index.php/X) | Y (/embryology/index.php/Y) | Z (/embryology/index.php/Z) | Numbers (/embryology/index.php/Numbers) | Symbols (/embryology/index.php/Symbols)

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What Links Here? (http://php.med.unsw.edu.au/embryology/index.php?title=Special:WhatLinksHere/Foundations_Lecture_-_Introduction_to_Human_Development)

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Categories (</embryology/index.php/Special:Categories>): [Medicine](/embryology/index.php/Category:Medicine) (</embryology/index.php/Category:Medicine>)
| [Foundations](/embryology/index.php/Category:Foundations) (</embryology/index.php/Category:Foundations>) | [2017](/embryology/index.php/Category:2017) (</embryology/index.php/Category:2017>)

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