Would you look at that? They're making a baby right in the front yard!

It's disgraceful.
Hmmm...

I thought it would have been 20.
Plenty of sex myths about…

• Be careful swimming around an octopus.

• And what about the size of your hands???
1. Both asexual and sexual reproduction occur in the animal kingdom

- **Asexual reproduction** - genes all come from one parent.
  - clones

- **Sexual reproduction** is the formation of offspring by the fusion of haploid **gametes**.
  - **Ovum**: usually large and nonmotile.
  - **Spermatozoon**: usually small and motile.

- Sexual reproduction increases genetic variation among offspring. One more time….HOW???
Advantages of asexual reproduction: Why Sex VT

- Can reproduce without needing to find a mate
- Can have numerous offspring in a short time
- In stable environments, allows for the perpetuation of successful genotypes.
- Sexual reproduction’s advantage occurs in changing environments where variation provides the natural selection process with adaptive choices.
• **Pheromones**: chemical signals released by one organism that influence the behavior of other individuals of the same species. Moths are a classic example…

• Many act as male attractants.

• Often these attractants are combined with deception as a female plots to secure mates, often behind our very backs, men…
Courtship behavior

- Ritualistic behaviors are often paired with certain structures, colors, etc. to help secure mates.
- What ancestor do you think is in this family tree?
- This is an example of what kind of selection?
- A male peacock’s tail feathers are a classic example, as is the mane of a male lion.
2.E.3.b.3. Explain, using one of the examples below, how behaviors in animals are triggered by environmental cues and why/how this behavior is vital to reproduction, natural selection and survival.

- Hibernation
- Estivation
- Migration
- Courtship
Are you a real Ponte Vedra shark?

• The gonads of sharks lie up high in their chest area, well protected by the surrounding body wall.

• Human ovaries are much lower, and testes have evolved to drop during development to be effectively (but not actually) outside the body.

• Remember we evolved from fish. Hold that thought and we will return to it…
1. Human reproduction involves intricate anatomy and complex behavior

- Reproductive Anatomy of the Human Male.
  - The scrotum and the penis are the external components of the reproductive system.
  - The internal reproductive organs consist of gonads, accessory sex glands, and ducts.
  - Here we see many examples of how structure is related to function. Your friend Billy Barnacle is a classic example.
  - Let’s watch or Here, 1:00 maybe. Spermatogenesis
  - Or here 1:40 anatomy
We're proud of our privates.

U.S. ARMY
• Testes are located in the scrotum, outside the body cavity.

• This keeps testicular temperature cooler than the body cavity.

• The testes develop in the body cavity and descend into the scrotum just before birth.
Back to that shark with its gonads in its chest

- When human testes evolved to drop into the scrotum and its cooler temperature, the process created a pouch in the body wall, making this a weak spot.
- When we strain our abdominal muscles as in lifting something heavy, some intestine might get squeezed through this weak spot.
- This is a hernia, and this is why ladies don’t get them as often as gentlemen.
So what’s the deal with Viagra?

- Viagra inhibits the enzyme PDE5 that breaks down cyclic GMP. The signal molecule NO, nitric oxide, a local regulator, causes the release of cyclic GMP. Produced during arousal, it causes the muscular and vascular changes that lead to erection. Men who don’t produce enough cyclic GMP or who break too much of it down because they produce high levels of PDE5 will have trouble maintaining an erection, so inhibiting PDE5 will help in either case.
Is this a genetic thing?

• Viagra doesn’t have the same effect on all men. Cyclic GMP needs specific receptors on the affected cells in order to work. Men whose genes cause them to have more receptors will have less ED (erectile dysfunction) problems than those with a smaller number, a variation that can’t be corrected by viagra. Viagra only works for men with too little cyclic GMP or too much PDE5. Blame mom and dad.
• **Ovaries** are the female gonads, homologous to testes.

  • Located in the abdominal cavity.  
  
  • Flanking, and attached by mesentery to, the uterus.

  • Each ovary is enclosed in a tough protective capsule.

  • Each ovary contains **follicles**.
• Each follicle consists of one egg cell surrounded by one or more layers of follicle cells.

• Follicles produce the primary female sex hormones: estrogens.

• Follicle cells nourish and protect the developing egg cell.

• A woman is born with about 400,000 follicles.

• Only several hundred will release eggs during a female’s reproductive years.
• Usually one follicle matures and releases its egg during each menstrual cycle.

• After ovulation the remaining follicular tissue develops into the corpus luteum, Latin for “yellow body”.

• It secretes estrogens and progesterone.

• This maintains the lining during pregnancy.

• If pregnancy does not occur the corpus luteum disintegrates.

Fig. 46.10
At ovulation the egg is released into the abdominal cavity near the opening of the oviduct. Let’s watch

- The cilia-lined funnel-like opening of the oviduct draws in the egg.
- Cilia convey the egg through the oviduct to the uterus.

- **Endometrium**: highly vascularized inner lining of the uterus.

- The neck of the uterus, the cervix, opens into the vagina.

- The vagina is a thin-walled chamber that forms the birth canal and is the repository for sperm during copulation.
2. Spermatogenesis and oogenesis both involve meiosis but differ in three significant ways

- **Spermatogenesis** is the production of mature sperm cells from spermatogonia.
  - This is a continuous and prolific process in the adult male.
  - Each ejaculation contains 100 – 650 million sperm.
  - Occurs in seminiferous tubules.
  - As spermatogenesis progresses the developing sperm cells move from the wall to the lumen of a seminiferous tubule.
• Sperm structure:

  • Haploid nucleus.

  • Tipped with an **acrosome**.

  • Contains enzymes that help the sperm penetrate to the egg.

  • A large number of mitochondria provide ATP to power the flagellum.

![Diagram of sperm structure with labels](Image)

Fig. 46.12
Fig. 46.13

Primordial germ cell in embryo

Differentiation

Oogonium

2n

Mitotic division

Differentiation and onset of meiosis I

Primary oocyte

2n

Completion of meiosis I and onset of meiosis II

Secondary oocyte

n

First polar body

Ovulation

Entry of sperm triggers completion of meiosis II

Ovum

n

Second polar body

(a)

(b)

1. Primary oocyte within follicle

2. Growing follicle

3. Mature follicle

4. Ovulation

5. Corpus luteum

6. Degenerating corpus luteum

Ruptured follicle

Ovary

Secondary oocyte

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• The Female Pattern.

• A cyclic pattern of hormone secretion and reproductive events.

• Humans and many other primates have menstrual cycles.

• If pregnancy does not occur the endometrium is shed through the cervix and vagina: menstruation.
The Reproductive Cycle of the Human Female.

- **Menstrual cycle**: changes that occur in the uterus.
  - **Day 1**: the first day of menstruation.
  - **Menstrual flow phase**.
    - **Menstrual bleeding**.
    - **Usually lasts for a few days**.
• Proliferative phase.
  • Regeneration and thickening of the endometrium.
  • About 1 – 2 weeks in duration.

• Secretory phase.
  • Continued endometrial thickening, increased vascularization of the endometrium, endometrium develops glands that secrete a glycogen-rich fluid, has a duration of about 2 weeks.
If, by the end of the secretory phase, an embryo has not implanted in the uterus a new menstrual flow commences.
• Ovarian cycle.
  • Follicular phase.
    • Several ovarian follicles begin to grow.
      • The developing egg enlarges.
      • Coat of follicle cells thickens.
    • Usually only one follicle continues to develop, the others disintegrate.
    • The follicular phase ends with ovulation.
      • Follicle and adjacent wall of the ovary rupture
      • Secondary oocyte is released.
- Luteal phase.
- Follicular tissue remaining in the ovary develops into the corpus luteum.
- Secretes estrogens and progesterone.
Hormonal coordination of the menstrual and ovarian cycles involves five hormones:

- Gonadotropin releasing hormone (GnRH) secreted by the hypothalamus.
- Follicle-stimulating hormone (FSH) secreted by the anterior pituitary.
- Luteinizing hormone (LH) secreted by the anterior pituitary.
- Estrogens secreted by the ovaries.
- Progesterone secreted by the ovaries.
Menopause: cessation of ovarian and menstrual cycles.

- Usually occurs between ages 46 and 54.
- Due to ovaries decreased responsiveness to gonadotropins, LH and FSH.
- Can cause mood swings.
4. Embryonic and fetal development occur during pregnancy in humans and other eutherian (placental) mammals

- From Conception to Birth.
  - In placental mammals, pregnancy is the condition of carrying one or more embryos.
    - Pregnancy is preceded by conception and continues until birth.
  - A human pregnancy averages 266 days.
Human gestation is divided into three trimesters.

First trimester.

- Fertilization occurs in the oviduct.

- 24 hours later the zygote begins cleavage.

- 3-4 days after fertilization it reaches the uterus; the embryo is a ball of cells.

- It takes about 1 week past fertilization for the blastocyst to form.

- After 5 more days it implants in the endometrium.
Fig. 46.16

From ovulation to implantation

1. Ovulation
2. Fertilization
3. Cleavage starts
4. Cleavage continues
5. The blastocyst implants

ENDOMETRIUM
Inner cell mass
Blastocyst
Cavity
• For the first 2 – 4 weeks of development the embryo obtains nutrients from the endometrium.

• Then the placenta provides for the diffusion of material between maternal and embryonic circulations.
You know what's funny? Paintings of Adam & Eve where they both have belly buttons. Think about that, take as much time as you need.
Maternal changes during the first trimester.

- The embryo secretes **human chorionic gonadotropin (HCG)**. This is what home pregnancy tests detect. Manny Ramirez can tell you what it does for him!!

- Maintains the corpus luteum and thus maintains the endometrium.

  - High levels of progesterone cause:
    - Increased mucus in the cervix.
    - Growth of the maternal part of the placenta.
    - Enlargement of the uterus.
    - Cessation of ovarian and menstrual cycling.
    - Breasts enlarge and are often very tender.
• Third trimester.
  • Fetus grows rapidly.
  • Fetal activity may decrease as the fetus fills the space available to it.
  • Maternal abdominal organs become compressed and displaced.
  • Terminates with parturition (fancy name for birth).
  • A decrease in progesterone levels triggers the release of oxytocin, then this POSITIVE feedback starts…
Hormonal regulation of birth.
- **Parturition** occurs as a result of labor.

- First stage: opening up and thinning of the cervix.

- Ending in complete dilation.

- Second stage: Expulsion of the baby as a result of strong uterine contractions.

- Third stage: Expulsion of the placenta.
Contraception can work in several ways.

- Chemical contraceptives, birth control pills.
  - Pills contain estrogen and progesterone, “fooling” the brain into thinking there is an embryo, therefore inhibiting the release of LH (= no ovulation)
    - Modern pills contain much less est. and progest.
  - Prevent the release of eggs.
- Spermicides
  - A vasectomy prevents the release of sperm. But watch this!
  - Tubal ligation cuts and ties oviducts.
- Barrier methods prevent egg and sperm from meeting.
  - Condoms and diaphragms
  - Prevent embryo from implanting. IUD’s
- Abort the embryo.