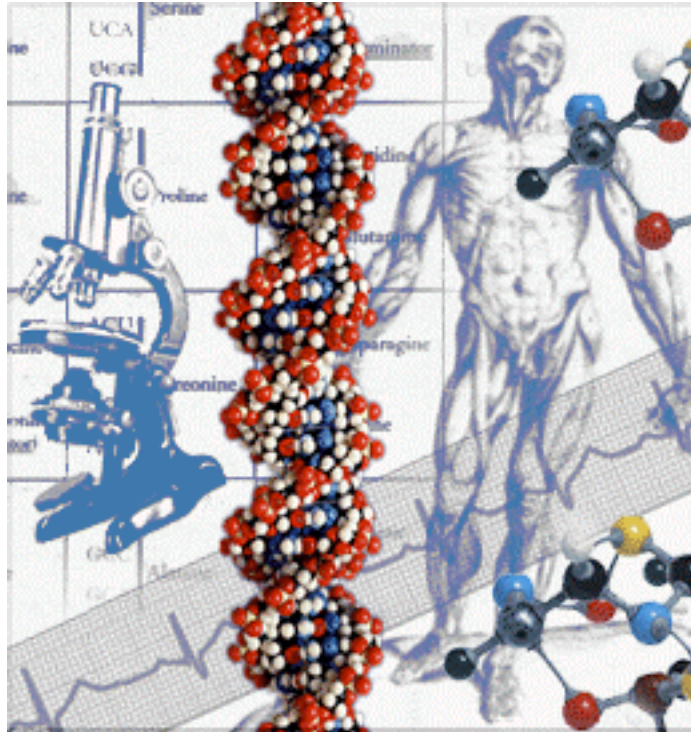


# Genetic Futures

PHIL/BIOL 2510

Spring 2009

# What is your genetic future?



The future is now!

# Future Politics of hESC?

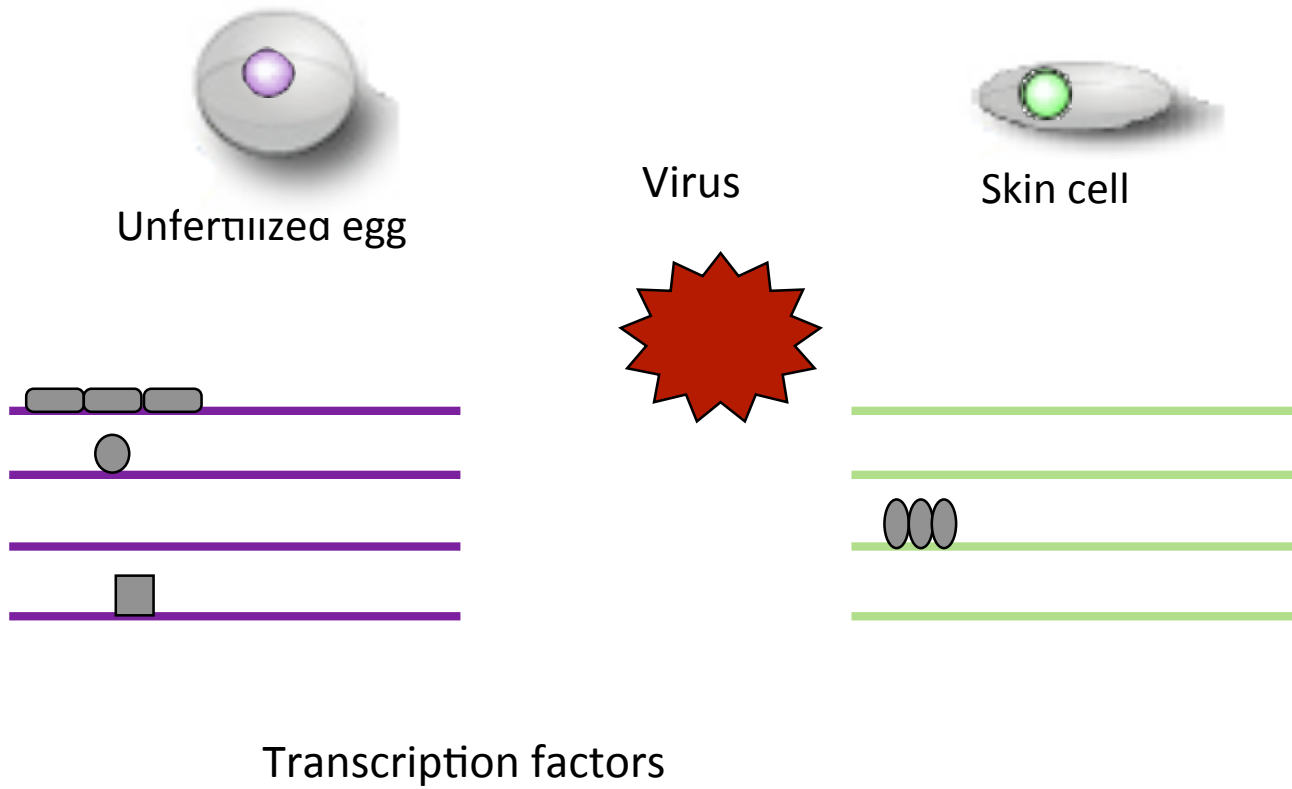
- **2001**, Aug. 9: Pres. Bush limits Fed\$\$ to current stem cell lines, but no new stem cell lines.\*(Cf. 1995-2000 policies.)
- **2004**, Nov. 2: California Prop 71 establishes the “California Institute for Regenerative Medicine” with \$3 billion general state funds (\$350 million annual limit). Other states have similar, but smaller agendas, e.g., NJ.
- **2009**: March 9 Pres. Obama reverses 2001 order, letting NIH devise regulation policy; Draft regulations posted April 2009: funding for lines from IVF discards, only.

## What does the near future hold for hESC research?

- New policy will expand federal involvement in hESC research...
- US takes lead on hESC research, but California Institute future uncertain, now...
- Pres. Obama (and Democratic congress) indicates support for “therapeutic cloning” as source of hESC...
- Still waiting successful trials...scientific and economic benefits uncertain...

# iPS cells

# iPS cells



# iPS cells

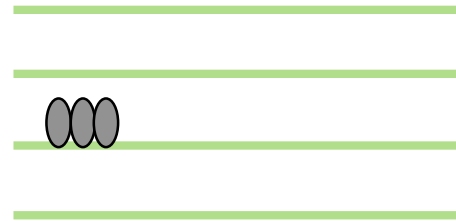
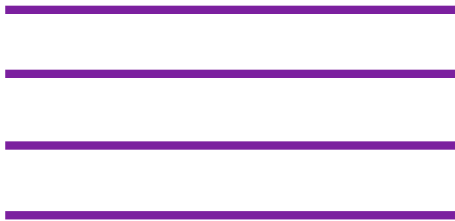
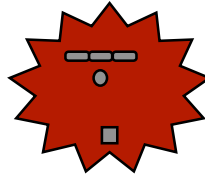


Unfertilized egg



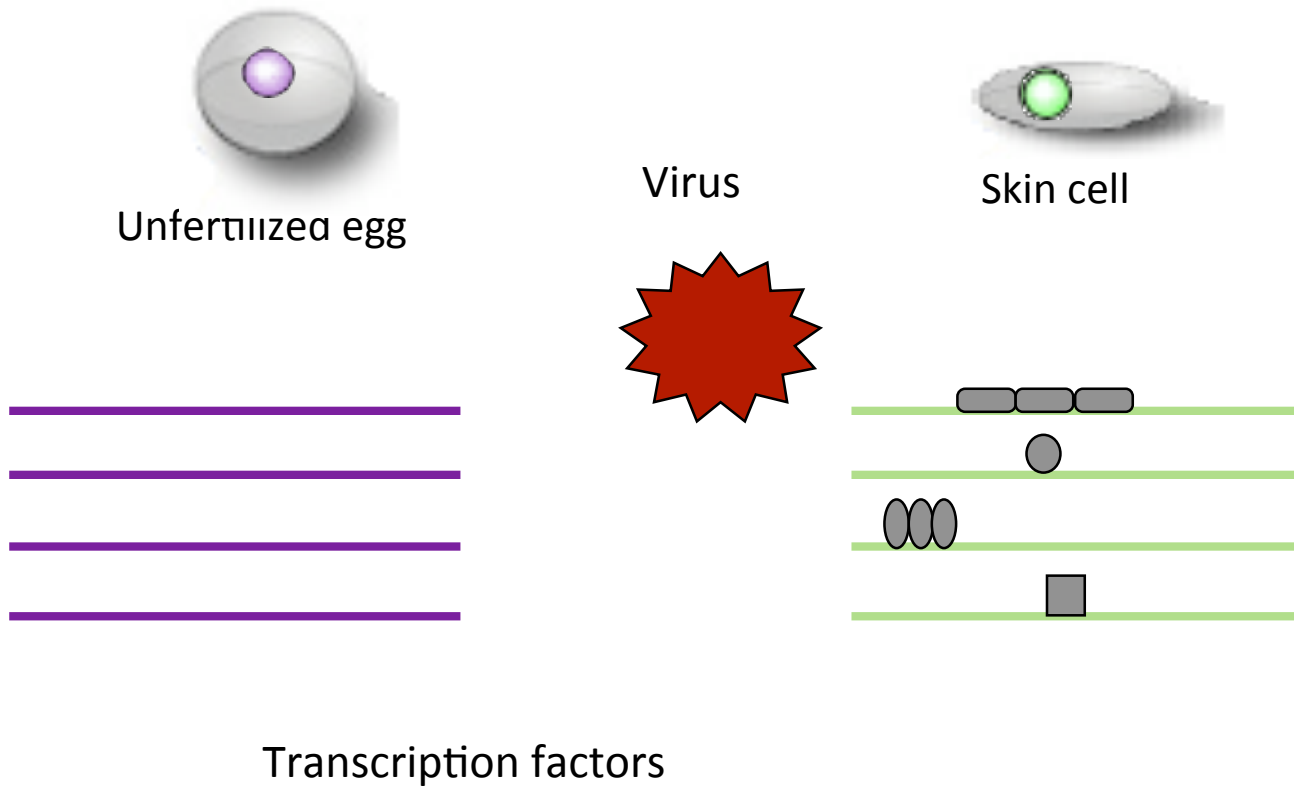
Skin cell

Virus

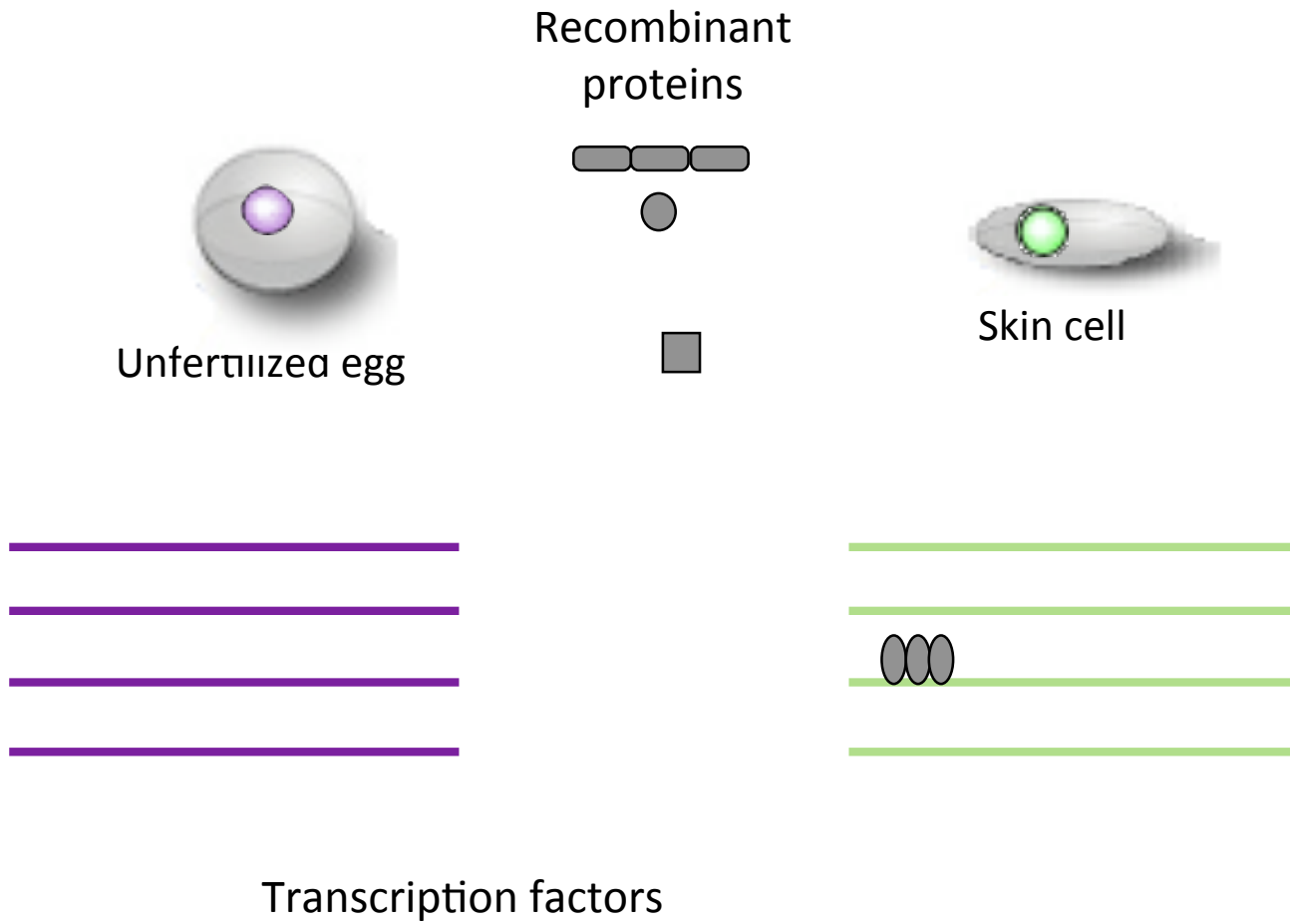


Transcription factors

# iPS cells



# iPS cells



# New Problems: iPS

- Totipotency not clear: Are these embryonic cells or new embryos?
- Opens up easier routes to reproductive cloning
- Opens up possibilities for male derived eggs or female derived sperm.

# New Pandemics

# New pandemics

- Three things to consider for every new report:
  - Person-to-person transmission
  - % lethality
  - Geographic spread

# New pandemics

	Bird flu	SARS	Swine flu
Person to person	no	yes	yes
lethality	yes	yes	???
Geographic spread	no	no	yes

# Baby Mammoth



- Discovery of baby mammoth (“Lyuba”) promises to reveal secrets of pleistocene animal.
- Speculations abound that with tissues samples enough DNA may be extracted to clone a baby mammoth using Asian Elephants as surrogates.
- Similar speculations about cloning Neandertals, and even some dinosaurs (remember Jurassic Park?).
- A 2 hour television special on National Geographic Channel, April 26, 2009.  
<http://channel.nationalgeographic.com/episode/waking-the-baby-mammoth-3630/Overview>

# Endangered species

# Endangered species

- New sequencing technologies are proposed to sequence the genomes of endangered and extinct species.

# Endangered species

- New sequencing technologies are proposed to sequence the genomes of endangered and extinct species.
- SCNT (cloning) together with improved DNA synthesis could allow us to revive extinct species. (Like we did with 1918 flu virus).
- NO Dinosaurs

# Engineering species

# Engineering species

- Proposal to introduce malaria resistant genes into the mosquitoes of malaria endemic regions.

# Engineering species

- Technology has been designed that allows these transgenes to spread widely in the population, replacing all normal mosquitoes with transgenics.
- Allows new transgenes to be introduced that replace the previous one in the species- allows software updates to be released.

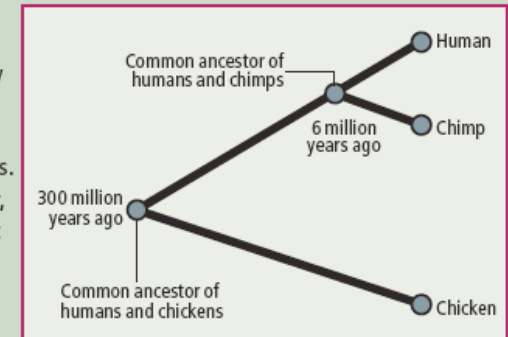
# Human vs. Chimps

- Chimps and humans share ~99% genomes. (~15 million bases diff.)
- Identify regions of human genome that have changed the most since chimps and humans diverged.
- Found >200 regions: HAR 1, HAR 2, FoxP2, ASPM, AMY1, LCT, retroviruses, etc.
- Insights into human-chimp differences, but also human disease and maladaptation.
- Kathrine S. Pollard. May 2009. What makes us Human? *Scientific American*: 44-49.

[EXPERIMENT]

## SCANNING THE GENOME

To find the parts of our genome that make us human, the author wrote a computer program that searched for the DNA sequences that have changed the most since humans and chimpanzees diverged from their last common ancestor. Topping the list was a 118-letter snippet of code known as human accelerated region 1 (HAR1). This region of the genome changed very little for most of vertebrate evolution, with chimp and chicken sequences differing by just two letters. Human and chimp HAR1s, however, differ by 18 letters, suggesting that HAR1 acquired an important new function in humans.



T	G	A	A	C	G	G	A	G	G	A	G	A	C	G	T	T	A	C
A	G	C	A	C	G	T	G	T	C	A	G	C	T	G	A	A	A	T
G	A	T	G	G	C	G	T	A	G	A	C	G	C	A	C	G	T	C
A	G	C	G	G	C	G	G	A	A	A	T	G	G	T	T	C	T	A
T	C	A	A	A	T	G	A	A	A	G	T	G	T	T	T	A	G	A
G	A	T	T	T	C	C	T	C	A	A	G	T	T	T	C	A		

Changes in human sequence relative to that of the chimp

T	G	A	A	A	T	G	G	A	G	G	A	G	A	A	A	T	T	A	C
A	G	C	A	A	T	T	A	T	C	A	A	C	T	G	A	A	A	T	
T	A	T	A	G	G	T	G	T	A	G	A	C	A	C	A	T	G	T	C
A	G	C	A	G	T	G	G	A	A	A	T	A	G	T	T	T	C	T	A
T	C	A	A	A	A	T	T	A	A	A	G	T	A	T	T	T	A	G	A
G	A	T	T	T	C	C	T	C	A	A	A	T	T	T	C	A			

Changes in chimp sequence relative to that of the chicken

T	G	A	A	A	T	G	G	A	G	G	A	G	A	A	A	T	T	A	C
A	G	C	A	A	T	T	T	A	T	C	A	A	C	T	G	A	A	A	T
T	A	T	A	G	G	T	G	T	A	G	A	C	A	C	A	T	G	T	C
A	G	C	A	G	T	A	G	A	A	A	C	A	G	T	T	T	C	T	A
T	C	A	A	A	A	T	T	A	A	A	G	T	A	T	T	T	A	G	A
G	A	T	T	T	C	C	T	C	A	A	A	T	T	T	C	A			



PERSONALGENOMES.ORG

Personal  
**Genome**  
Project



- From PGP-10 to PGP-100
  - March 2009 announcement
  - NOW SEEKING TO EXPAND THE PGP BY ONE ORDER OF MAGNITUDE AND ENROLL 100 ADDITIONAL VOLUNTEERS, FOLLOWED BY 1000 VOLUNTEERS, AND SO ON, UNTIL WE REACH 100,000 ENROLLEES



photo by Kris Snibbe

# DNA Forensic Phenotyping

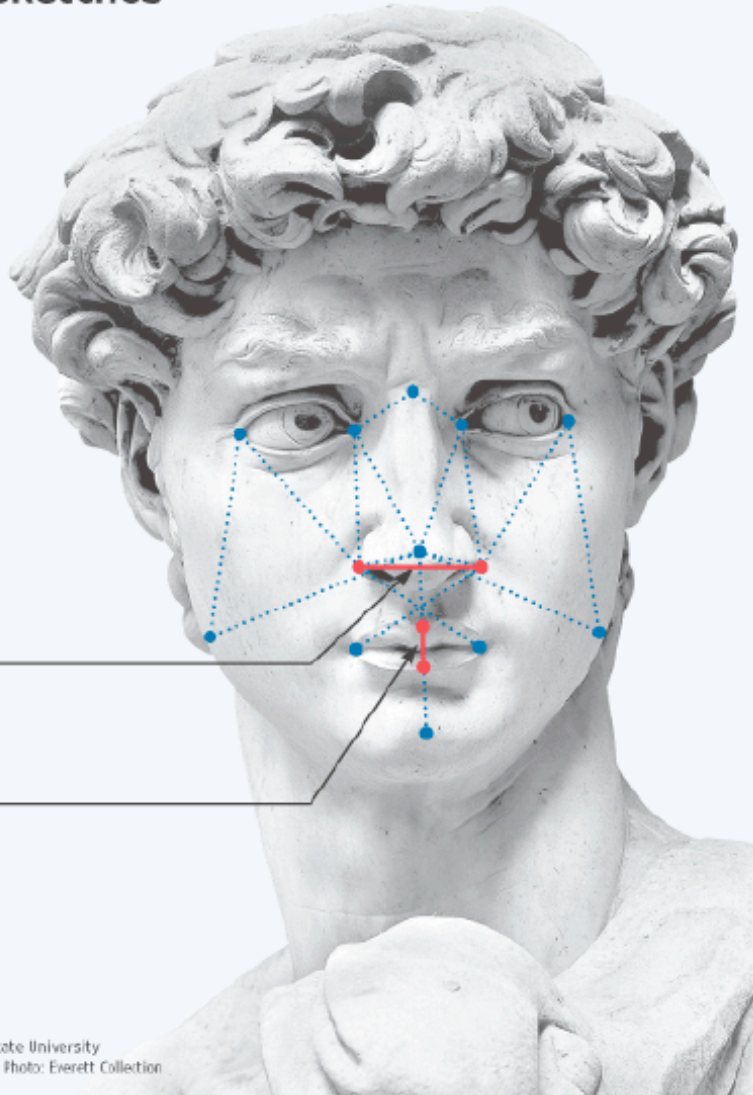
## Genetic Police Sketches

Scientists are working to identify genetic markers that influence facial features such as nose width and eye spacing in the hopes of one day using DNA samples from crime scenes to reconstruct a perpetrator's appearance.

Researchers at the Pennsylvania State University collected DNA samples and photographs from 243 people and used computer techniques to correlate individual genes with varying facial features in different ethnic groups. They found several genes that seem to influence facial traits.

A gene has been identified that influences the width of the nose at the widest point.

Another gene influences the height of lips.



Source: Mark Shriver, the Pennsylvania State University  
Photo illustration by The Wall Street Journal; Photo: Everett Collection

“Researchers are identifying genes that give rise to a person’s physical traits, such as facial structure, skin color or even whether they are right- or left-handed. That could allow police to build a picture of what a criminal looks like not just from sometimes-fuzzy eyewitness accounts, but by analyzing DNA found at a crime scene.”

Early days and potential risks:

- Ethnic stereotyping/targeting
- DNA goose chases
- Neo-eugenics?
- Storage and use of information?

UK and Netherlands allow, but Germany and several US states don’t allow inference to ethnicity or physical traits.

Gautam Naik. March 27, 2009. To sketch a thief: Genes draw likeness of suspects. *Wall Street Journal*: A9.



# The Fertility Institutes

Los Angeles • New York • Mexico

## Helping Couples Become Families™

- “A fertility clinic's promise to deliver the ultimate in designer babies - letting parents choose eye, hair and even skin color - is sparking a worldwide uproar.
- Dr. Jeff Steinberg has already let thousands decide their kids' gender. Now he says that within the next six months, the Manhattan and L.A. offices of his Fertility Institutes will let would-be moms and dads pick whether junior has blue or brown eyes or black or blond hair. "In the process of doing gender selection ... we've also uncovered the technology [to] characterize things like eye and hair color," said Steinberg, 54.
- The idea of a Build-A-Bear style baby was slammed Monday by bioethicists and right-to-life groups - and Pope Benedict has warned against it for years.”
- Later that same week, in response to the public response, Dr. Steinberg and the Fertility Institutes retracted the offer. But sex selection is still an available option.

Gina Salamone. March 4, 2009. Custom-made Babies Delievered. *New York Daily News*. And Editorial. May 2009. Designing rules for designer babies. *Scientific American*: 29.



Photo Illustration by Isaac Lopez/News  
Boy or girl? Blond or brunette? Blue eyes or brown? Fertility doc thinks he can deliver.

# Closing Remarks

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*"Your DNA doesn't match your credit history."*