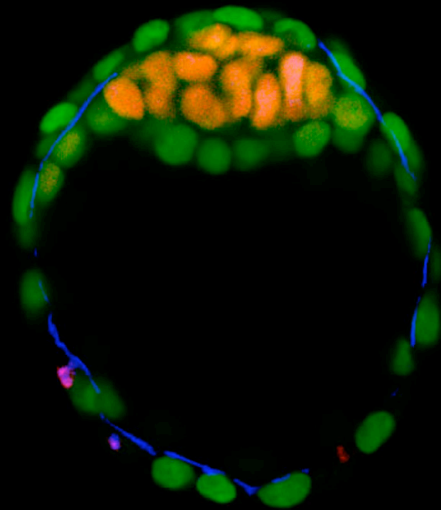
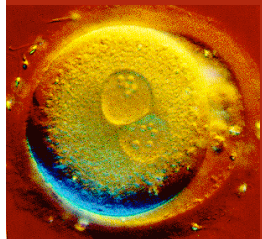


# WHEN DOES PERSONHOOD BEGIN? THE BIOLOGY AND THE RHETORIC

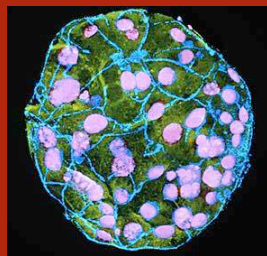


Scott F. Gilbert  
Professor of Biology  
Swarthmore College

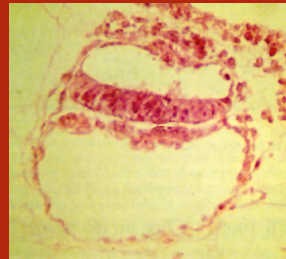
# FIVE BIOLOGICAL LANDMARKS USED BY DIFFERENT GROUPS OF SCIENTISTS TO DEFINE PERSONHOOD



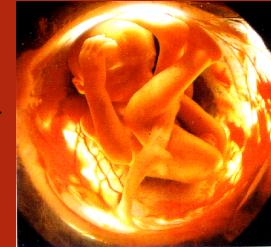
Fertilization



Day 5-7: Implantation/  
Blastocyst



Day 14: Gastrulation



Weeks 24-28: EEG



Perinatal,  
Birth

Why might the public assume that life begins at fertilization?

## *A Syllabus*

1. The instructions for development and heredity are all in the fertilized egg.
2. The implanted embryo is safe within the womb

## *of Errors*

3. There is a moment of fertilization where passive egg meets active sperm.
4. There is a consensus among scientists as to when personhood begins.

## ERROR I

The instructions for development and heredity are all in the fertilized egg.

RAMSEY (1970):

“Genetics teaches that we were from the very beginning what we essentially are in every cell and in every human attribute.”

STANDUP GIRL (2005):

Even more amazingly, intelligence and personality – the way you look and feel – were already in place in your genetics code. At the moment of conception you were essentially and uniquely you.

# Popular Culture Promotes the Fallacy of “Sacred DNA”

Dorothy Nelkin and Susan Lindee, *The DNA Mystique*

## DNA AS SOUL

1. That which is your essence
2. That which determines your behaviors
3. That from which you can be resurrected  
(à la *Jurassic Park*)



(From Christian Business Network website)

**DNA as a metaphor for ESSENCE, CORE:  
Even cars have “DNA”!**

**A Sterling’s remarkable handling is “in its genes.”**

**A BMW Sedan has “a genetic advantage.”**

**A Subaru is a “genetic superstar.”**

**A Toyota “has a great set of genes”**

**“While some luxury sedans just look like their  
elders, ours have the same DNA” (Infinity)**

**“The new Nissan design DNA is evident”**

Newsweek, May 23, 2005



**SAME DNA. SMALLER CHROMOSOMES.**

THE ALL-NEW MIDSIZE H3. LIVING UP TO THE OFF-ROAD REPUTATION HUMMER MADE FAMOUS.  
COMING SOON. STARTING AT \$29,500. VEHICLE SHOWN \$30,195.\*

**HUMMER**  
LIKE NOTHING ELSE.™

\*MSRP. TAX, TITLE, LICENSE, DEALER FEES AND OPTIONAL EQUIPMENT ARE EXTRA. 1.800.REAL.4WD  
© GENERAL MOTORS CORPORATION, 2005.

**THE NOTION THAT WE ARE PHYSICALLY AND MENTALLY DETERMINED BY OUR GENES IS SCIENTIFICALLY INVALID**



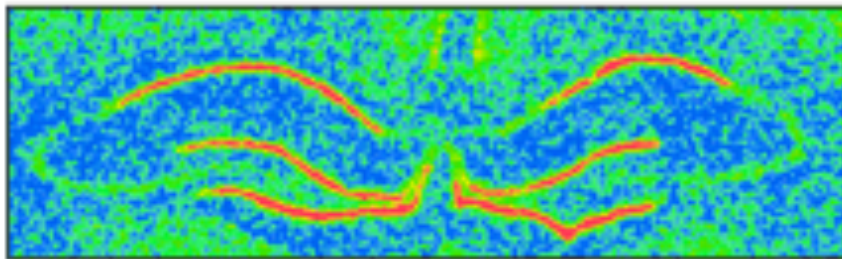
**1. Genetically identical mice  
whose mothers were fed diets containing different levels of folate during pregnancy**



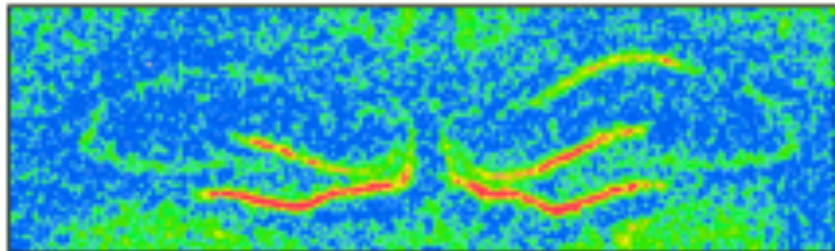
## 2. Maternal Care Affects Gene Activation in the Brain

MATERNAL CARE CAUSES EXPRESSION of the HIPPOCAMPAL GLUCOCORTICOID RECEPTOR in the RAT BRAIN

Rats with the same genome can become anxious or normal as adults due to the maternal care they had during the first week after birth.



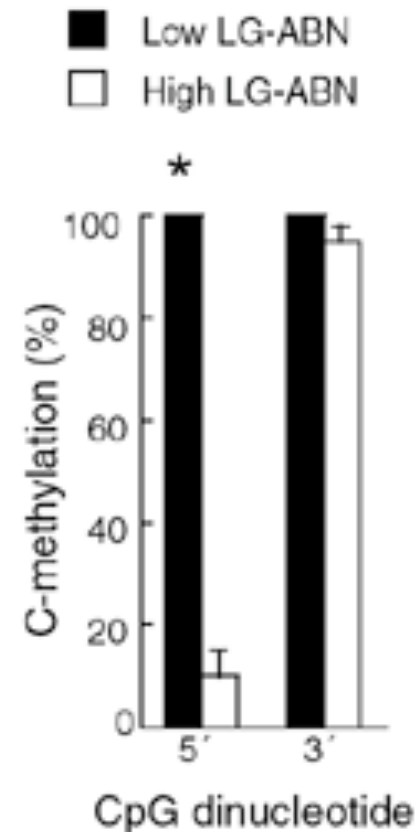
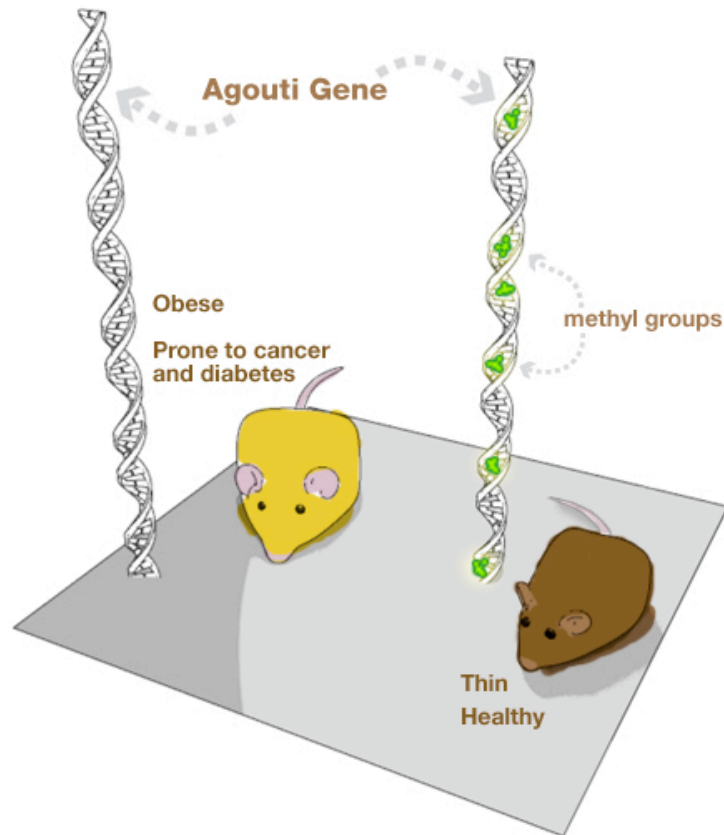
High glucocorticoid receptor gene expression in hippocampus of rat who received high levels of maternal care during first week.



Low glucocorticoid receptor gene expression in hippocampus of rat who received low levels of maternal care during first week.

Francis et al 1999. *Science* 286: 1155 – 1158;  
Weaver et al. 2004. *Nature Neurosc.* 7: 847 - 854.

IN BOTH CASES, THE **ENVIRONMENT** CHANGES DNA METHYLATION, THEREBY ALLOWING DIFFERENT GENES TO BE EXPRESSED



Dietary folate allows the methylation of specific cytosines in the DNA of mice carrying the *viable-Agouti* gene, turning it off.

Hormones induced by maternal care decrease cytosine methylation in the DNA of the rat glucocorticoid receptor gene, turning it on.

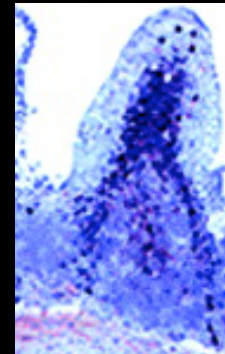
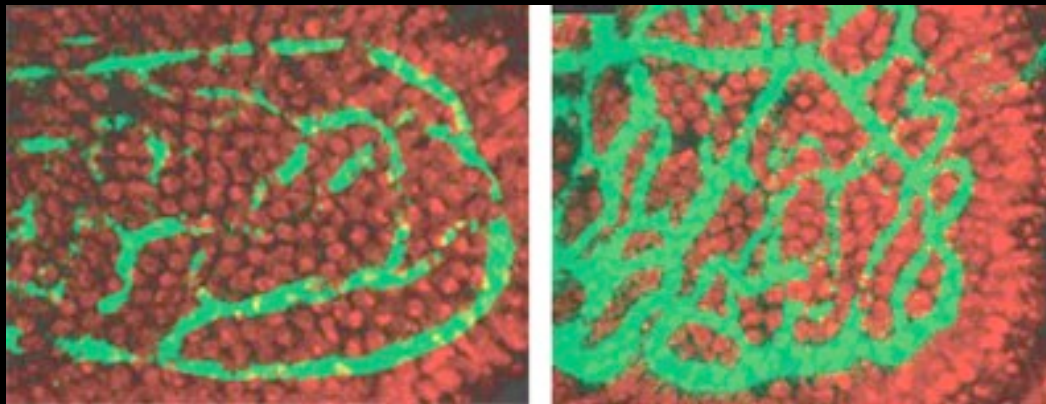
### 3. BACTERIA ARE NECESSARY FOR NORMAL MAMMALIAN DEVELOPMENT

of the immune system...

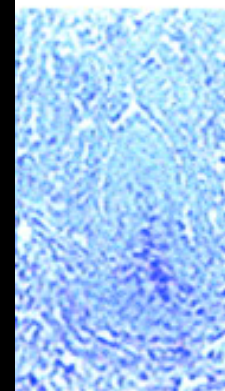
and of the intestine...

Germ-free

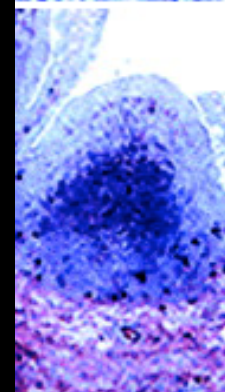
Bacteria present



Bacteria present



Bacteria absent



Bacteria introduced into "germ-free" rabbit intestine

Rhee et al 2004. *J. Immunology* 172: 1118 - 1124

Stappenbach et al. 2002. *Proc. Natl. Acad. Sci. USA* 99: 15451 - 15455.

## NEW SYLLABUS. I.

We are not determined to be “essentially” who or what we are at fertilization. Many of our fundamental bodily and behavioral characters are determined by the environment, not by the genes.

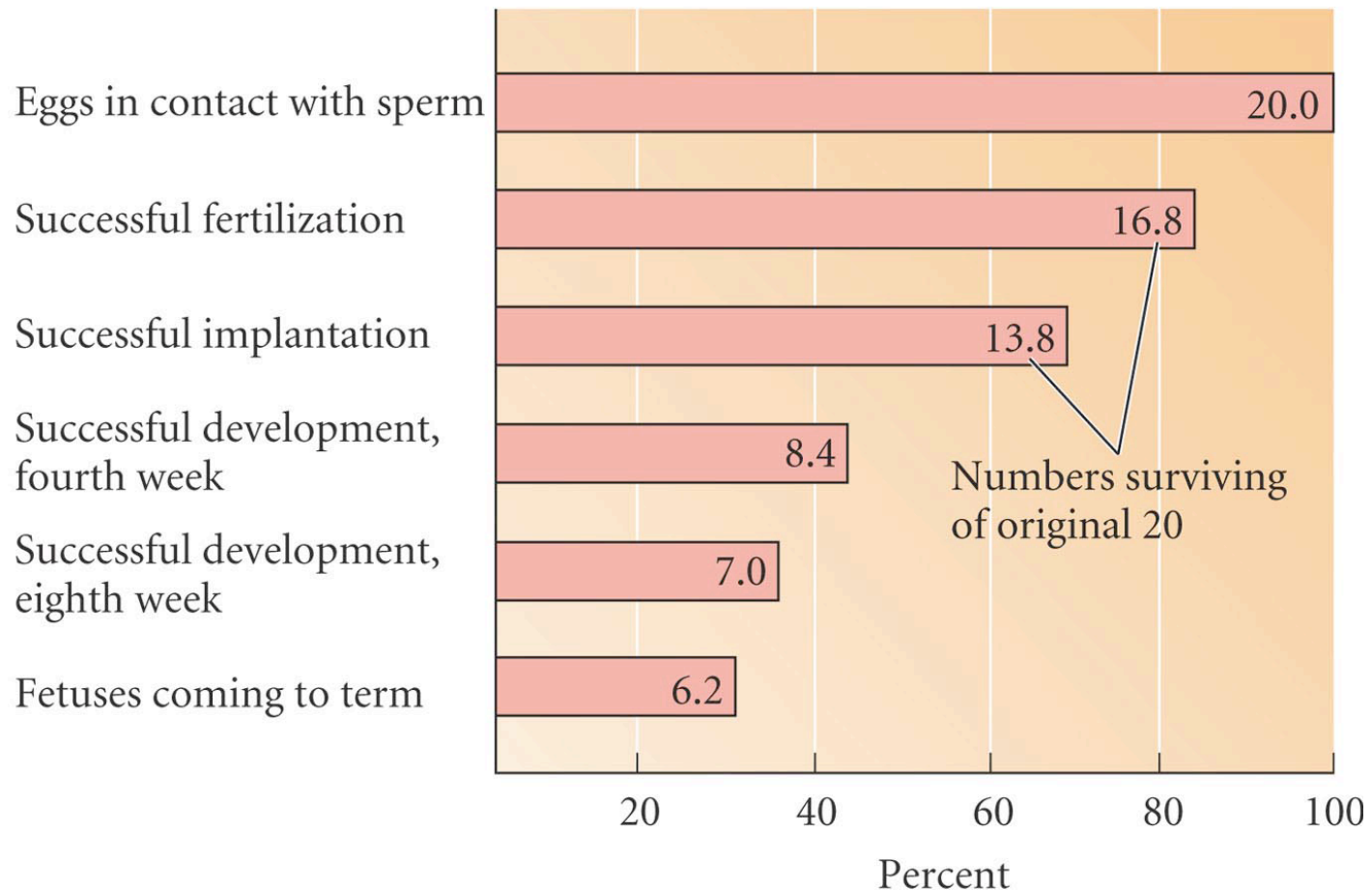
## ERROR II

**The implanted  
embryo is  
safe within  
the womb.**

C. Ward Kischer (2002):

“From the first moment of conception, human development is a fait accompli, under conditions which we have come to understand and embrace as NORMAL.”

# Most conceptions do not come to term as babies



“If the embryo loss that accompanies natural procreation were the moral equivalent of infant death, then pregnancy would have to be regarded as a public health crisis of epidemic proportions: Alleviating natural embryo loss would be a more urgent moral cause than abortion, in vitro fertilization, and stem cell research combined.”

-Michael Sandel (2003)

## DRUG AND CHEMICAL TERATOGENS

Ethanol  
Gentamycin  
PTU  
Bromine  
Cortisone  
DES  
Diphenylhydantoin  
Penicillamine  
Streptomycin  
Tetracycline  
Trimethadone  
Thalidomide  
Valproic Acid  
Warfarin

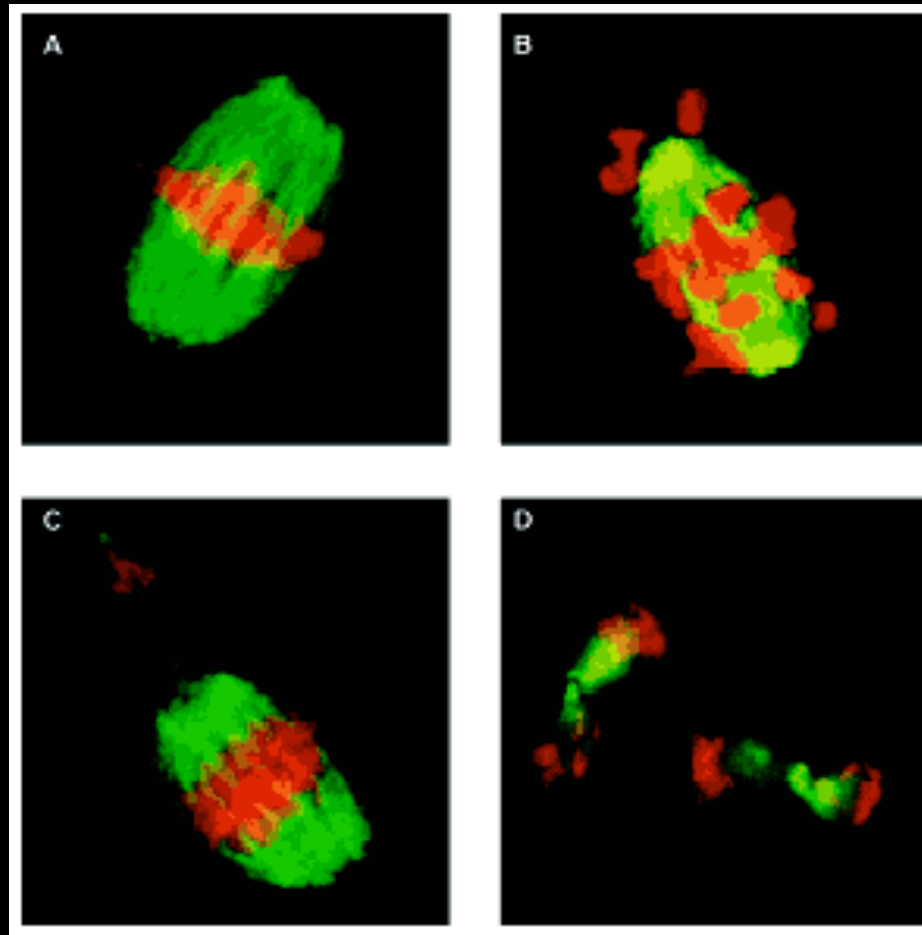


Heroin  
Lead  
Methylmercury  
Veratrum alkaloids  
Quinine

Also: X-rays, hyperthermia  
(but not saunas, taken properly)

[www.iephb.nw.ru/~spirov/hazard](http://www.iephb.nw.ru/~spirov/hazard)

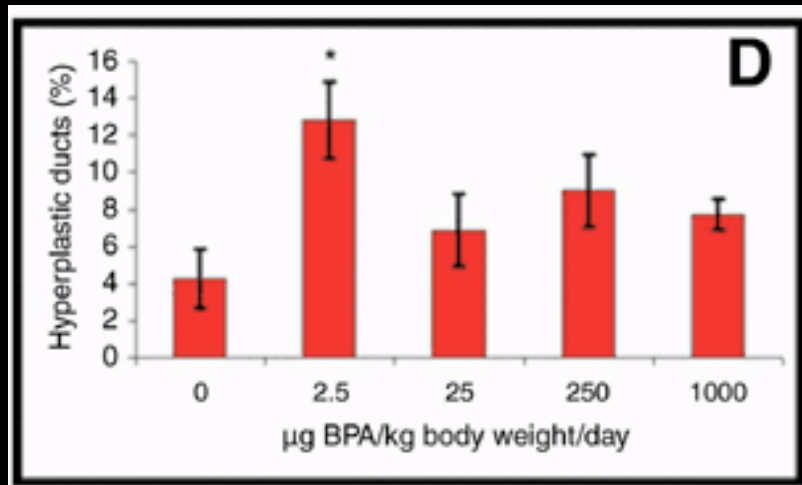
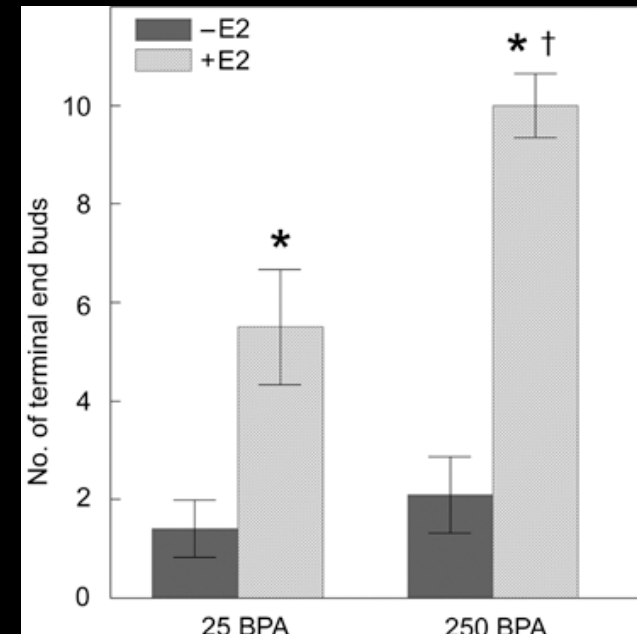
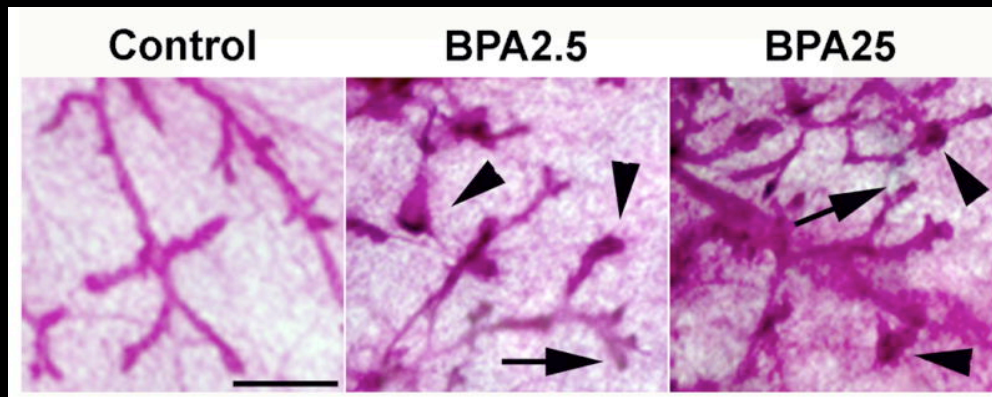
# BISPHENOL-A CAUSES ABNORMALITIES IN EGG DEVELOPMENT IN EMBRYONIC FEMALE MICE



Hunt et al. 2003. *Current Biology* 13: 546 - 553.



# BPA exposure *in utero* predisposes rat mammary glands to have cancers later in life



Perinatal bisphenol A (BPA) exposure alters the sensitivity of the mammary gland to estradiol at puberty. Animals exposed perinatally to vehicle or 250 ng BPA/kg/d were ovariectomized and challenged with 0 (-E2) or 0.5 µg estradiol/kg/day (+E2) at 25 days of age (pre-puberty). BPA-exposed animals had a heightened response in number of terminal end buds (TEB) compared to control animals.

Murray et al. 2007. *Reproductive Toxicology* 23: 383 – 390;

Vandenberg et al. 2008. *Reproductive Toxicology* 26: 210 – 219.

## **NEW SYLLABUS. II.**

### **THE FETUS IS NOT SAFE IN THE WOMB**

**CURRENT TECHNOLOGICAL SOCIETY IS INCREASING THE RISK THAT BABIES WILL BE BORN WITH ANOMALIES, FERTILITY PROBLEMS, AND SUSCEPTIBILITIES TO DISEASES. MOREOVER, THESE ANOMALIES AND DISEASE SUSCEPTIBILITIES CAN BE TRANSMITTED THROUGH DNA METHYLATION TO OUR OFFSPRING AND GRANDCHILDREN.**

**MOST FERTIZATION EVENTS DO NOT BECOME BABIES.**

**(This is an obvious place where science and religion can be allies.)**

### ERROR III

There is a moment  
of fertilization  
where passive egg  
meets active sperm.

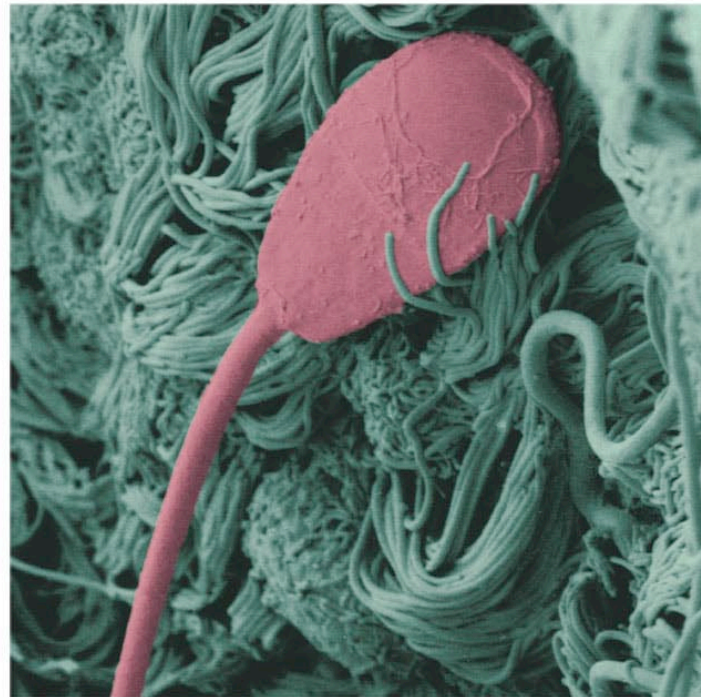


Figure 5. From Jennifer Davis (2001) *First Comes Love: All About the Birds and the Bees – and Alligators, Possums and People, Too*. Published by Workman Publishing.

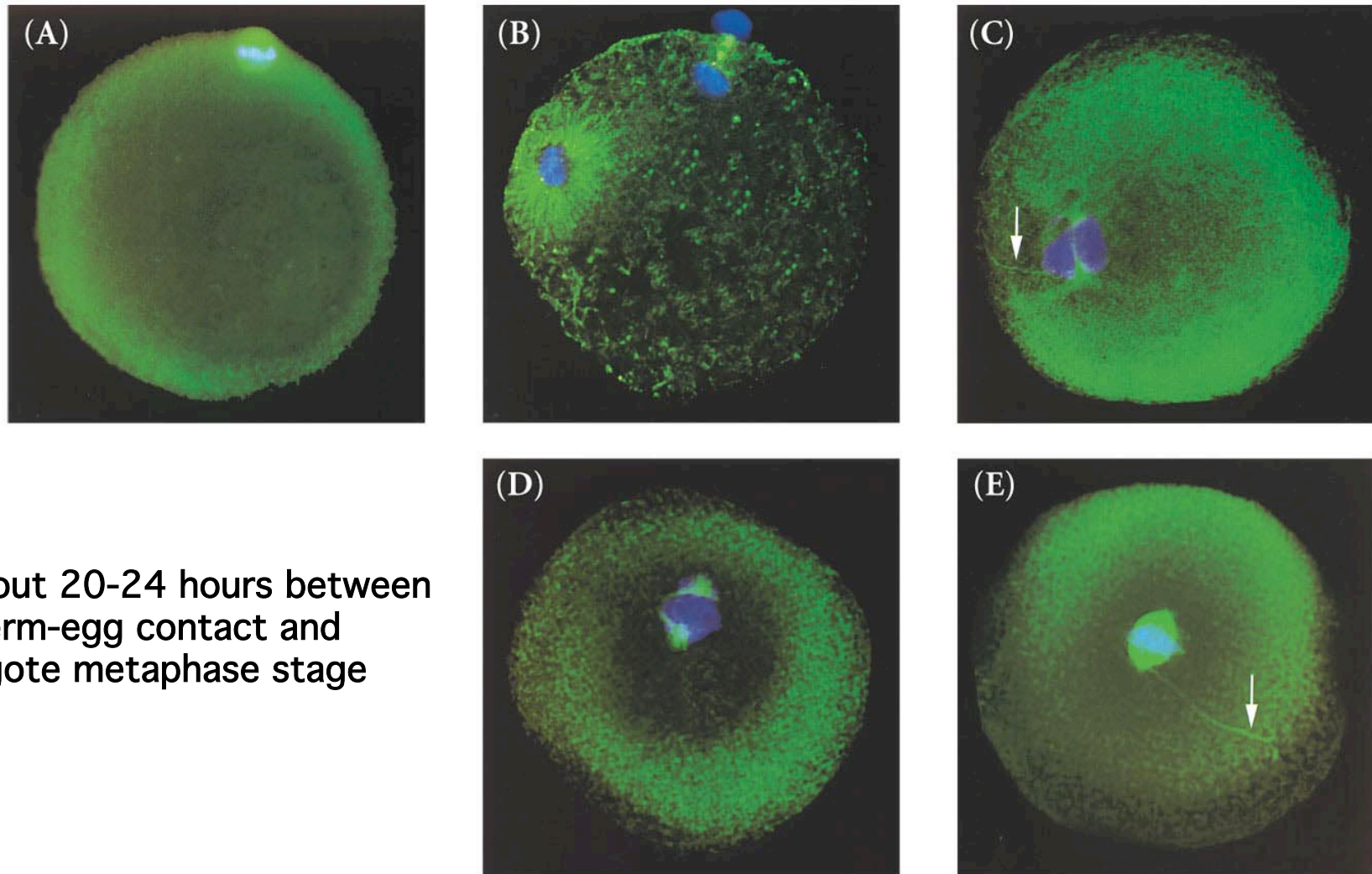
# FERTILIZATION IS A PROCESS, NOT A MOMENT

## 1. CAPACITATION

SPERM FINISH THEIR DEVELOPMENT IN THE  
FEMALE REPRODUCTIVE TRACT



## 2. *Pronuclear Movements During Human Fertilization*



About 20-24 hours between sperm-egg contact and zygote metaphase stage

## NEW SYLLABUS. III.

Fertilization is not immediate. Coitus does not equal “impregnation.” It can take 2-5 days. Fertilization is not a moment. It’s a process.

Both the egg and the sperm are active and passive partners.

The sperm is activated by chemicals from the egg and oviduct.

Capacitation by oviduct needed for sperm to reach the egg.

Acrosome reaction on egg surface needed for fusion.

The egg is activated by the entry of the sperm.

The result of fertilization is not a 1-cell zygote, but a 2-cell embryo.

## ERROR IV

**There is a consensus  
among scientists  
as to when  
personhood begins.**

Every human embryologist  
worldwide, states that  
the life of a new  
individual human being  
begins at fertilization.

- "American Bioethics  
Advisory Commission"  
2002

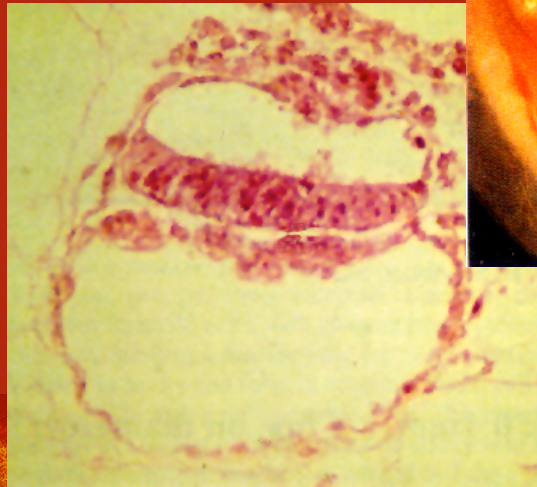
Perinatal, Birth



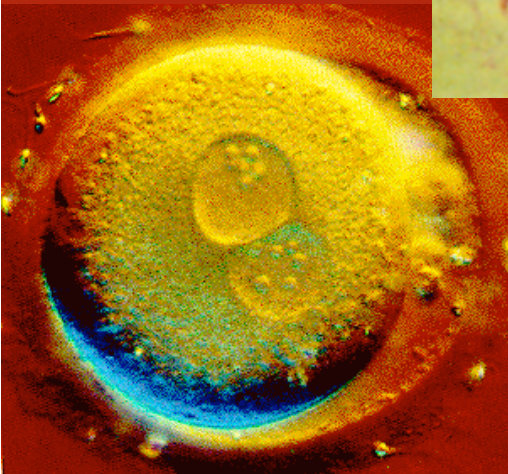
Weeks 24-28:  
EEG (Brainwaves)



Day 14: Gastrulation



Fertilization

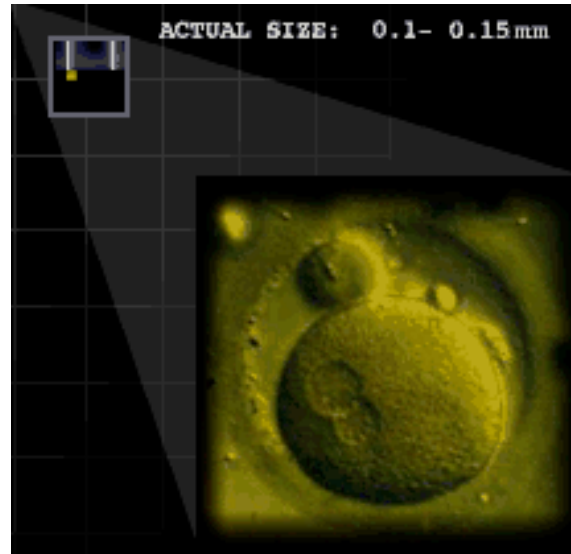


**WHEN DOES HUMAN PERSONHOOD BEGIN?  
Some Scientific Considerations**



## Position 1: Personhood Begins at Fertilization

A unique genome is made and the conditions exist to generate a baby.

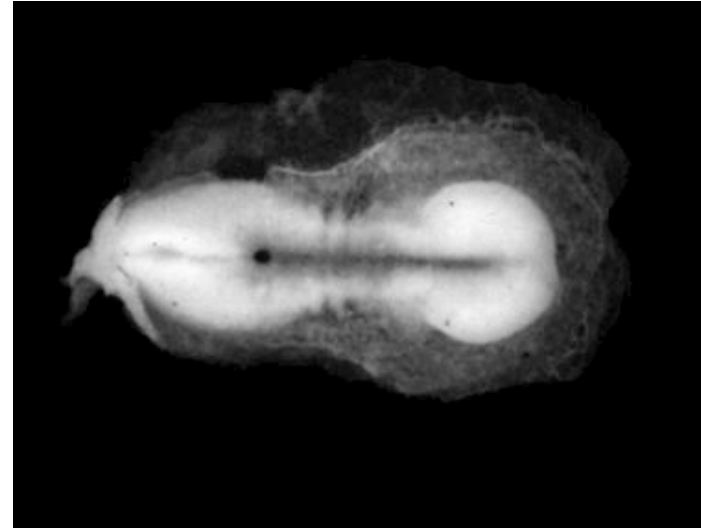
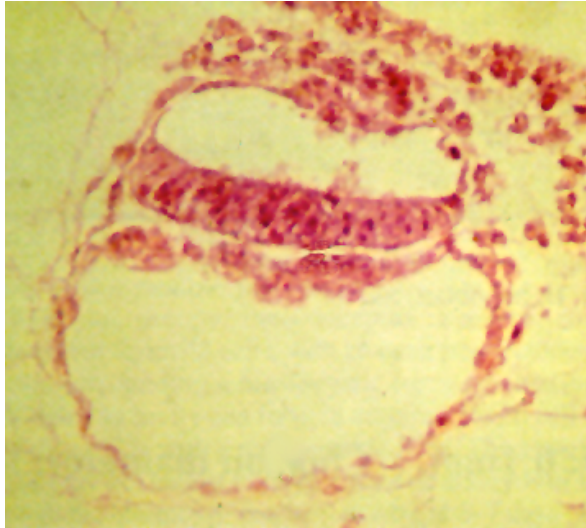


Q: At what point does that individuation take place?

Dr. Lejeune: Oh, that takes place at fecundation, at fertilization, at conception. Because it just tells us that the constitution of this person is unique to this person.

## POSITION 2: HUMAN PERSONHOOD BEGINS AT GASTRULATION

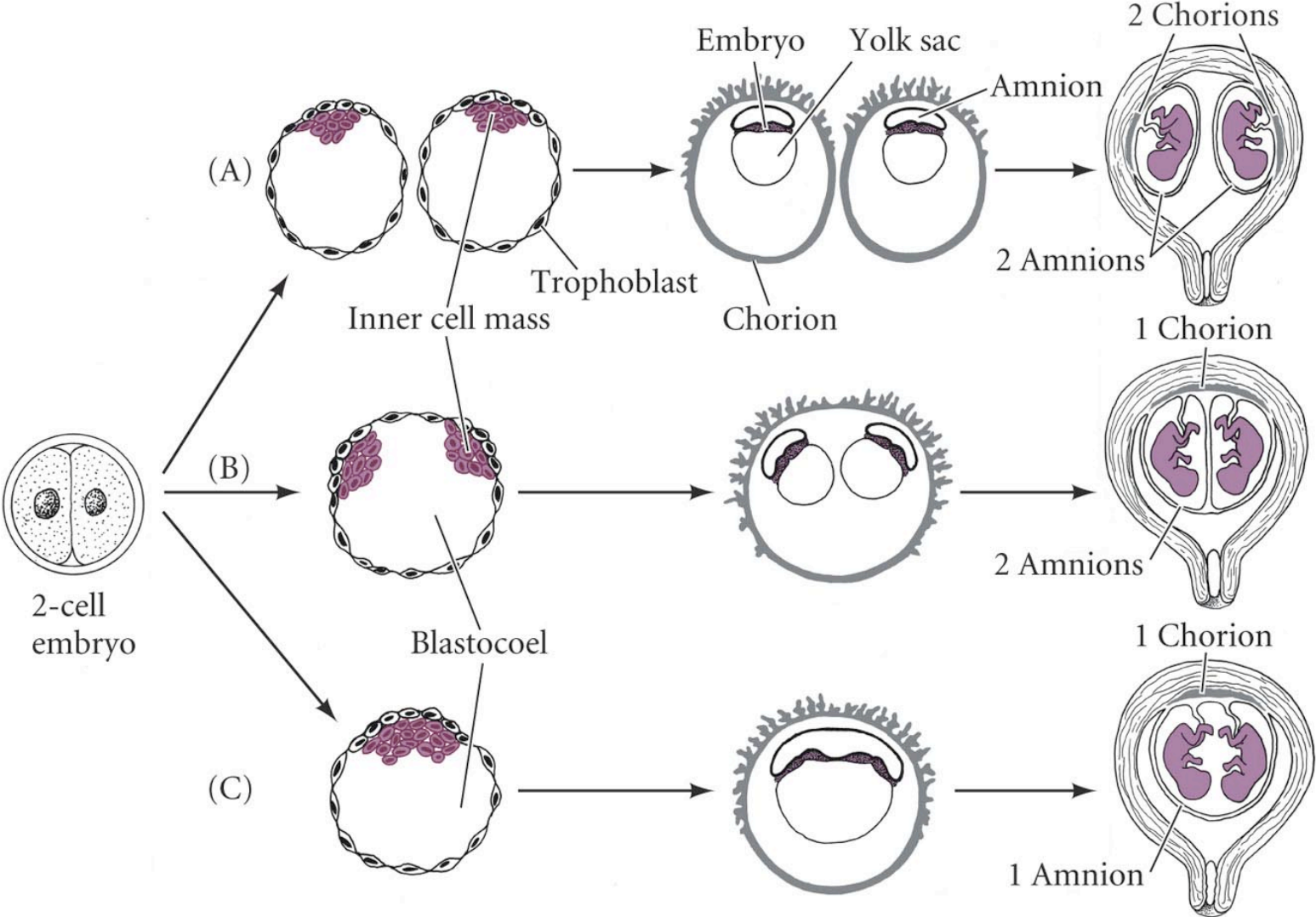
Only one unique person can form, rather than numerous persons.



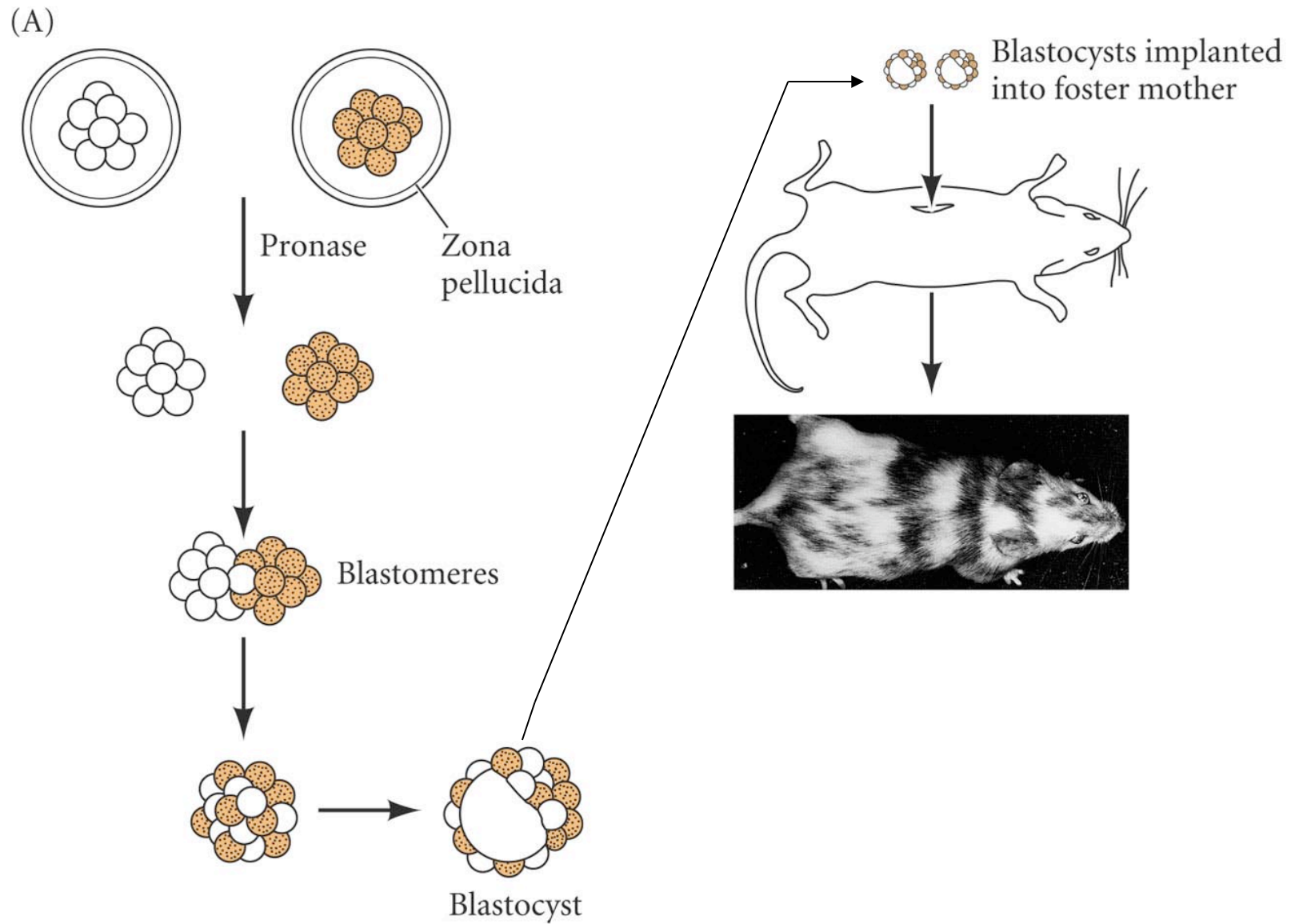
Renfree (1982): “Assuming that monozygotic twins have separate souls, it follows that ensoulment must occur after cleavage..at least 12 days after conception!”

Green (2001): “”But twinning and fusion events suggest that, even well after the formation of the zygote, biological individuality is not firmly established. Only at gastrulation can we say that the lengthy process of individuation is complete.”

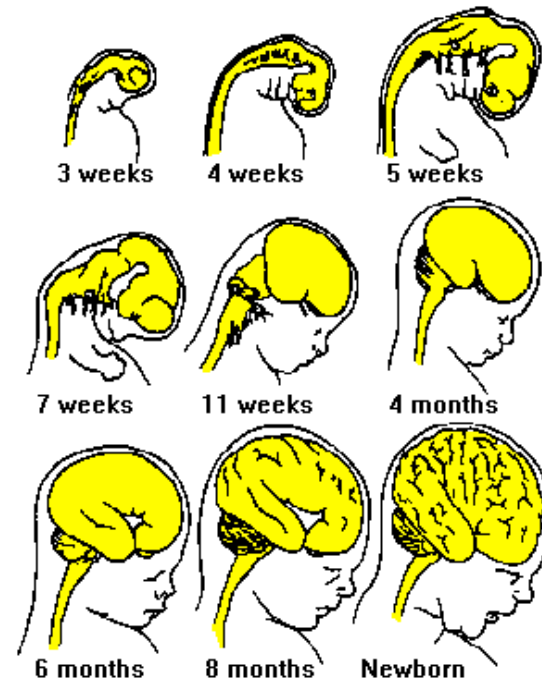
# Human Monozygotic Twinning



# Production of Chimeric Mice



## POSITION 3: PERSONHOOD BEGINS WHEN THE FETUS ACQUIRES THE HUMAN-SPECIFIC EEG (ELECTROENCEPHALOGRAPH) PATTERN

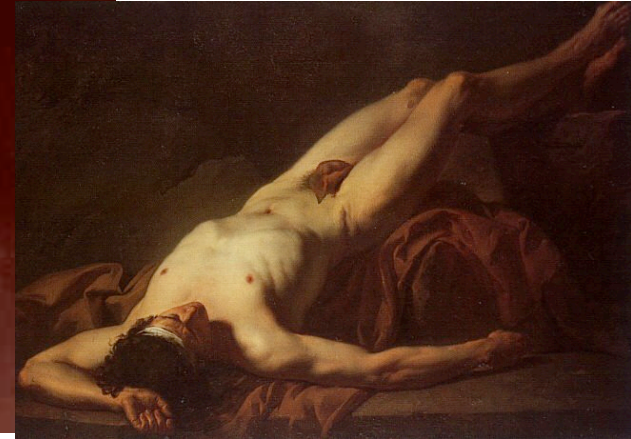


MOROWITZ AND TREFEL (1992): “In our usage, we say that our species acquired humanness when the enlarged cortex developed, and the individual fetus acquires humanness when the cortex begins to function.”

ESWARAN et al 2007. *Clin . Neurol.* 118: 1940 – 1946: “We were able to identify specific patterns and track changes in fetal brain activity starting at 28 weeks of gestation.”

## SYMMETRY ARGUMENT FOR EEG CRITERION:

If *loss* of EEG pattern is considered human death (although heart is beating, cells are respiring, etc.), then *acquisition* of EEG should be considered human life.



### Corollary arguments:

Argument of similar office: Embryos and corpses are humans but not persons.  
Neither is counted in a census; neither can inherit; neither has moral agency.

Argument of respect: They are to be treated with respect because of their human condition, even if not given rights of personhood. (One does not eat human flesh, even if it's dead).

Argument of age-appropriateness: Fetus need not be given certain rights until it is mature, just as we must not give 9-year olds the right to drive or vote.

## POSITION 4: HUMAN PERSONHOOD BEGINS AT BIRTH

Legal personhood, Time of one's identity



Jeffrey Baker:

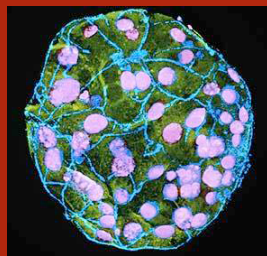
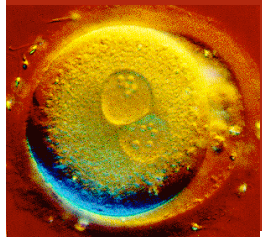
Birth is not merely a “move from one room to another,” but a passage through a perilous discontinuity between fetal and newborn life.

### REDIRECTION OF DEVELOPMENT:

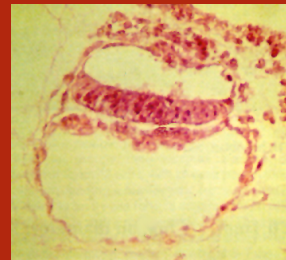
1. LUNGS MUST BE ABLE TO FUNCTION
2. FIRST BREATH CHANGES HEART ANATOMY
3. FIRST BREATH CHANGES BLOOD CIRCULATION WITHIN HEART  
AND WITHIN BODY
4. HEAD MUST GET THROUGH BIRTH CANAL

"The wish felt by many people to pinpoint such a stage probably stems from the belief that a soul, conceived as a preternatural entity, descends upon a formerly soulless living stuff, and suddenly transforms the latter into human estate. I hope that modern theologians can accept the idea that the transformation is not sudden, but gradual."

-Theodosius Dobzhansky, 1976.



Day 5-7: Implantation/  
Blastocyst



Day 14: Gastrulation



Weeks 24-27: EEG



Perinatal,  
Birth

**POSITION 5:**

**GRADUAL ACQUISITION  
OF PERSONHOOD**



**There is no consensus among scientists as to when human personhood begins.**

**Positions include:**

**1. FERTILIZATION**

(Individual genotype. Cell capable of developing into human or humans)

**2. GASTRULATION**

(Individual human life. Animal-specific movement. No longer can form twins, etc.)

**3. EEG (ELECTROENCEPHALOGRAM)**

(“Rational soul”; evolution-hominization; symmetry with view of death as its loss)

**4. PERINATAL PERIOD**

(Ability to breath. Legal personhood, distinct entity from mother.)

**5. GRADUAL HUMANIZATION DURING EMBRYOGENESIS**



=



## A Problem: The Equation Works Both Ways

If the zygote or blastocyst is a person, then the person can be treated as a zygote or blastocyst. Is a zygote a “who” or a “what”? If a “what,” then the dignity of the newborn or adult is enormously diminished.

What/Who would you rescue from a burning clinic: a nurse or a canister containing 1000 preimplantation embryos?

## BIBLICAL BRAKE TO EQUATING PERSONS WITH HUMAN EMBRYOS

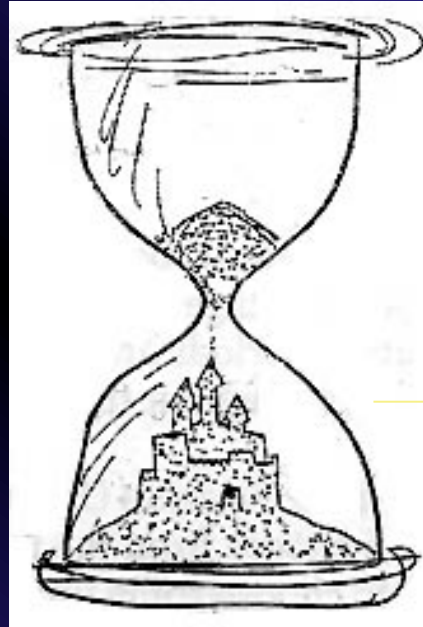
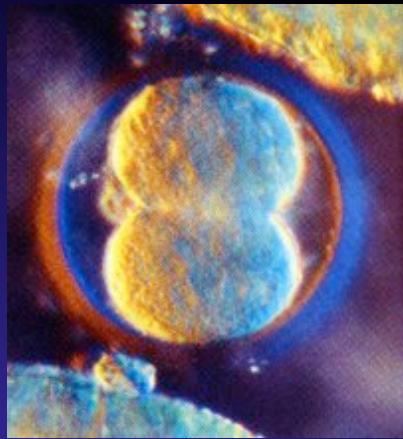
### Syllogism:

Genesis 9:16: Those who kill the Image of God must themselves be killed.

Exodus 21:22: If a man causes a woman to miscarriage, he is not killed, but has to pay the woman a price determined by the court.

Therefore, the fetus does not have the Image of god.  
Image of God--personhood--is obtained at birth. It is a Birth-right.

“What a profession this is--this daily inhalation of wonder!”  
-Embryologist Jean Rostand, 1962



Gilbert, SF. et al. *Bioethics and the New Embryology*. Sinauer Assoc., Sunderland, MA

Gilbert, SF. Gilbert, S. F. 2008. When "personhood" begins in the embryo: avoiding a syllabus of errors. *Birth Def. Res C Embryo Today* 84: 164 - 173.

<http://www.sinauer.com/pdf/BioethicsCh02.pdf>