Summary: Reproduction and Embryonic Development

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April 9, 2020

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1 The nature of asexual reproduction

Reproduction, or "the creation of new individuals from existing ones" is essential to the continuation of life over the lifespan of an organism. **Asexual reproduction** is one permutation of the two types of reproduction: sexual reproduction and asexual reproduction. In contrast to *sexual* reproduction, *asexual* reproduction poses no stipulations as to genetic diversity, nor the ability of a parent organism to find a mate: an organism may reproduce without sex via budding, fission, or the process of fragmentation and regeneration, for example.

Advantages	Disadvantages
Allows animals that live in isolation to produce offspring	Produces genetically uniform populations
Perpetuates a particular genotype precisely and rapidly	

Table 1: Advantages and disadvantages associated with asexual reproduction

2 The nature of sexual reproduction

Sexual reproduction, or "the creation of genetically unique offspring by the fusion of two haploid sex cells (gametes), orming a diploid zygote" is an alternative pathway to "reproduction" in organisms where the **fertilization** of **gamete** cells—sex cells with n chromosomes—is the desired mode of reproduction. In organisms where the mode of reproduction involves such fertilization, there exist two types of gametes:

- **Sperm**, the male gamete: travels by means of a flagellum

  and the

- **Egg**, the female gamete: is not self-propelled

The fusion of the two aforementioned cells leads to the formation of a **zygote**, which develops into a new individual.

In contrast with asexual reproduction, sexual reproduction increases genetic diversity in the resulting population through random fertilization and meiosis. The combination of these randomization factors results in the principal force of natural selection: genetic variability.

While the aspect of variability associated with sexual reproduction might be attractive for various mobile species, for isolated or immobile organisms, sexual reproduction is implausible, as it requires a mate with which to procreate. This inconvenience is addressed by the development of **hermaphroditism**, or the existence of both female and male reproductive systems in a single organism—"perfect" flowers with both stamens and carpels, are an example of such a development. The development of hermaphroditism can be seen as advantageous, as it allows for animals to reproduce with respect to environmental conditions.

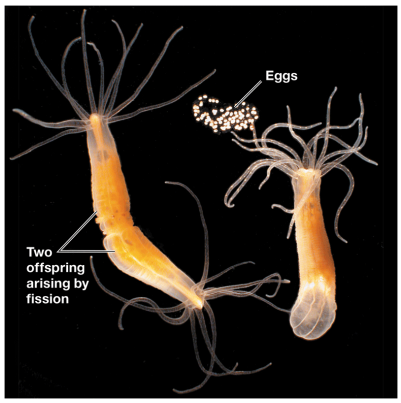

Figure 1: The utilization of both asexual and sexual reproduction in the hydra.

2.1 Different mechanisms for sexual reproduction

Even with respect to sexual reproduction, there exist two separate development of reproductive mechanisms:

- **Reproduction by external fertilization**: gametes are released into and fuse in the environment—this is common in various acquatic animals
- **Reproduction by internal fertilization**: sperm are depsoited in or near the female reproductive tract

3 The human female reproductive system

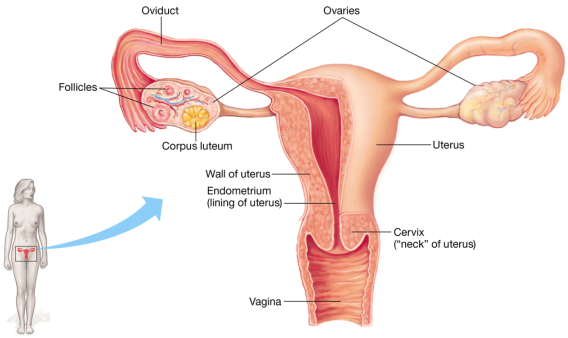

Figure 2: A diagram of the female human reproductive system.

The **ovaries** are the gamete-producing organs in the female reproductive system, and can be described as having a "bumpy" surface—caused by the **follicles** that both produce estrogen and enclose a developing egg cell.

In the process of **ovulation**, a female will release an immature egg via the cilia lining the **oviduct**, or *fallopian tube*— after starting puberty, of course—as a result of the maturation of a follicle, every 28 days. In addition, after having matured and formed the **corpus luteum**, a follicle will begin to release progestrone, alongside additional estrogen, complementing the maintainence of the uterine lining. This process usually ceases near the age of 50.

With consideration to the above structural definitions, the following statements regarding the development of a zygote, and the eventual birth of a human fetus can be made:

1. When ovulation occurs, if sperm are present in the upper part of the oviduct, fertilization may occur.
2. After fertilization occurs, the zygote should continuously divide as it traverses the oviduct, eventually becoming an embryo.
3. In the **uterus**—the site of pregnancy[1]—, an **embryo** will be deposited in the inner lining of the uterus **endometrium**.
4. After implantation, the embryo will complete development until the 8th week of pregnancy, when the developing human will, henceforth, be referred to as a **fetus**.
5. After continued development of the fetus, the **vagina** will serve as the canal through which the baby is born. The vagina is separated from the uterus by the **cervix**—the "neck" of the uterus.

In addition to each of the aforementioned structures utilized in embryonic and fetal development, various external structures collectively referred to as the **vulva** provide functionality in copulation[2]:

- In sexual intercourse, the **vagina** serves as a repository for sperm, and is guarded by the **labia minora** and **labia majora**.
- Though it does not provide additional *necessary* functionality in reproduction, the **clitoris**—an erectile organ consisting of a short shaft, followed by the **prepuce**, a small hood of highly sensitive skin—does serve a purpose in reproduction in that it evokes a highly presurable sensation when stimulated. As do the vagina and th elabia minor, this organ enlarges during sexual activity as a result of increased concentration of blood in the area.

[1] In rare cases, an **ectopic pregnancy** may commence, where an embryo implants itself in the oviduct, potentially rupturing surrounding tissues.

[2] The **hymen** could be categorized as one such structure, but provides little functionality in reproduction, and is ruptured in vigorous physical activity or intercourse.

4 The human male reproductive system

As is the case with many other mammals, the natural temperature of the human body presents a challenge for the proper development of sperm cells within the **testes**—the male gonads. That is, in humans, the most desirable temperature for sperm development is approximately 2°C less than the normal human body temperature of 36.5–37.5°C. In humans, the **scrotum** solves this dilemma by keeping sperm-forming cells within the acceptable temperature range.

After a sufficient volume of sperm cells have been produced in the testes, sperm leave the gonads through the **epididymis**, where sperm cells will continue to develop until **ejaculation**.