

3. Infertility and ART

1/5 couples has low fertility

many reasons for infertility

equally likely = male or female deficit

male fertility declining- environmental?

a. Assisted reproductive technologies (ART)

Try to overcome infertility.

b. Often use **in vitro fertilization (IVF)** with donated sperm, eggs

IVF entails hormonal stimulation so that many eggs mature in one month (“**superovulation**”)

Normally, in humans, many oocytes begin to mature (complete meiosis and grow larger), but competition for FSH is involved in ensuring that only one egg matures each month.

Superovulation requires injections of GnRH + FSH and then LH to circumvent normal hormonal feedback loops.

Mature eggs are retrieved via minor surgery.

This, plus the discomfort of hormone injections explains why an egg donor is paid about 10 times more than a sperm donor!

Egg + sperm mixed in tube or dish. Sperm are usually treated with a solution that encourages **capacitation**.

A few days later, healthy looking early embryos (blastocysts) that have undergone normal cell division are introduced into a recipient uterus. The recipient has been hormonally treated so that the uterus is receptive for the embryo, to encourage it to implant. Progesterone is especially important here.

c. In cases of severe male infertility non-motile or immature sperm (haploid) can be injected into an egg using **Intracytoplasmic Sperm Injection (ICSI)**.

d. Preimplantation Genetic Diagnosis (PGD) addresses specific genetic traits. For example, a couple may want to ensure that an embryo is not carrying mutations in both copies of the gene involved in cystic fibrosis (a recessive condition).

For PGD, after IVF, a single cell (blastomere) is removed and used in a PCR reaction with the genomic DNA to examine the presence of specific mutations in one or more specific genes. This is tricky from a single nucleus! The remainder of the embryo is maintained in culture and after the PCR has been performed, the decision on whether to implant the embryo is made.

e. In alternate procedures, most usually **amniocentesis**, sloughed off cells are collected from older embryos in utero (about 16 weeks after fertilization) using a needle inserted into the amniotic cavity. These cells are used in PCR diagnosis or in chromosome “spreads”. In the latter, chromosome-specific probes are used in a hybridization reaction, and the number of chromosomes or translocations can be examined. The decision can then be made whether to continue a pregnancy.

More to say about ART when we discuss stem cells and cloning