Population, Fertilization, & Reproductive Technologies

Barry Bean for BioS 10 & 90  5 October 2011
Historic and Projected Population Growth

13 years

To add the next 1 billion people

8 Billion 2024
7 Billion 2011
6 Billion 1999
5 Billion 1987
4 Billion 1974
3 Billion 1960
2 Billion 1930
1 Billion 1800

Sources: Carl Haub, Population Reference Bureau (PRB), 2010; U.N. Population Division (UNPD), 2011
World Population Growth, 1950–2050 (medium variant)

- More developed countries
- Other less developed countries
- Africa
- China
- India

9.3 Billion

SOURCES: UNPD, 2011
World Population Growth Through History

All sexually reproducing organisms do something like this!

Zygo- = yoked, paired [Greek]

from Sylvia Mader, Human Reproductive Biology, 3rd ed.
The most important day of your life...
World Population Clock

math.berkeley.edu/~galen/popclk.html
from Sylvia Mader, Human Reproductive Biology

250 m

0.16 miles
From Alberts et al., Molecular Biology of the Cell, 5th ed., 2008
Duration of spermatogenesis
Mean: 74 days   95% CI: 69 - 80 days
Not affected by DSP/g or frequency of emission

Epididymal transit time
Caput+corpus: 0.7 - >3.5 days
Cauda: 1.5 - >4.5 days
Transit time varies with DSP/testis

DSP = daily sperm production $\sim 10^8$/day

Consider the role of each compartment…

from Sylvia Mader, Human Reproductive Biology, 3rd ed.
Timeline for human prenatal oogenesis
Oogenesis and cell death in human prenatal ovaries: what are the criteria for oocyte selection?
1. Primary follicles contain oocyte and begin producing the sex hormone estrogen.

2. Secondary follicles contain secondary oocyte and produce the sex hormones estrogen and some progesterone.

3. Vesicular (Graafian) follicle develops.

4. Ovulation: The secondary oocyte is released.

5. Corpus luteum produces the sex hormones progesterone and some estrogen.

6. Corpus luteum degenerates.

from Sylvia Mader, Human Reproductive Biology, 3rd ed.
Fertilization

Green = Acrosome
Purple = Zona Pelludica
Gray = Sperm w/out Acrosome

**note that the acrosome compartment opened after contact with the zona pellucida**

http://www.nature.com/fertility/content/images/ncb-nm-fertilitys57-f1.jpg
Gametes are prefabricated for action, a cascade of functions.

Gamete production includes unique patterns of gene expression and regulation.

Gametes have complex structure and many phenotypes.

Every Gamete is a genetically distinct human individual!
Try to remember... when you were gametes!

Think like a sperm...

Think like an oocyte...
Adapted from
Barratt et al. Journal of Biology 2009 8:63
From Alberts et al., Molecular Biology of the Cell, 5th ed., 2008
And then…

from Sylvia Mader, Human Reproductive Biology
Reproductive Technologies

Half of Pregnancies are Unwanted…

Contraception

Infertility    Subfertility
Reproductive Technologies

Donor or husband insemination

Intrauterine insemination

Sperm cryopreservation

Embryo cryopreservation and now, oocyte cryopreservation

In Vitro Fertilization & Embryo Transfer

Intracytoplasmic sperm injection
Ethics &
Controversies