Biology and Society

Unit Five: Human Reproduction

Human reproduction is one of many areas in our lives where changes in the degree of control we have are happening faster than our ability to understand their ethical implications.

Topics related to Human Reproduction

• Prenatal Care, Testing and Screening

• Conception Control, Birth Control, Population Control

Infertility Treatments, also known as
• Assisted Reproductive Technologies (ARTs)

• Gender Selection

• Stem Cell Research

• Cloning Humans

• Genetic Engineering of the Human Germline

What scientific knowledge do we need to understand these topics?

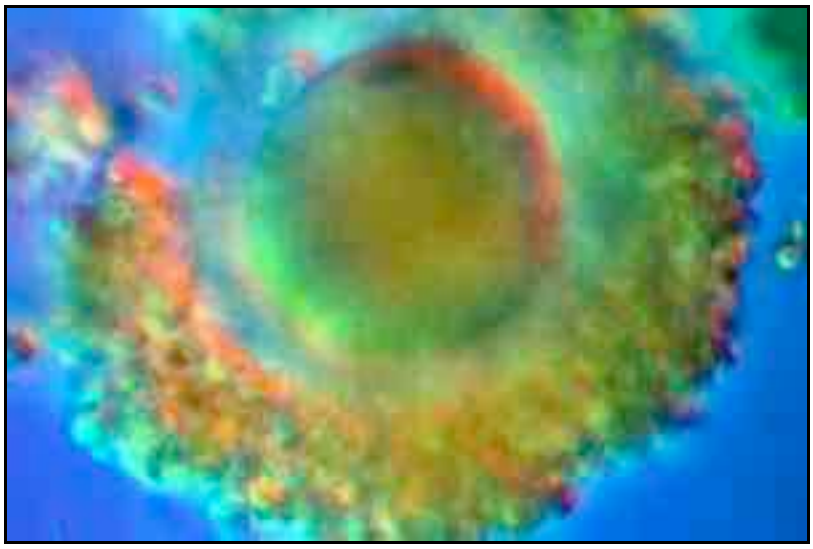
What are the ethical issues raised by these topics?

Unit Five: Human Reproduction

Topic One: Embryogenesis and Development

Human Egg and Sperm at the Moment of Fertilization

The Process of early Human Embryogenesis



The oocyte or unfertilized egg

The egg is the ball sitting in the middle of a mass of follicular cells that act to protect the egg itself as it moves down the fallopian tube. To reach the egg, sperm must first penetrate this mass (called the cumulus) and then they must bore through the rubbery coat that directly surrounds the egg (visible in the next picture).

The fertilized egg (also called a zygote or 1-cell embryo)

The cumulus mass has been removed manually by movement down the fallopian tube. The egg is the larger of the two balls contained within the thick circular rubbery coat called a zona pellucida. Within the egg, are two smaller concave-looking spherical objects -- each of these is a 'pro-nucleus' contributed by one parent or the other and containing the parental DNA. Next to the egg (but within the zona pellucida) is spherical object called a 'polar body'. The polar body is extruded from the egg proper after fertilization with a second portion of maternal genetic material.

The 2-cell embryo.

The first cell division takes place a day after fertilization. (At this stage, it is no longer appropriate to call it a zygote or egg.) From the 1-cell stage of embryogenesis all the way down to the blastocyst stage (shown below), the embryo is floating freely without a source of nutrients and it is physically constrained within the zona pellucida. So during this entire period, the embryo remains the same size.

The 4-cell embryo

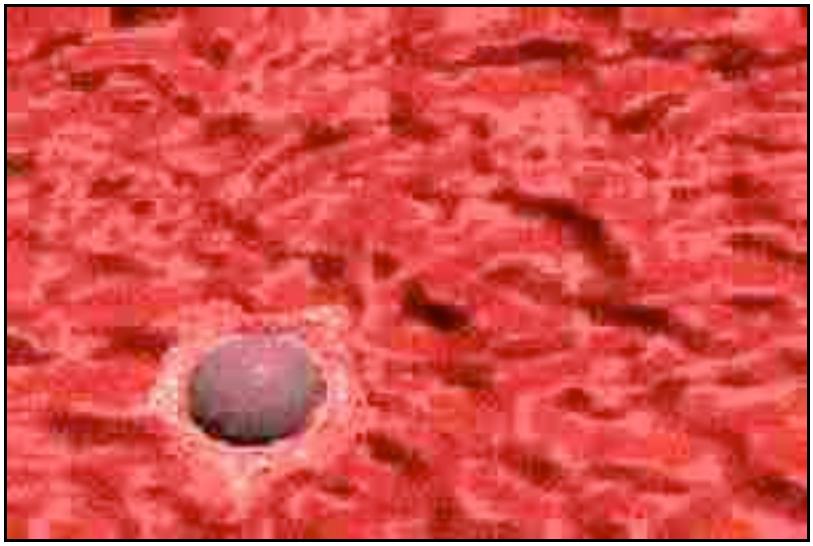
Once again, each of the cells in the embryo divides. At this stage, it is still possible for each individual cell to become an entire human being. If the embryo breaks apart into its four cells at this stage, four identical quadruplets could develop to birth. Although a rare event, there are many known cases.

The 8-cell embryo

Differentiation has still not taken place. Each cell could become an entire human being (in theory). Therefore, any cell can be removed at this point for genetic diagnosis without any effect on the development of the remaining embryo.

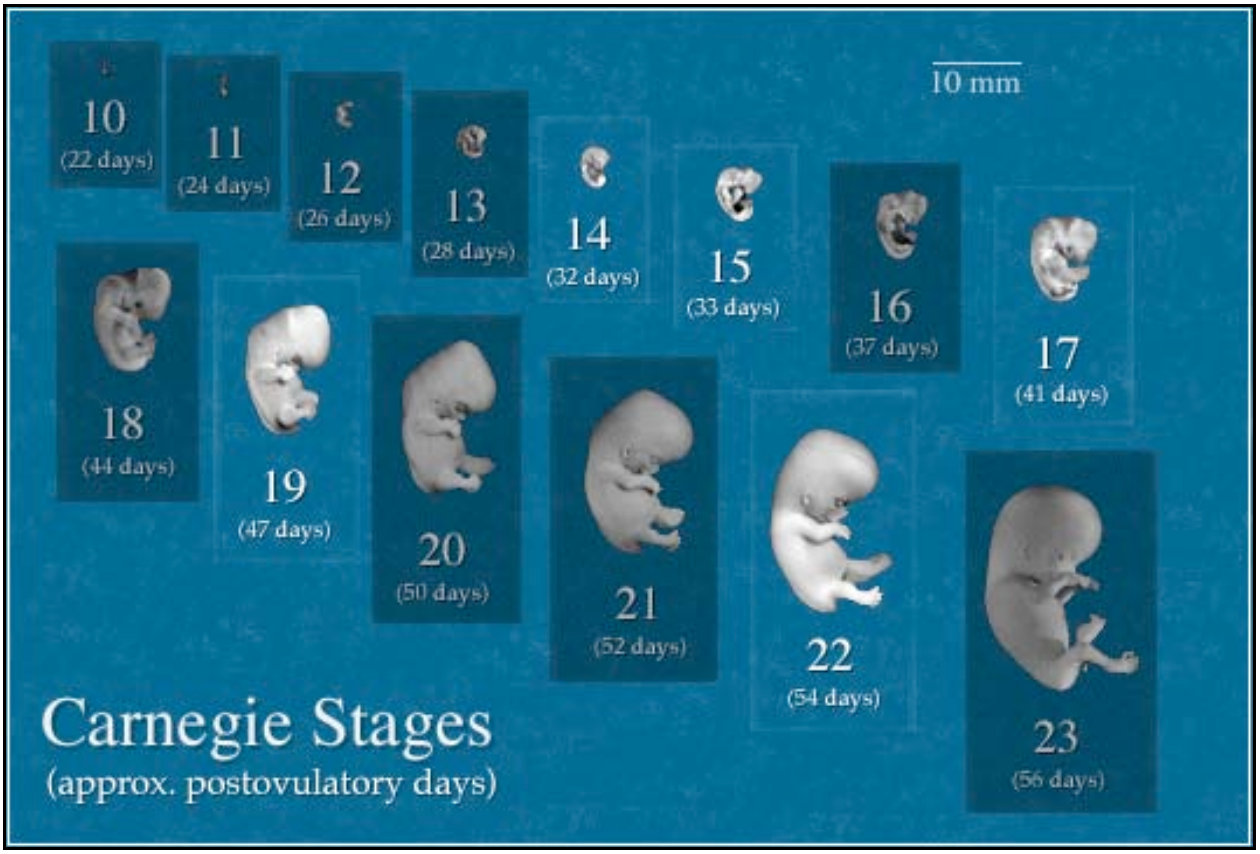
The blastocyst

After approximately four days the embryo now has about 64 cells. The cells are no longer equivalent. The embryo now has a fluid-filled cavity and a portion of the embryo called the Inner Cell Mass (or ICM, not visible) lies on the side of the cavity. The half-dozen cells of the ICM are the only ones that will be used to develop the fetus and child. The remaining cells help to form the placenta.



Implantation

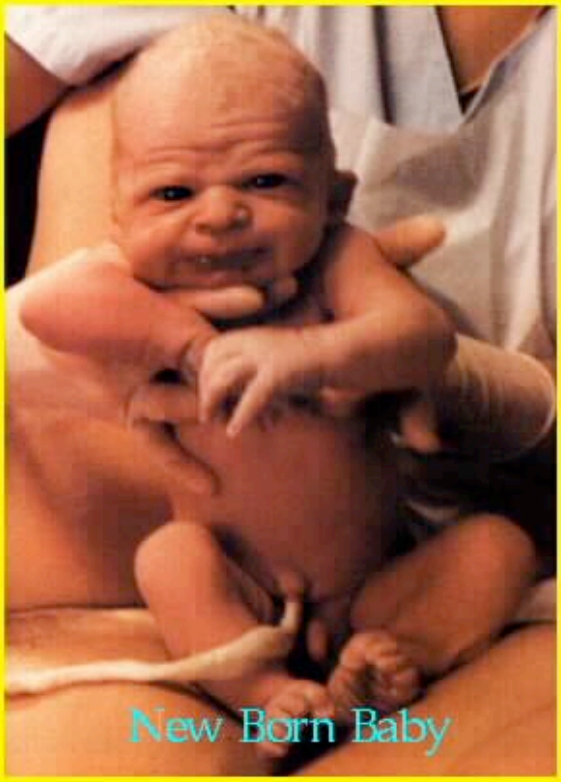
Unlike the previous images, this is simulated. Implantation of the embryo into the uterine wall occurs 7-10 days after fertilization. Within implantation, the embryo connects to the maternal blood supply and is now able to grow. At implantation, the woman's body becomes pregnant for the first time. Prior to implantation, the body is unable to detect the difference between an unfertilized egg (on its way out) or a developing embryo.


10 mm
10
(22 days)
11
(24 days)
12
(26 days)
13
(28 days)
14
(32 days)
15
(33 days)
16
(37 days)
17
(41 days)
18
(44 days)
19
(47 days)
20
(50 days)
21
(52 days)
22
(54 days)
23
(56 days)
Carnegie Stages
(approx. postovulatory days)

Embryogenesis & Fetal Development
In perspective

1-week old
Embryo
(not a fetus)

6-week old
Fetus



Topic Two: Prenatal Care, Testing and Screening

Who receives Prenatal Care in the U.S.?

(figures are for 1998)

Mothers Receiving 1st Trimester Care: 82.8% (of live births)

Mothers Receiving only Late Care: 3.9%

Teen Mothers Ages 15-19 Receiving 1st Trimester Care: 63.2%

Teen Mothers Receiving only Late Care: 8.8%

Median Number of Care Visits reported: 12.6

(Source: National Vital Statistics Report, Vol. 48, No. 3)

What are the ethical issues that surround prenatal care?

- Unequal access to prenatal care in the U.S.
- Cost effective aid to underdeveloped countries

Topic Three:

Conception Control, Birth Control, and Population Control

Conception Control

The artificial prevention of fertilization

Web Reference
http://www.nlm.nih.gov/medlineplus/birthcontrolcontraception.html

Emergency Contraception
http://www.plannedparenthood.org/pp2/portal/medicalinfo/ec/

What are the ethical issues surrounding contraceptives?

- When does life begin?

- What is the nature of "personhood?"

Birth Control:

The artificial prevention of birth.

Web References for Birth Control
http://www.plannedparenthood.org/ABORTION/chooseabort1.html

Mifepristone (RU-486): The Medical Abortion
http://www.plannedparenthood.org/library/facts/medabort_fact.html

Difference between ECP and Medical Abortion
http://www.plannedparenthood.org/pp2/portal/files/portal/medicalinfo/ec/fact-contraception-abortion.xml

---

What are the ethical issue related to birth control?

Where to begin?

Population Control:

The artificial regulation of the size of the human population.

Why is it different from conception or birth control?

References

Angier, N. (1999). *Woman: An Intimate Geography*. Boston: Houghton Mifflin.

Ellison, P. T. (2001). *On Fertile Ground: A Natural History of Human Reproduction*. Cambridge, MA: Harvard University Press.

Hrdy, S. B. (1999). *Mother Nature: A History of Mothers, Infants, and Natural Selection*. New York: Pantheon.

Return to Alles Honors Biology 350 Illustrated Lectures
http://fire.biol.wwu.edu/trent/alles/350Lectures_Index.html

Return to Alles Biology Homepage
http://fire.biol.wwu.edu/trent/alles/index.html