Human Embryonic Development

Human fetal development

- **Day 1: 1\textsuperscript{st} cleavage**
  - 1 cell becomes 2 (2-cell stage)

- **Day 2: 2\textsuperscript{nd} cleavage**
  - 4-cell stage

- **Day 3: 6-12 cell stage**
  - can test at this stage for genetic diseases if done by IVF

- **Day 4: 16-32 cell stage**
  - solid ball of cells = morula
Ovulation to implantation

From ovulation to implantation

Day 0: Ovulated secondary oocyte

Day 1:
- Fallopian tube
- Zygote

Day 2:
- 2 cells
- 4 cells
- Fertilization

Day 3:
- Day 3 cell mass

Day 4:
- Inner cell mass
- Blastocyst implants

Day 5:
- Solid morula develops into hollow, fluid-filled blastula
- Embryo will develop from the inner cell mass, or embryonic disc

Day 6-7:
- Blastocyst attaches to the endometrium (uterine lining) & burrows in: implantation
- Blastocyst starts to secrete HCG = human chorionic gonatotropin
  - Stimulates estrogen & progesterone to prevent menstrual flow
  - Causes "morning sickness" in some women...
  - Pregnancy test measures the amount of this hormone!
Human fetal developmental

Days 10 - 14:
- Pregnancy becomes established
- Fluid filled amniotic cavity starts to form
- Yolk sac starts to form
  - Will make blood cells, germ cells
- Embryo starts to form from embryonic disc
- Chorion (placenta) starts to form

At the end of this stage, a woman will have just missed her period!

Day 14

Human fetal developmental

Days 15 - 21:
- Emergence of the vertebrate body plan
  - Primitive streak starts to form
    - The site of gastrulation (formation of 3 tissue layers = ecto, endo, and mesoderm)
- Neural groove begins to form
  - Future spinal cord & brain
- Somites begin to form
  - Bands of tissue that will become muscles & bones
- Pharyngeal arches begin to form
  - Future face, neck, mouth, nose
Vertebrate body plan

Day 19

Human embryonic developmental

- Week 3 - Week 8 = **embryo**
  - development of all organ systems
- Day 22: the heart begins to beat

Day 28
Week 4

Day 24
Human embryonic development

- embryo showing tail & limb buds

beginning of the eye can be seen, as well the bulging heart & the umbilical cord
Human embryonic development

- lens of the eye can be seen forming, the mass of the heart bulging from the chest, & the beginnings of the finger rays
Human embryonic development

- beginning of the ear is clearly seen

Note the bend of the elbow joint has begun, the fingers are forming and toes are beginning to bud off the foot.

Human embryonic development

- Note the formation of the nose, eyelids, ear flap & well defined toes & fingers

Both the knee & the elbow are visible. 50–60 days: the embryo has formed most of basic organ systems & will spend remainder of development in “fetal” period. Organs grow, mature, & begin to learn their respective functions.
Day 52:
- First brain waves can be detected
- Weeks 4-8 is when all major organ systems of the body are formed & when most teratogens have greatest effect

Week 8

Week 10
Human fetal development

- At 15 weeks the embryo begins to take on more of a typical baby’s form & the attachment of umbilical cord can be clearly seen

Week 15

Human fetal development

- Week 9 - week 40 = fetus
  - after 12 weeks or so, the baby’s development is largely "finished"
    - some exceptions: brain & lung development

Week 16
Human fetal development

- The fetus just spends much of the 2\textsuperscript{nd} & 3\textsuperscript{rd} trimesters just growing
  
  ...and doing various flip-turns & kicks inside amniotic fluid

Week 20

Human fetal development

- 24 weeks (6 months)

fetus is covered with fine, downy hair called lanugo.
It’s skin is protected by a waxy substance called vernix
Human fetal development

30 weeks

The fetus sleeps 90-95% of the day & sometimes experiences REM sleep, an indication of dreaming.
The end of the journey!