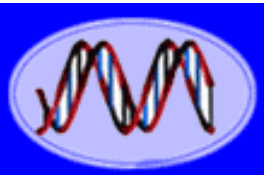

DNA
Genetic Code of Life

Entire Genetic Code
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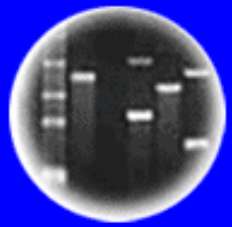


DNA Fingerprinting

Cloning: Ethical Issues
and Future Consequences

Plants of Tomorrow

HC70A, PLS530, & SAS70A
Winter 2012
Genetic Engineering in Medicine, Agriculture, and Law

Professors Bob Goldberg, Channapatna Prakash, & John Harada

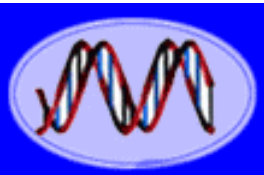
Lecture 1
The Age of DNA: What Is Genetic Engineering-Part One

Please Turn Off Your Cell Phones!!

UCLA

TUSKEGEE UNIVERSITY

UCDAVIS
UNIVERSITY OF CALIFORNIA



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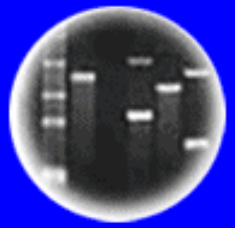

DNA Fingerprinting

Cloning: Ethical Issues
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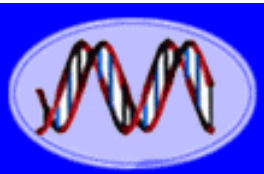
Plants of Tomorrow

THEMES

1. The Age of DNA, Genomics, Genetic Engineering & Synthetic Organisms
2. Is DNA Part of Our Culture – Some Examples
3. What Do Genes Look Like - DNA Demonstration
4. How Was Modern Genetic Engineering Invented & What Is the Genetic Engineering Process?
5. Why Use Genetic Engineering?
6. How Has Genetic Engineering Affected Our Lives?
7. How Has Genetic Engineering Created New Ethical and Legal Issues?



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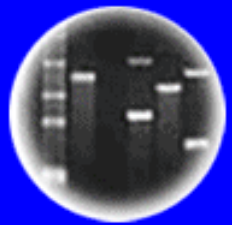


DNA Fingerprinting

Cloning: Ethical Issues
and Future Consequences

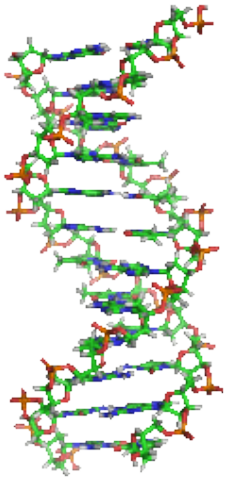
Plants of Tomorrow

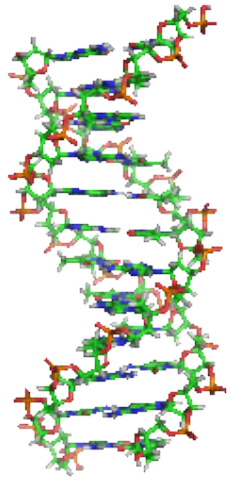
Going Long Distance
HC70A, SAS70A, & PLSS530
Winter 2012

UCDAVIS
UNIVERSITY OF CALIFORNIA

UCLA

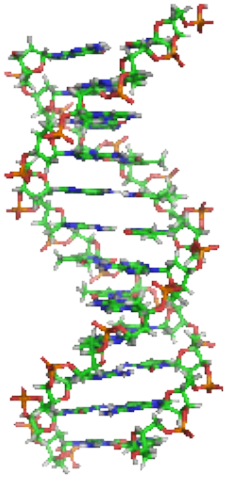
A Model For Cross-Campus Interactive Learning



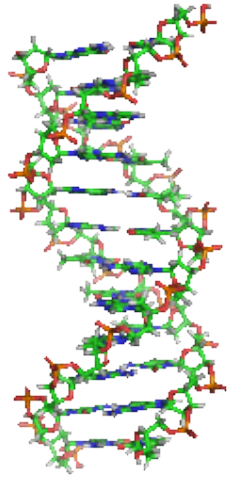


We Live in
The Age of DNA!

Genetic Engineering Is
Manipulating DNA!

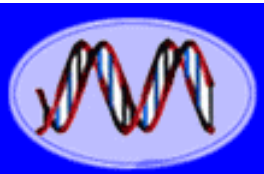


By Breeding or in a Test Tube
It's All the Same!



DNA is Part of Our Culture!!

"It's In Our DNA!"



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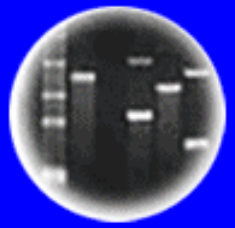


DNA Fingerprinting

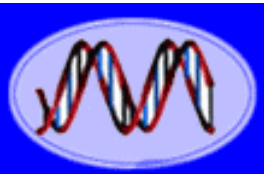
Cloning: Ethical Issues
and Future Consequences

Plants of Tomorrow

We Live in the Era of....

- Genes & DNA
- Genomics & Genome Sequencing
- Genetic Engineering of Microbes, Plants, & Animals
- A $32B Biotechnology Industry Using Genetic Engineering Technology
- Synthetic Microbes Made by "Man"
- Personalized Genomes and Ability to Identify Any Individual Using DNA
- Stem Cells, Mammalian Reproduction, & Cloning

And the INTEGRATION of These Technologies!!



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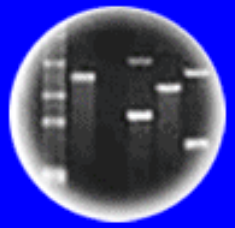

DNA Fingerprinting

Cloning: Ethical Issues
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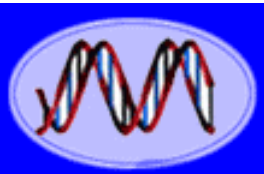
Plants of Tomorrow

Genetic Engineering……..

Is the Most Revolutionary Technology in Biology to Have Been Invented to Date!

Has Generated the Vast Majority of New Biological Knowledge Over the Past 40 Years From Experiments in Biology Laboratories Around the Globe

Has Changed Our Lives Dramatically!



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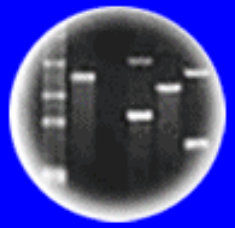
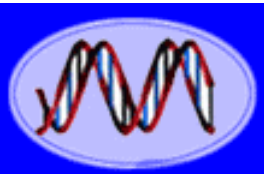


DNA Fingerprinting

Cloning: Ethical Issues
and Future Consequences

Plants of Tomorrow

- From New Medicines
- To Better Crops
- To the Sequence of the Human Genome & 50,000 Year-Old Fossil Genomes
- To Novel Ways To Identify Individuals
- To Understanding the Basis of Human Disease and Providing Novel Treatments
- To Personalized Genomes and Medicine Geared To Specific Individuals
- To Creating Synthetic Organisms For Industrial Purposes
- To Unraveling the Mysteries of ALL Cellular Processes!
- To Ultimately - Immortality?



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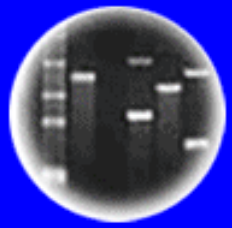

DNA Fingerprinting

Cloning: Ethical Issues
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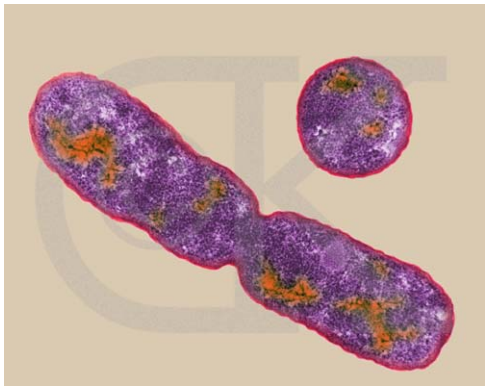
Plants of Tomorrow

We Are Entering The Era of Synthetic Biology

Genetic Engineering Can Be Used To Synthesize and Engineer Entire Chromosomes From Chemicals and Create Synthetic Microbes in a Test Tube



2 JULY 2010 VOL 329 SCIENCE www.sciencemag.org

Creation of a Bacterial Cell Controlled by a Chemically Synthesized Genome

May 20, 2010

Researchers Say They Created a 'Synthetic Cell'

By NICHOLAS WADE

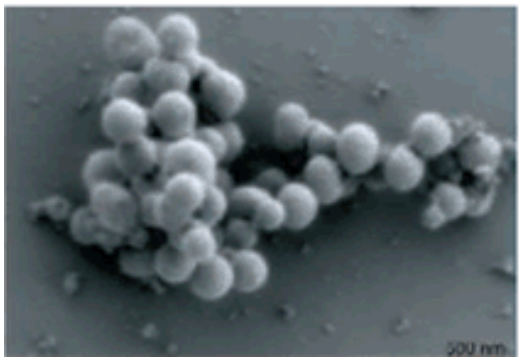
The genome pioneer J. Craig Venter has taken another step in his quest to create synthetic life, by synthesizing an

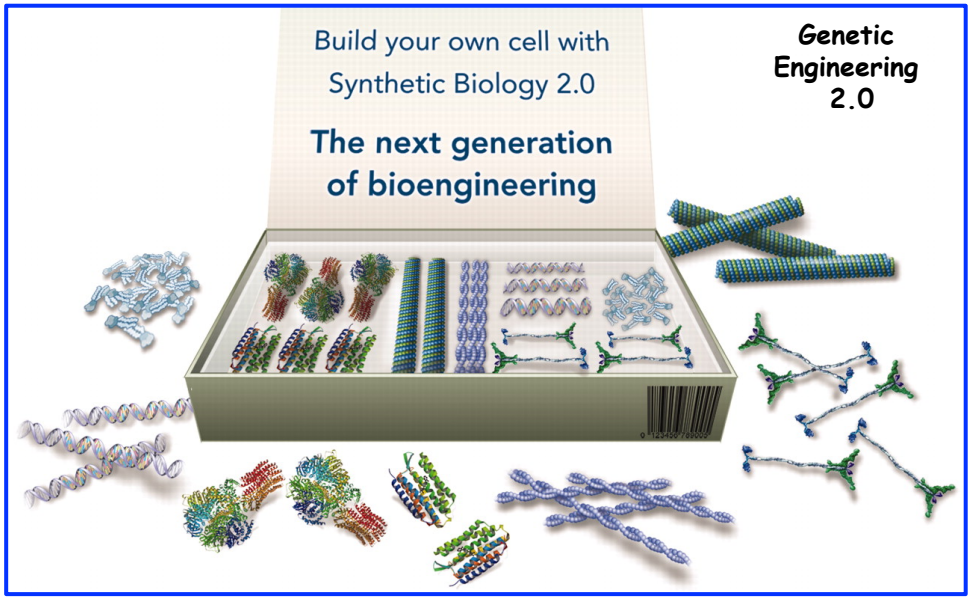
July 14, 2011

Genetic Code of E. Coli Is Hijacked by Biologists

By NICHOLAS WADE

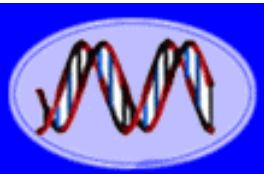
Science, July 15, 2011





Creating Life: Synthetic Microbes
J. Craig Venter

60 Minutes-December 2010



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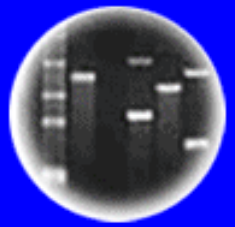

DNA Fingerprinting

Cloning: Ethical Issues
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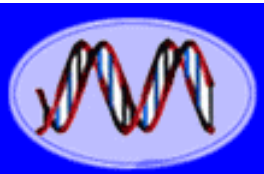
Plants of Tomorrow

Question One

Are You Uncomfortable With Creating Microbes With Synthetic Genomes?

a. Yes

b. No



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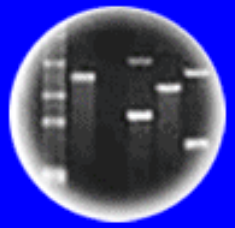

DNA Fingerprinting

Cloning: Ethical Issues
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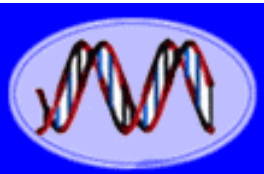
Plants of Tomorrow

Question Two

Are You Uncomfortable With Creating Synthetic Microbes That Can Produce Unlimited Amounts of Transportation Fuel or Industrial Products Cheaply?

a. Yes
b. No



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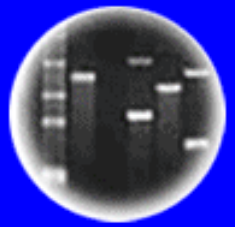

DNA Fingerprinting

Cloning: Ethical Issues
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Plants of Tomorrow

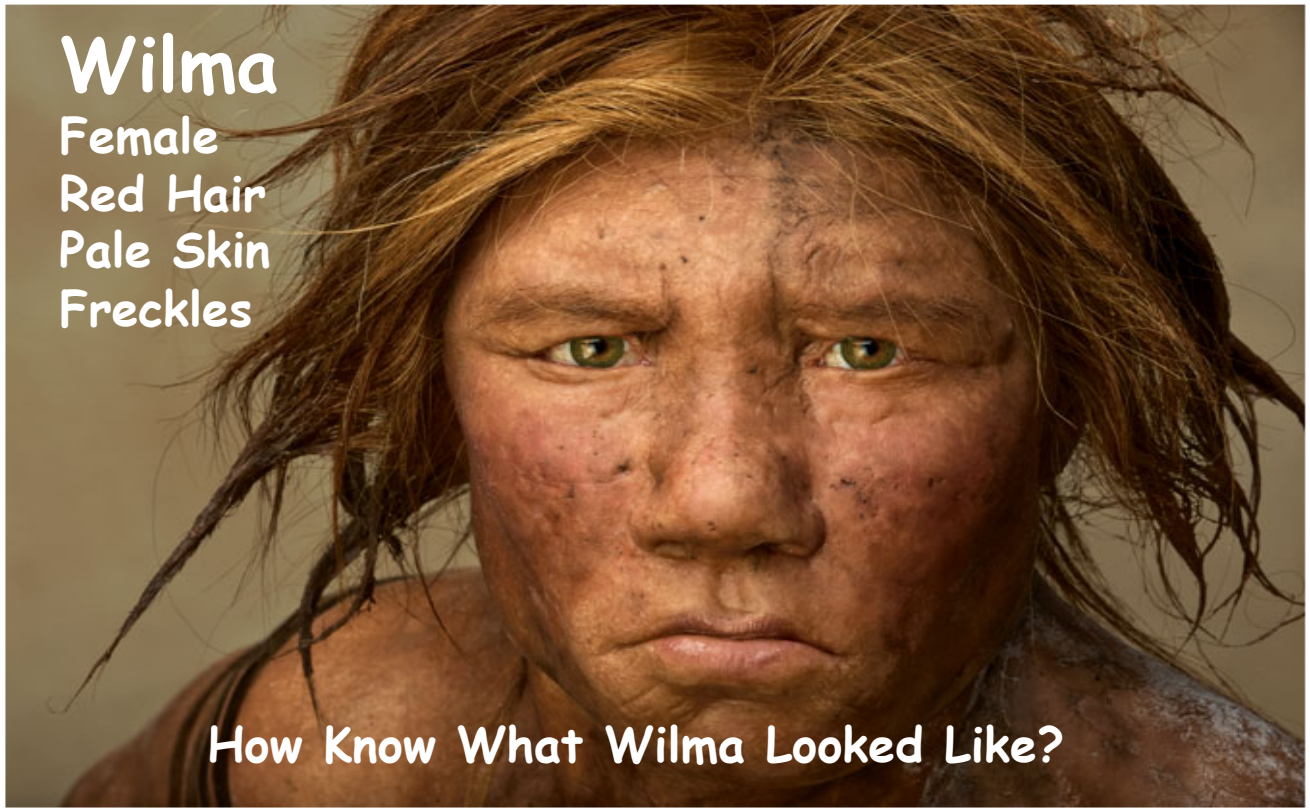
DNA Can Be Used To Look Into The Past and "Bring Back the Dead!!

RESEARCH ARTICLE

Science, May 7, 2010 (328, 710-722)

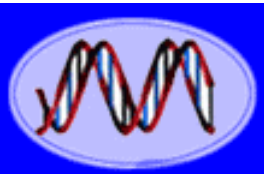
A Draft Sequence of the Neandertal Genome

From a 45,000 Year-Old Bone



Reconstruction by Kennis & Kennis / Photograph by Joe McNally

For the first time, a Neanderthal female peers from the past in a reconstruction informed by both fossil anatomy and ancient DNA. At least some of her kind carried a gene for red hair and pale skin.



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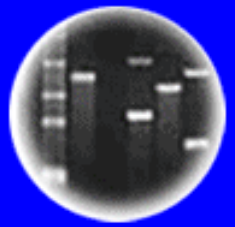

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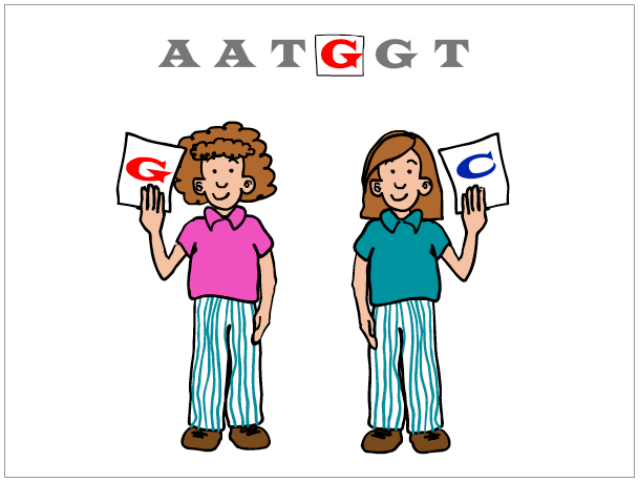
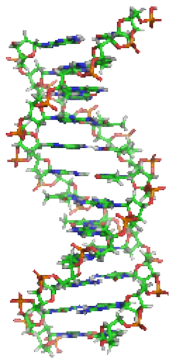
Plants of Tomorrow

DNA Sequences Can Be Used To Specify Eye Color





Yo….It's In the DNA!

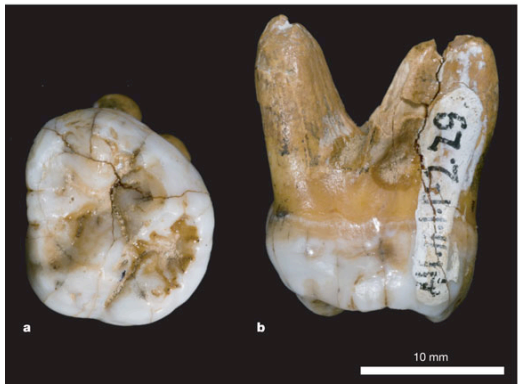
Nature, December 30, 2010 (468,1053-1060)

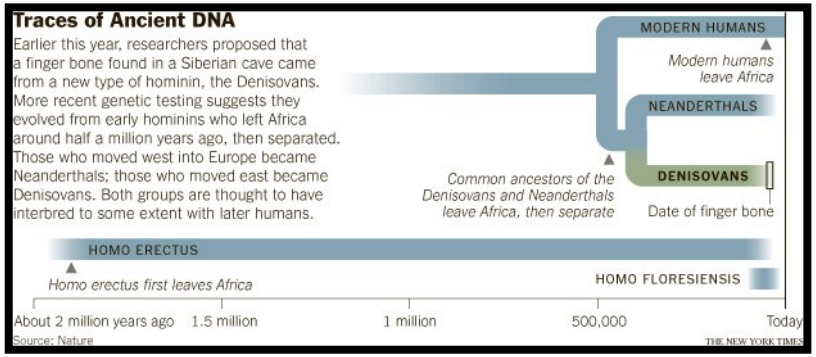
Genetic history of an archaic hominin group from Denisova Cave in Siberia

David Reich[1,2]*, Richard E. Green[3,4]*, Martin Kircher[3]*, Johannes Krause[3,5]*, Nick Patterson[2]*, Eric Y. Durand[6]*, Bence Viola[3,7]*, Adrian W. Briggs[1,3], Udo Stenzel[3], Philip L. F. Johnson[8], Tomislav Maricic[3], Jeffrey M. Good[9], Tomas Marques-Bonet[10,11], Can Alkan[10], Qiaomei Fu[3,12], Swapan Mallick[1,2], Heng Li[2], Matthias Meyer[3], Evan E. Eichler[10], Mark Stoneking[3], Michael Richards[7,13], Sahra Talamo[7], Michael V. Shunkov[14], Anatoli P. Derevianko[14], Jean-Jacques Hublin[7], Janet Kelso[3], Montgomery Slatkin[6] & Svante Pääbo[3]

Using DNA extracted from a finger bone found in Denisova Cave in southern Siberia, we have sequenced the genome of an archaic hominin to about 1.9-fold coverage. This individual is from a group that shares a common origin with Neanderthals. This population was not involved in the putative gene flow from Neanderthals into Eurasians; however, the data suggest that it contributed 4–6% of its genetic material to the genomes of present-day Melanesians. We designate this hominin population 'Denisovans' and suggest that it may have been widespread in Asia during the Late Pleistocene epoch. A tooth found in Denisova Cave carries a mitochondrial genome highly similar to that of the finger bone. This tooth shares no derived morphological features with Neanderthals or modern humans, further indicating that Denisovans have an evolutionary history distinct from Neanderthals and modern humans.

DNA Sequence From 40,000 Year Old Fossil DNA!!

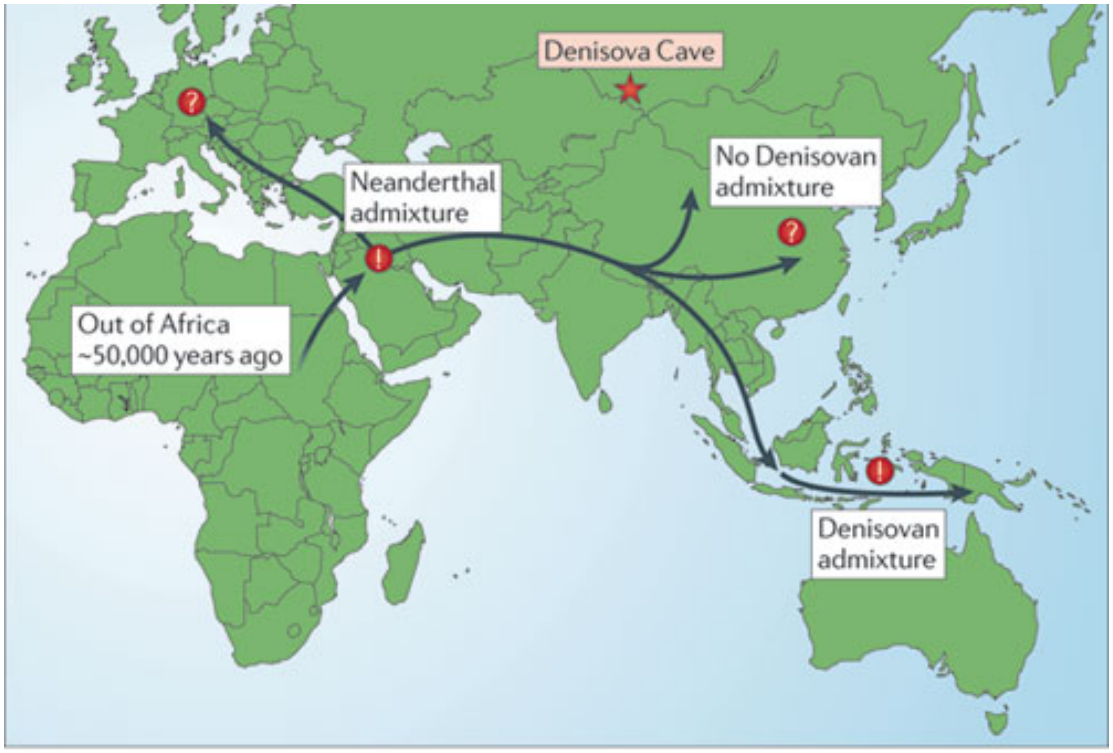




The Shaping of Modern Human Immune Systems by Multiregional Admixture with Archaic Humans

www.sciencemag.org **SCIENCE** VOL 334 7 OCTOBER 2011

Comparing 40,000 Year-Old Fossil Genomes to Our Genome Reveals Ancient "Matings" Between Diffferent Human Ancestor Lineages!!



We Have Neanderthal & Denisovan Genes in Our Chromosomes

It's All in the DNA!

Nature Reviews | Genetics
September, 2011

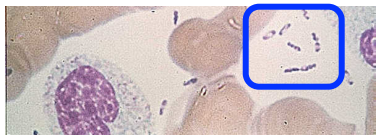
LETTER

Nature, October 27, 2011

doi:10.1038/nature10549

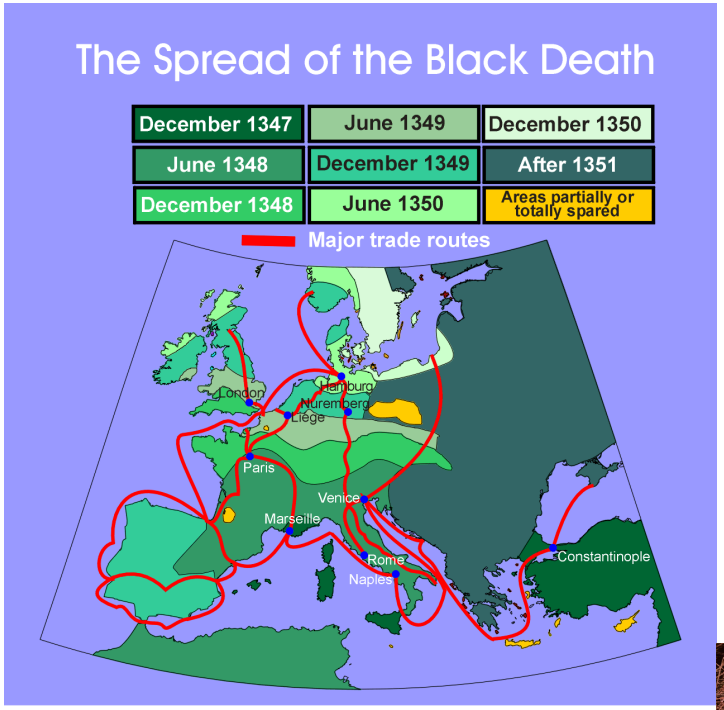
A draft genome of *Yersinia pestis* from victims of the Black Death

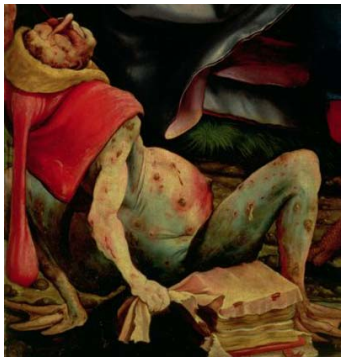
Kirsten I. Bos[1]*, Verena J. Schuenemann[2]*, G. Brian Golding[3], Hernán A. Burbano[4], Nicholas Waglechner[5], Brian K. Coombes[5], Joseph B. McPhee[5], Sharon N. DeWitte[6,7], Matthias Meyer[4], Sarah Schmedes[8], James Wood[9], David J. D. Earn[5,10], D. Ann Herring[11], Peter Bauer[12], Hendrik N. Poinar[1,3,5] & Johannes Krause[2,12]



Rat Blood

1347-1351





- Killed 30% of Europe's Population
- Killed 100M People in Four Years!
- Population of 450M to 350M
- Took 150 Years to Recover

Vol 456|20 November 2008|doi:10.1038/nature07446 nature

Nature, November 2008

LETTERS

Sequencing the nuclear genome of the extinct woolly mammoth

Think About Bringing a Woolly Mammoth Back to Life!!

Webb Miller[1], Daniela I. Drautz[1], Aakrosh Ratan[1], Barbara Pusey[1], Ji Qi[1], Arthur M. Lesk[1], Lynn P. Tomsho[1], Michael D. Packard[1], Fangqing Zhao[1], Andrei Sher[2]‡, Alexei Tikhonov[3], Brian Raney[4], Nick Patterson[5], Kerstin Lindblad-Toh[5], Eric S. Lander[5], James R. Knight[6], Gerard P. Irzyk[6], Karin M. Fredrikson[7], Timothy T. Harkins[7], Sharon Sheridan[7], Tom Pringle[8] & Stephan C. Schuster[1]

PNAS

November 11, 2008

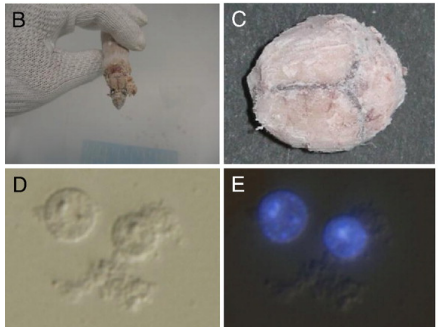
Production of healthy cloned mice from bodies frozen at −20°C for 16 years

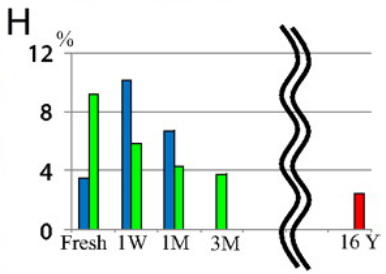
Think of the possibilities!

Sayaka Wakayama[a], Hiroshi Ohta[a], Takafusa Hikichi[a], Eiji Mizutani[a], Takamasa Iwaki[b], Osami Kanagawa[c], and Teruhiko Wakayama[a,1]

[a]RIKEN, Center for Developmental Biology, 2-2-3 Minatojima-minamimachi, Kobe, 650-0047, Japan; [b]Jikei University School of medicine, Tokyo 105-8461, Japan; and [c]RIKEN, Research Center for Allergy and Immunology, 1-7-22, Suehiro-cho, Tsurumi-ku, Yokohama, 230-0045, Japan

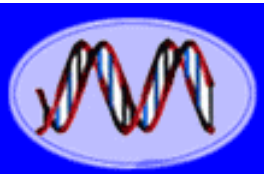
How Know a Clone or Genetically Identical Individual - DNA!





Resurrecting the Extinct

60 Minutes, January, 2010



DNA
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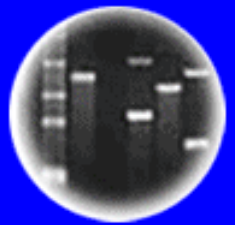

DNA Fingerprinting

Cloning: Ethical Issues
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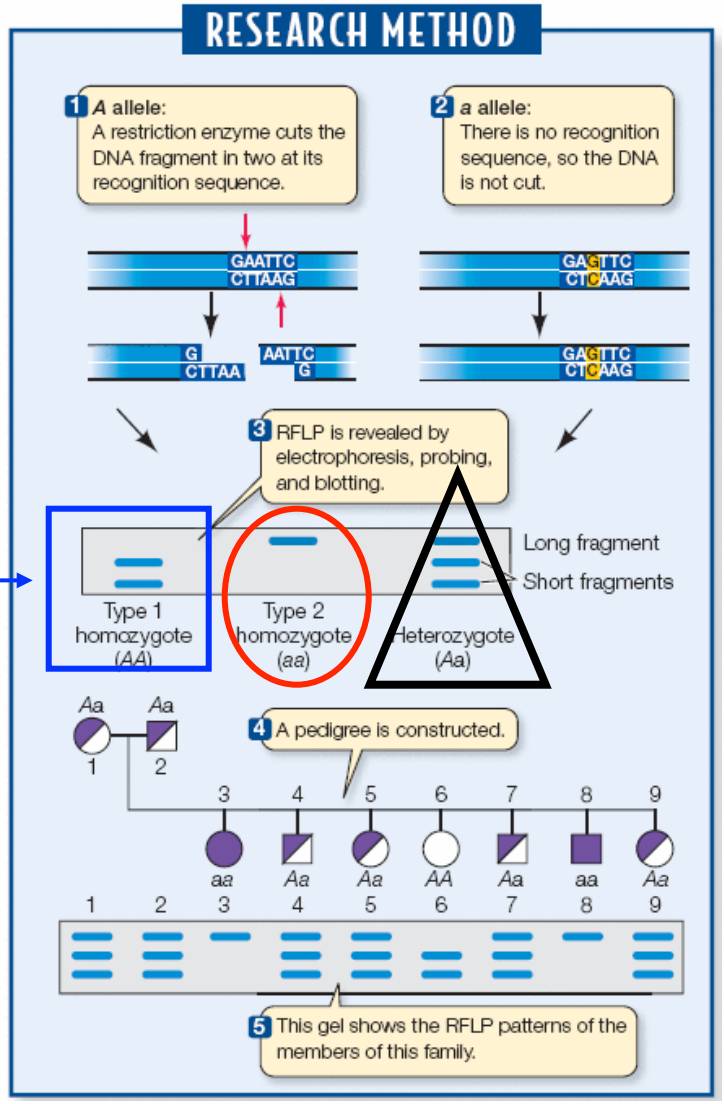
Plants of Tomorrow

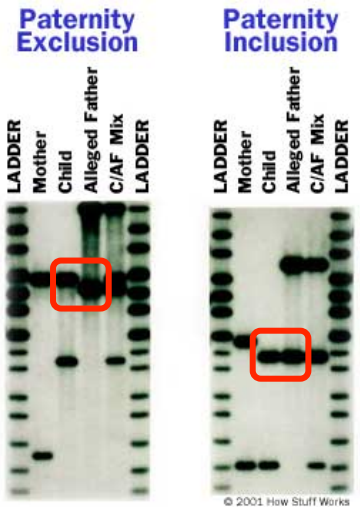
DNA Can Be Used To Identify Individuals For Genetic Diseases, Paternity, Ancestry, Forensics, Crimes, and Much More

Using DNA Fingerprints to Identify Individuals & Genes

DNA Fingerprints →



What is YOUR DNA Fingerprint?

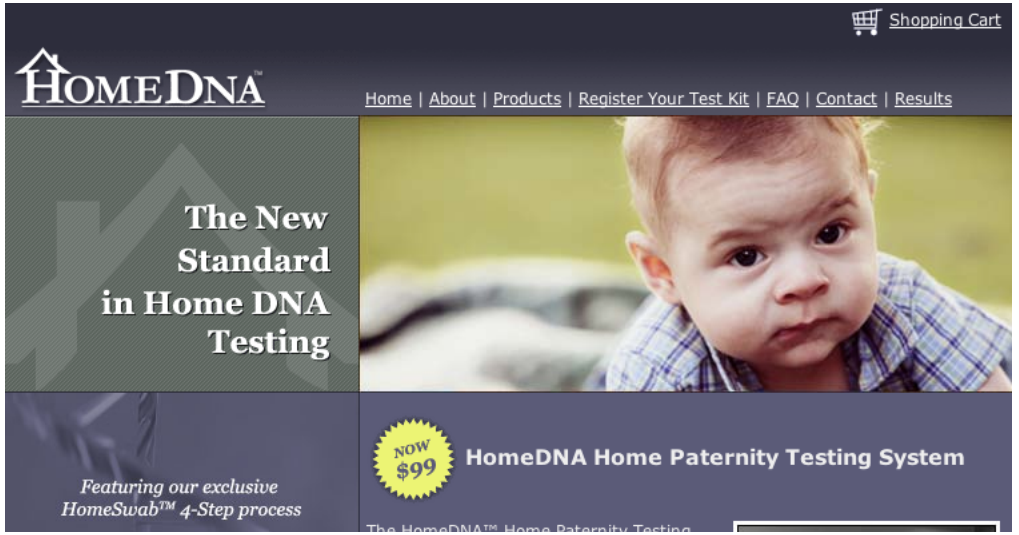


DNA Testing Into the Home - Fast & Inexpensive DNA Testing Kits!

Paternity

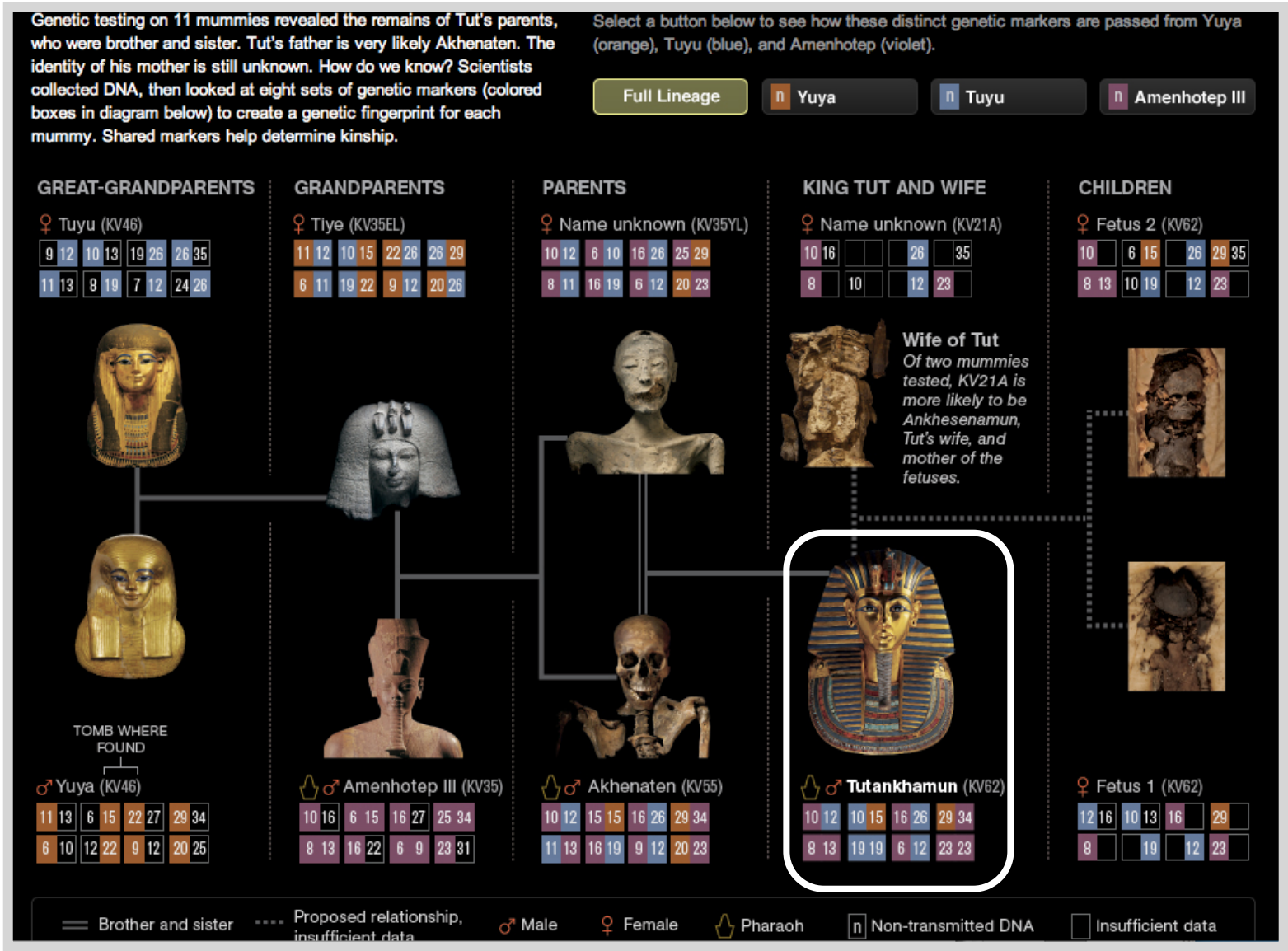
Ancestry

What are the Scientific, Legal, Ethical, & Privacy Issues??



Immigration

Even Lineages of Ancient Mummies Such As King Tut Can Be Determined Using DNA Fingerprinting!!



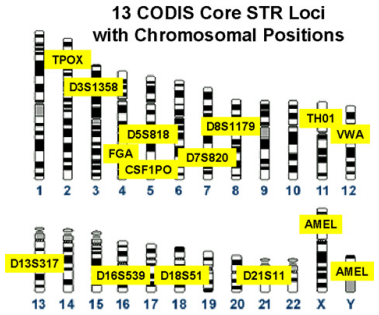
National Geographic, September 2010

King Tut Lived 3,500 years Ago!!

DNA Has Impacted the Law in Dramatic Ways

Combined DNA Index System of DNA Profiles

- Convicted Felons
- Suspects Arrested For Felonies
- DNA Samples From Crime Scenes
- Unidentified Human Remains
- Relatives of Missing Persons



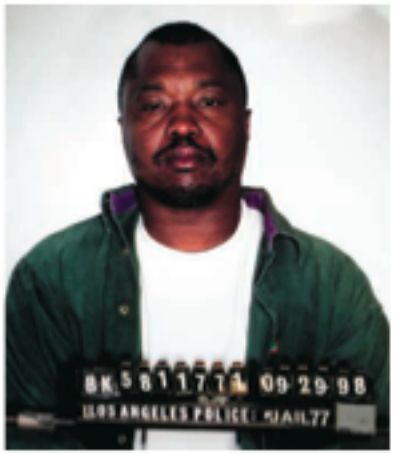
November, 2011

Offender Profiles	10,343,027
Forensic Profiles	403,392
Database "Hits"	166,200

What Are State Laws?

FORENSICS

Familial DNA Testing Scores A Win in Serial Killer Case



Proud of their work. A familial DNA search by forensic scientists in California led to the arrest of Lonnie Franklin, the suspected Grim Sleeper killer.

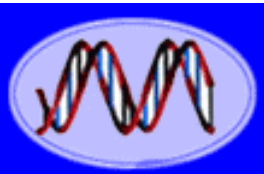
Grim Sleeper Caught By DNA!!

Set Free By DNA Evidence

INNOCENCE PROJECT

15th Person Cleared by DNA in Dallas. Charles Chatman was released from state custody Jan. 3 in Dallas, after serving nearly 27 years in prison for a rape he didn't commit. He is the 15th Dallas man to be cleared by DNA testing after being wrongfully convicted. After his hearing, he hugged Judge John Creuzot, who advocated for testing in the case. Innocence Project of Texas Attorney Jeff Blackburn (left) represents Chatman.

- **281 Post-Conviction DNA Exonerations Since 1989**
- **17 of 281 People Exonerated Were on Death Row**
- **Average Time Served Was 13 Years**
- **Average Age at Time of Wrongful Conviction Was 27**
- **75% of Wrongful Convictions Due to Eyewitness Misidentification**
- **50% of Wrongful Convictions Due to Improper Forensic Science, Such As Hair Sample, Shoe Print, & Bite Mark Comparisons**



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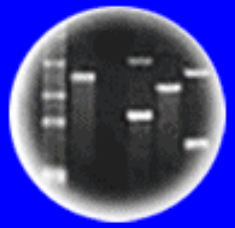

DNA Fingerprinting

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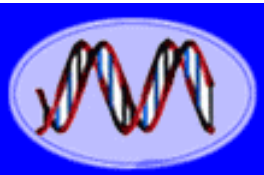
Plants of Tomorrow

Question Three

Should every individual who is arrested for a crime be required to have their DNA fingerprinted and deposited in a National Criminal DNA database (CODIS)?

a. Yes
b. No



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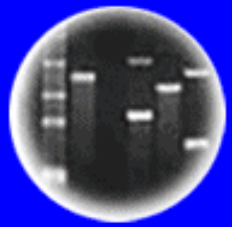

DNA Fingerprinting

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DNA Can Also Be Used To Uncover Consumer Fraud and Identify Poached Wildlife

May 26, 2011

Tests Reveal Mislabeling of Fish

By ELISABETH ROSENTHAL

Scientists aiming their gene sequencers at commercial seafood are discovering rampant labeling fraud in supermarket coolers and restaurant tables: cheap fish is often substituted for expensive fillets, and overfished species are passed off as fish whose numbers are plentiful.

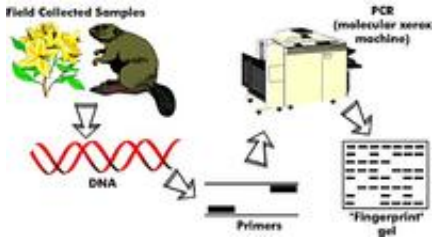
$11,250 IN FINES FOR ILLEGAL MOOSE HUNT AND COVER UP

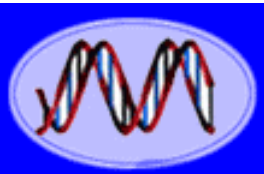
NEWS

November 16, 2010

Four southern Ontario men have been convicted of charges related to illegal moose hunting.

Anton Gerritsen Jr. and Anton Gerritsen Sr., both of Cayuga, Shank A. Vanderheide of Canfield and James E. Kruis of St. George, were each fined $1,000 for obstructing a Ministry of Natural Resources conservation officer and Gerritsen Jr., Gerritsen Sr. and Vanderheide were each fined $500 for illegally possessing a cow moose. Gerritsen Jr. was also fined $250 for illegally possessing a calf moose, $1,500 for hunting cow moose without a licence and $500 for failing to immediately attach a game seal to a harvested animal. Gerritsen Sr. was fined $500 for using a hunting licence that was issued to someone else.





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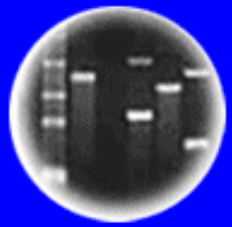

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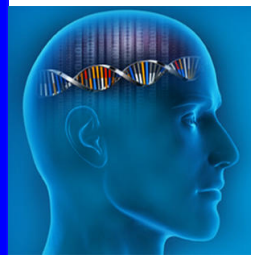
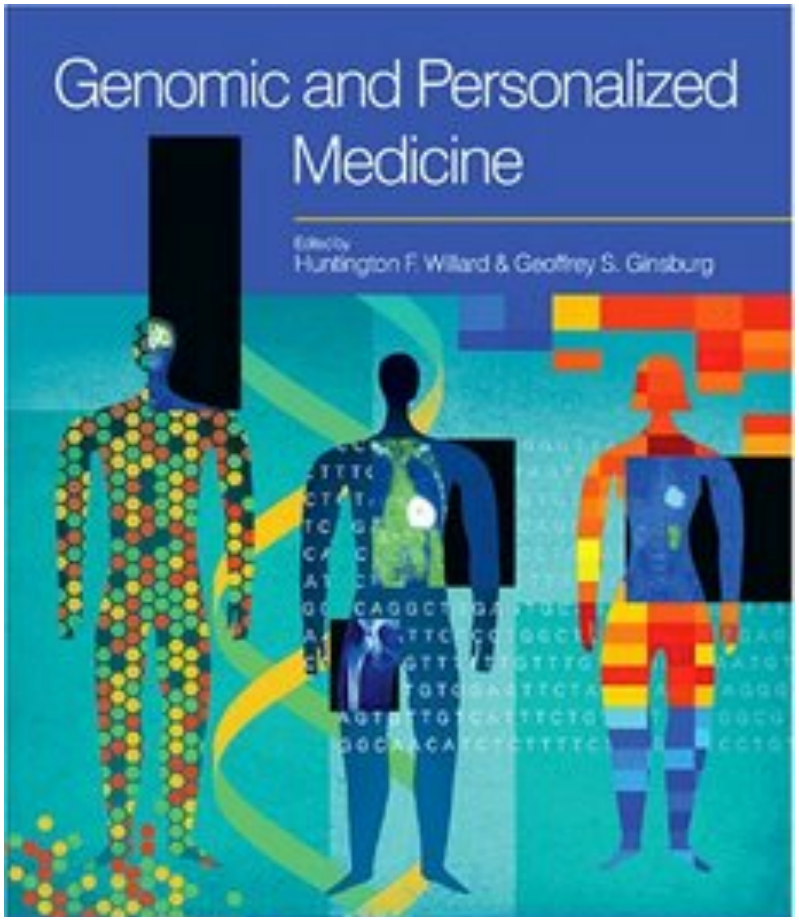


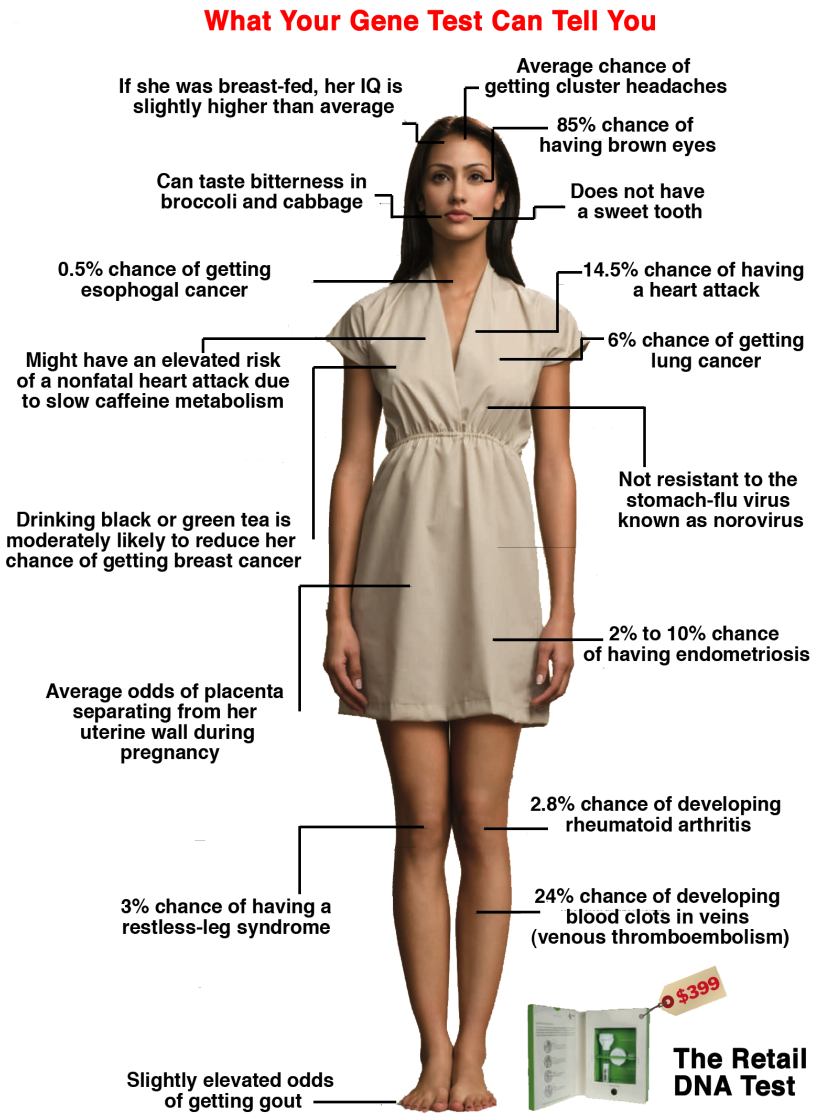
DNA Is Leading to a New Era in Personalized Medicine



23andMe
DNA TRIBES
Navigenics
IDENTIGENE
HOMEDNA

DNA Can Be Used To Test For Hundreds of Disease Genes and Human Traits and Generate Personalized Gene Profiles

Time Magazine 2008 - Invention of the Year Your Personal Genome - 23andMe®



Invention Of the Year

And Before Birth!!!

What Are the Problems & Laws That Govern Direct To Consumer DNA Tests?

https://www.23andme.com/

Your Complete Genome Can Now Be Decoded and Sequenced Very Inexpensively ($5,000)!!

Genome of DNA Pioneer Is Deciphered

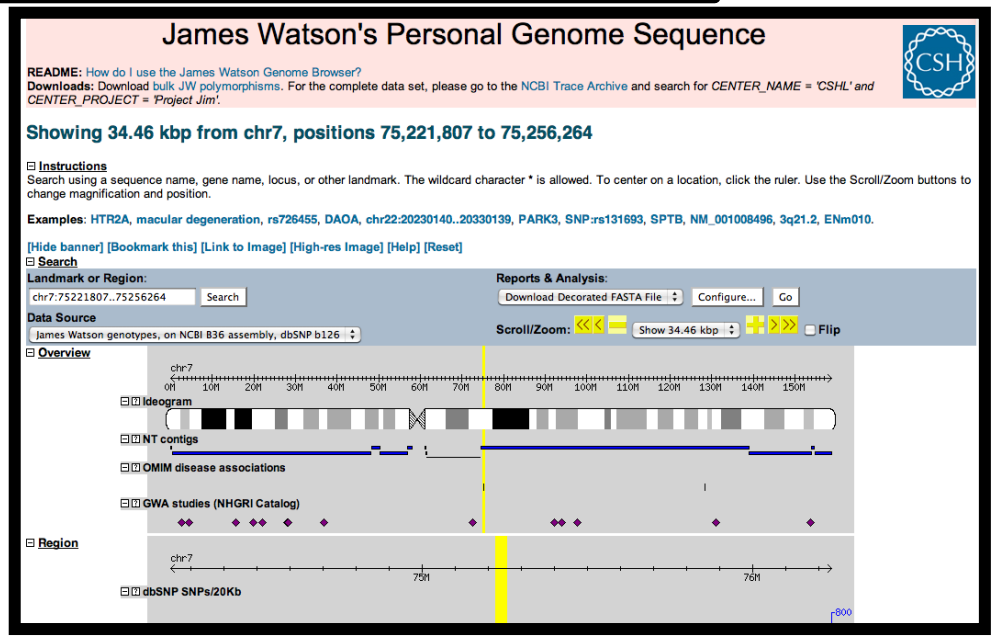
By NICHOLAS WADE
Published: May 31, 2007

A map of human genome variation from population-scale sequencing

~200 Individual Genomes

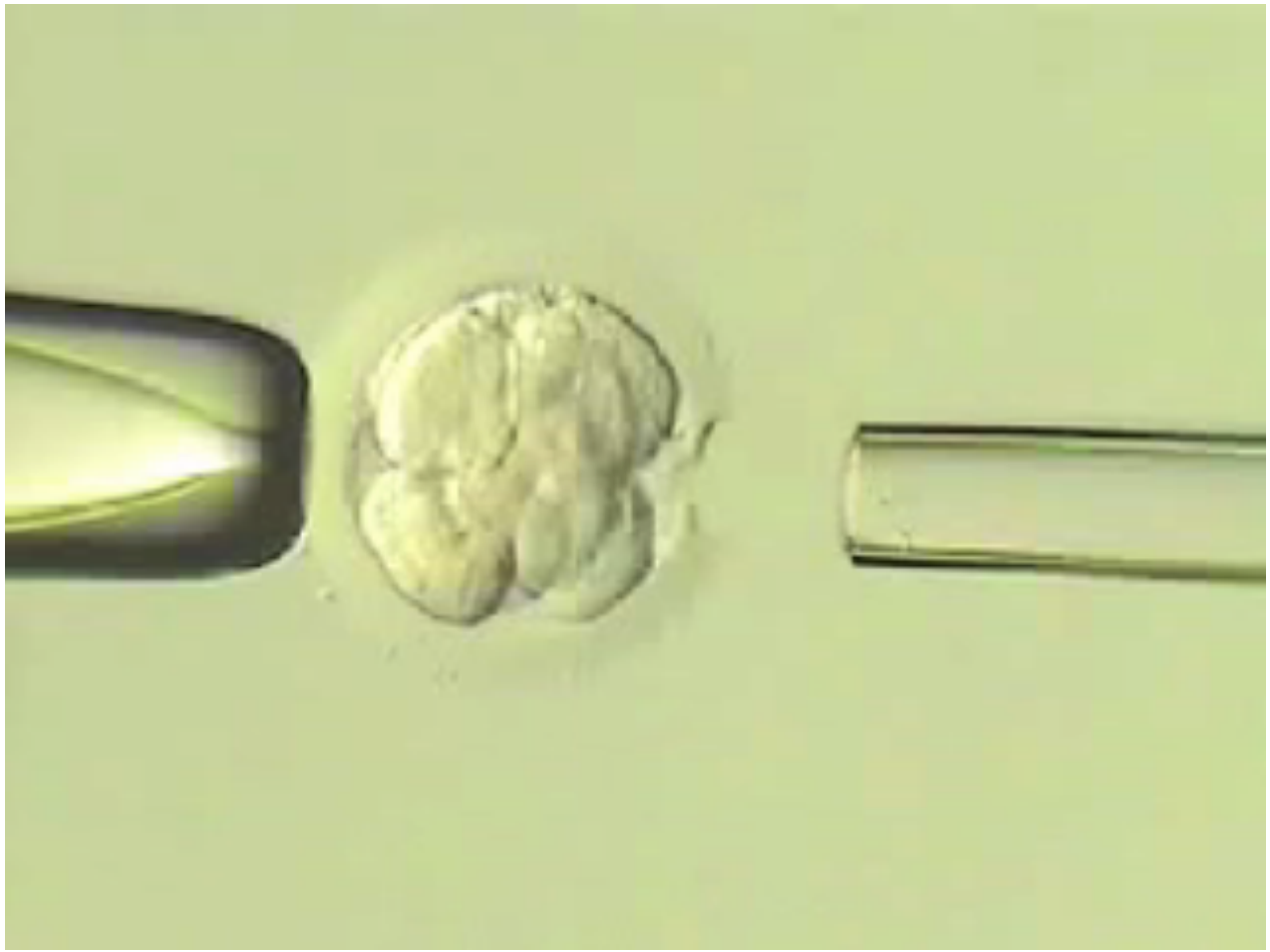
The 1000 Genomes Project Consortium*

Nature, October 28, 2010



The Era of Personalized Genomes is Here!

Determining the Genetic Identity of a Human Embryo Before Implantation!



Prenatal Genetic Diagnosis (PGD)

RESEARCH ARTICLE

PRENATAL DIAGNOSIS

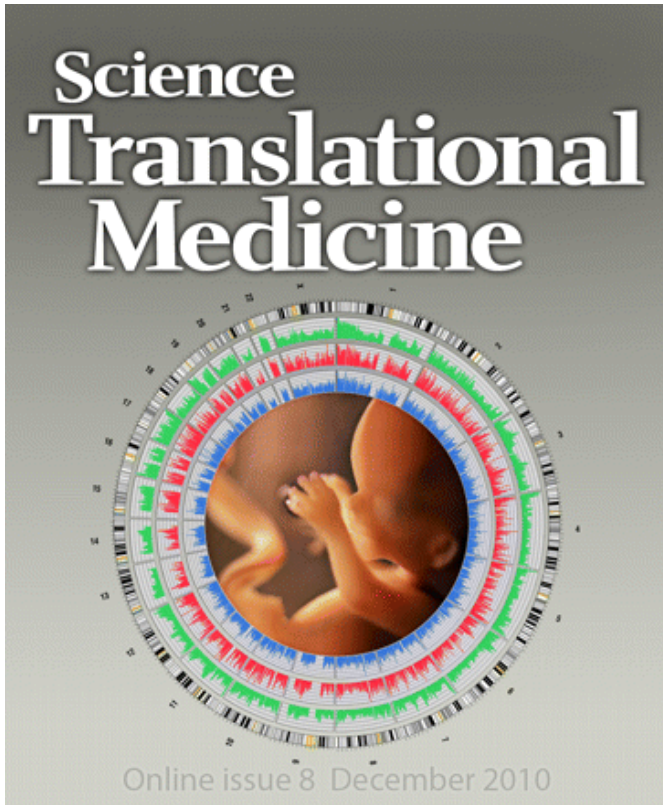
Maternal Plasma DNA Sequencing Reveals the Genome-Wide Genetic and Mutational Profile of the Fetus

Science Translational Medicine, December 8, 2010 (61,1-12)

Sequencing DNA From the Blood of a Pregnant Woman Allows the Complete Genome Of the Fetus to Be Decoded!

~10% of DNA in Maternal Plasma is From the Fetus

A New Era in DNA Testing!!



Your Complete Genome Can Now Be Decoded and Sequenced For $1,000!

Science Moves At Warp Speed

"Scientists Always Overestimate What Can Be Done in a Short Time and Always Underestimate What Can Be Done Over Longer Periods of Time!"

THE WALL STREET JOURNAL.
WSJ.com

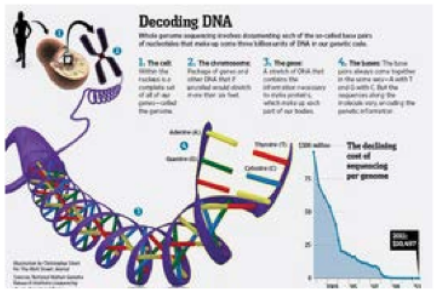
U.S. NEWS | JANUARY 10, 2012

Soon, $1,000 Will Map Your Genes

By RON WINSLOW And SHIRLEY S. WANG

SAN FRANCISCO—The quest to harness the power of DNA to develop personalized medicine is on the threshold of a major milestone: the $1,000 genome sequencing.

Life Technologies Corp., a Carlsbad, Calif., genomics company, plans to introduce Tuesday a machine it says will be able to map an individual's entire genetic makeup for $1,000 by the end of this year. Moreover, the machine and accompanying microchip technology, both developed by the company's Ion Torrent unit, will deliver the information in a day, the company says.

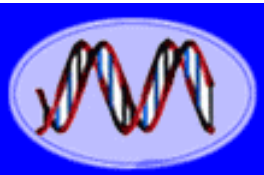


Christopher Short

If Life Technologies delivers on the claim, it would likely make the company the first among a group of rivals racing to produce a $1,000 gene map. The current cheapest sequencing costs about $3,000 and takes a week.

The goal, triggered in part by an initiative launched by the U.S. government's National Human Genome Research Institute in 2004, already has resulted in a dramatic cost reduction in sequencing all three billion units of DNA, known as base-pairs, that make up the human genetic code.

Scientists say that breaking the $1,000 barrier—roughly the price of an MRI test—will accelerate an already fast-moving transformation in genetic discovery and drug development.



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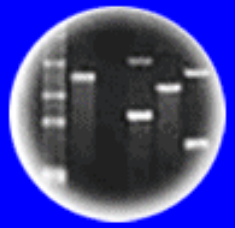

DNA Fingerprinting

Cloning: Ethical Issues
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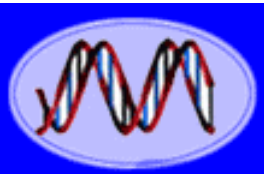
Plants of Tomorrow

Question Five

Should parents that carry a gene for a genetic disease be required to test their children to determine whether they are carriers or have the disease?

a. Yes
b. No



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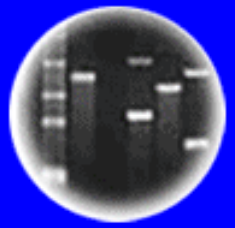

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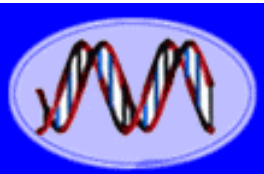
Question Six

Should Individuals Be Told That They Have a Genetic Disease Even Though There is No Treatment or Cure?

a. Yes
b. No



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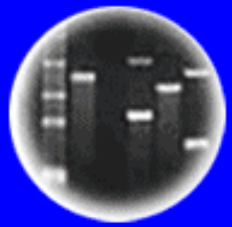

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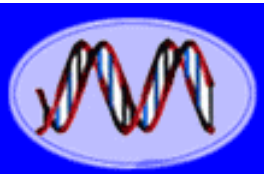
DNA and Genetic Engineering Has Lead To Novel Crops and New Medicines to Treat Disease!!

Roundup Ready SOYBEANS

Rice seed yields blood protein

PNAS, October, 2011

Human serum albumin from transgenic rice could ease shortages of donated blood.



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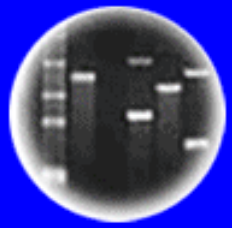

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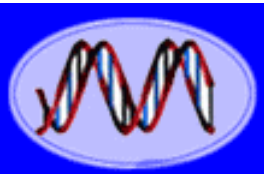
Plants of Tomorrow

Question Seven

Would you eat food obtained from genetically modified plants and animals?

a. yes
b. no



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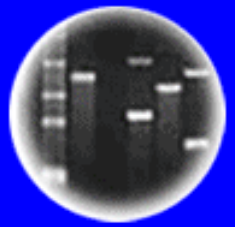

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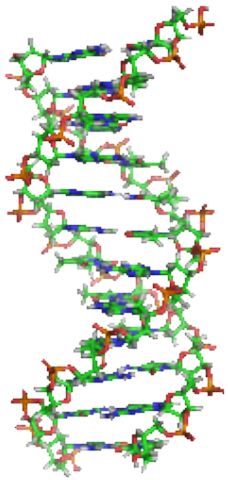
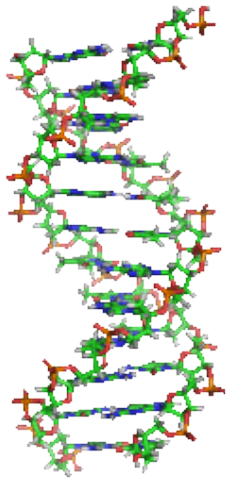
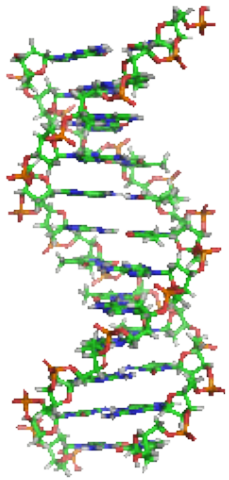
What Is A Gene?

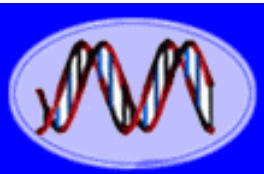
What Do Your Genes Look Like?

Have Your Seen or Touched Your Genes?









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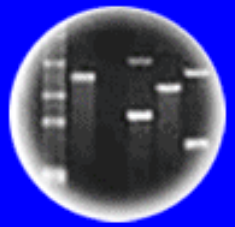

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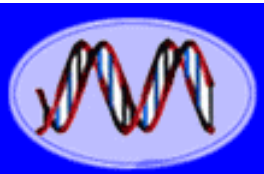
How Was Genetic Engineering Invented?
&
How Did It Lead To Remarkable Advances With DNA?

Genetic Engineering 1.0



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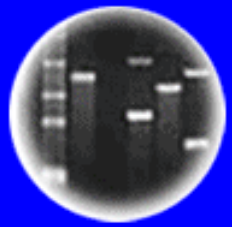

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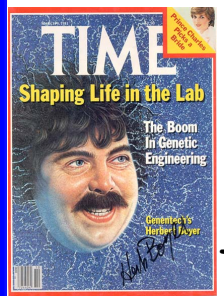
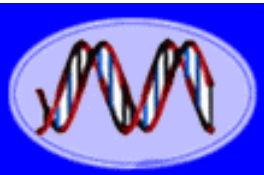
Genetic Engineering Started in a Hawaii Delicatessen 40 Years Ago…..

With An Unexpected "Eureka" Moment Dealing With Two Unrelated Areas of Study:

1. The Mechanism of Bacterial Antibiotic Resistance
2. How Novel Enzymes That Protect Bacteria From Destruction By Viruses "Cut" DNA Into Pieces



TIME, March, 1981



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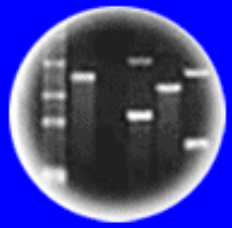

DNA Fingerprinting

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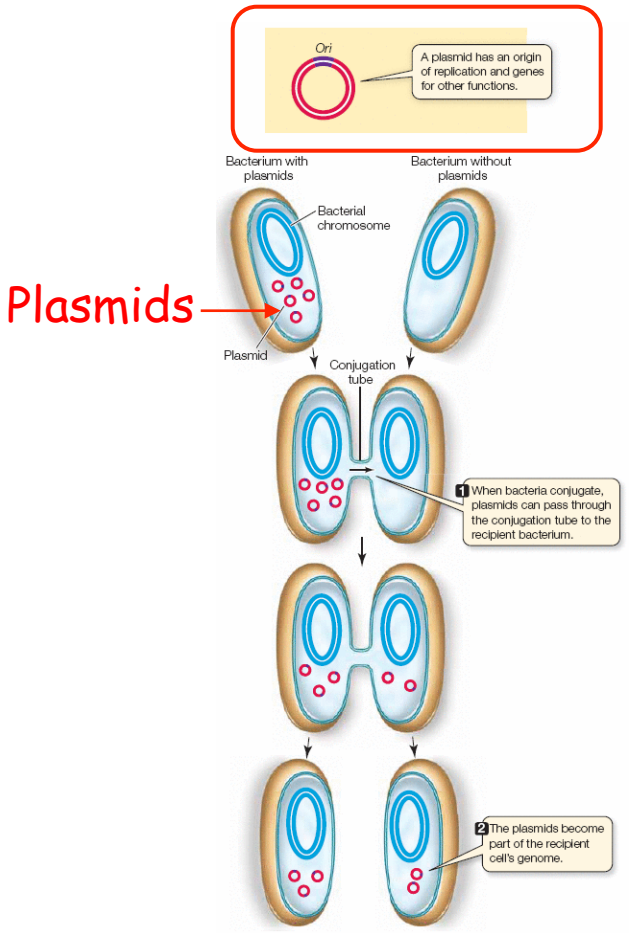
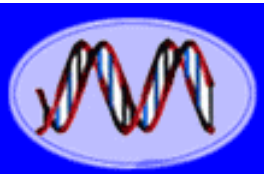
Plasmids Are Circular Self-Relicating DNA Molecules in Bacterial Cells That Carry Antibiotic Resistance Genes

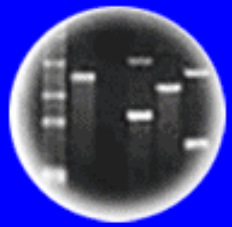


Plasmids Defend Bacteria Against Antibiotics!



DNA
Genetic Code of Life

Entire Genetic Code
of a Bacteria

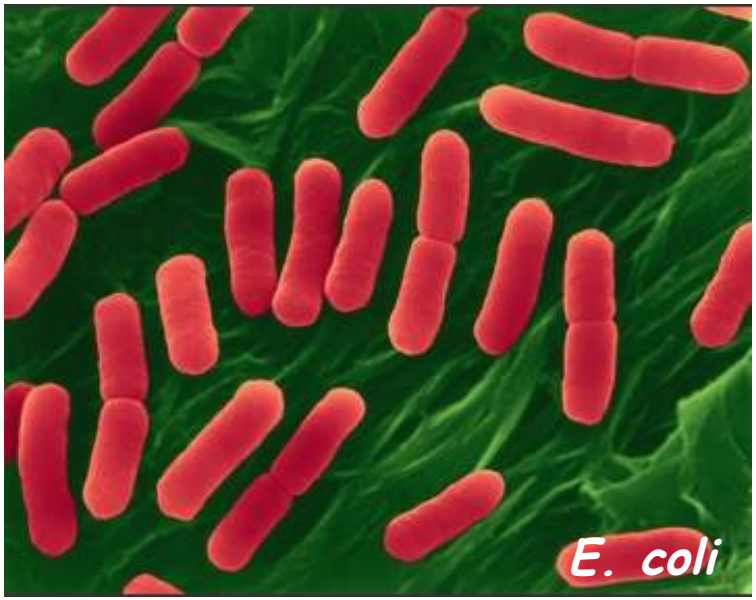


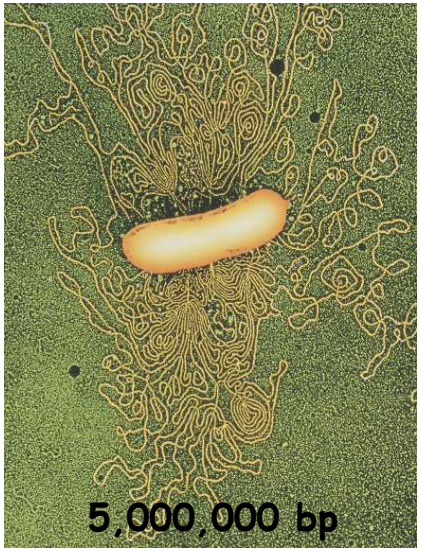
DNA Fingerprinting

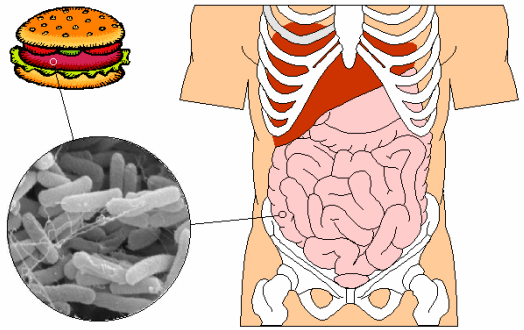
Cloning: Ethical Issues
and Future Consequences

Plants of Tomorrow

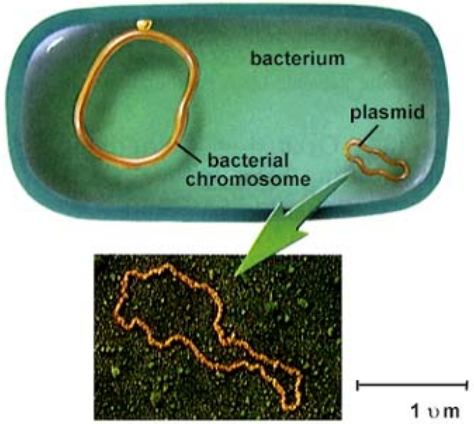
Plasmids Are Circular Self-Relicating DNA Molecules in Bacterial Cells That Carry Antibiotic Resistance Genes



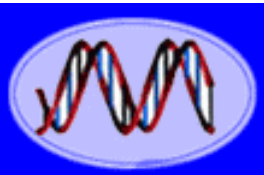




E. coli in Gut



5,000 bp



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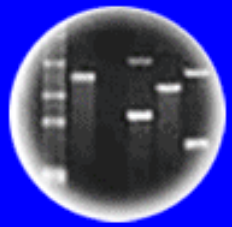


DNA Fingerprinting

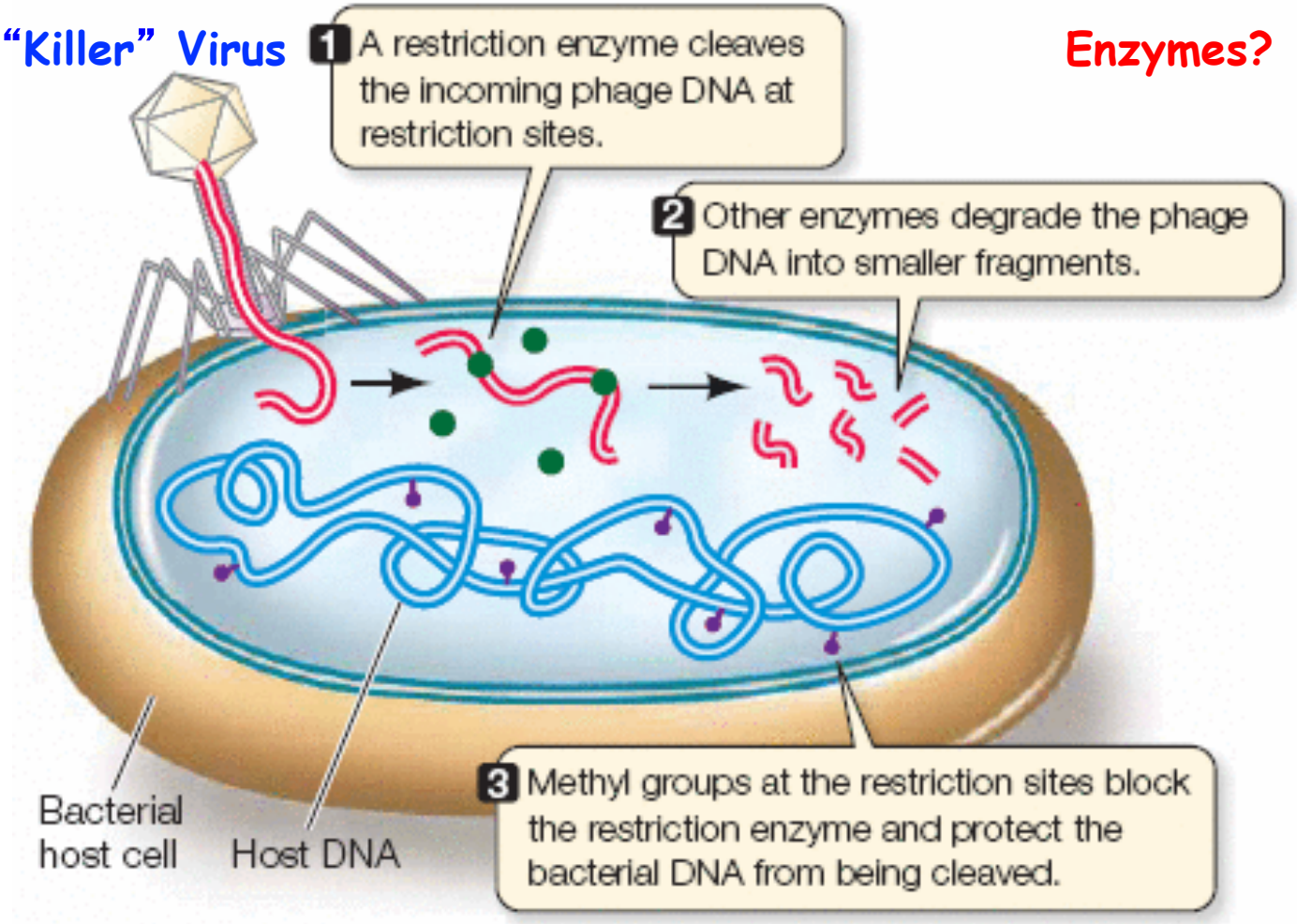
Cloning: Ethical Issues and Future Consequences

Plants of Tomorrow

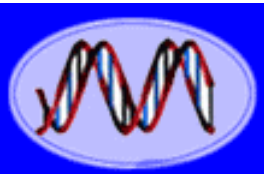
Restriction Enzymes Are Proteins That "Cut" DNA Into Pieces

"Killer" Virus

Enzymes?



Restriction Enzymes Protect Bacteria From "Killer" Viruses!



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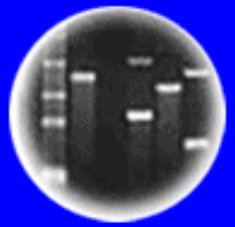

DNA Fingerprinting

Cloning: Ethical Issues
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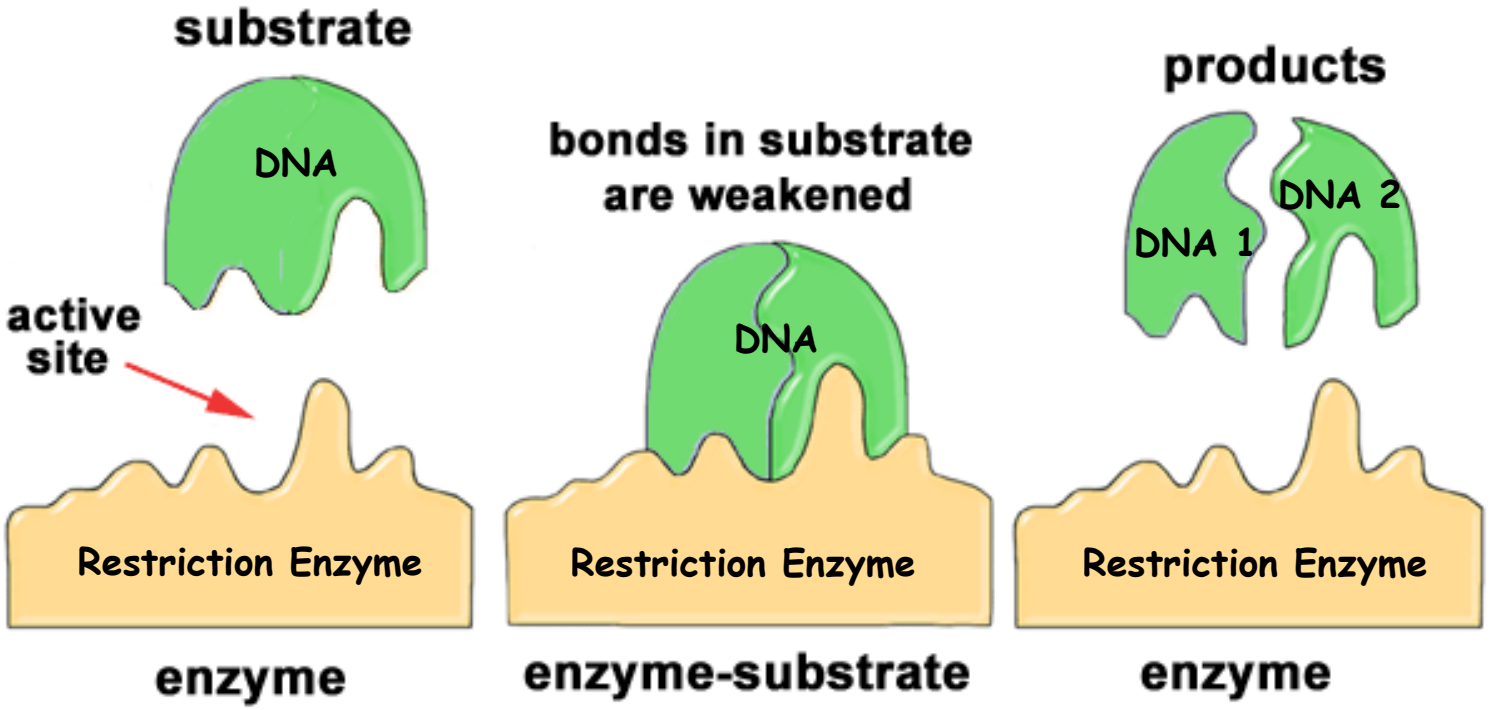
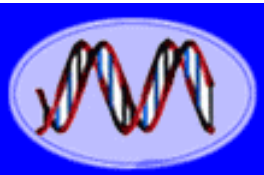
Enzymes Are Proteins That Catalyze or Facilitate Chemical Reactions





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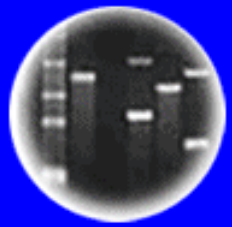
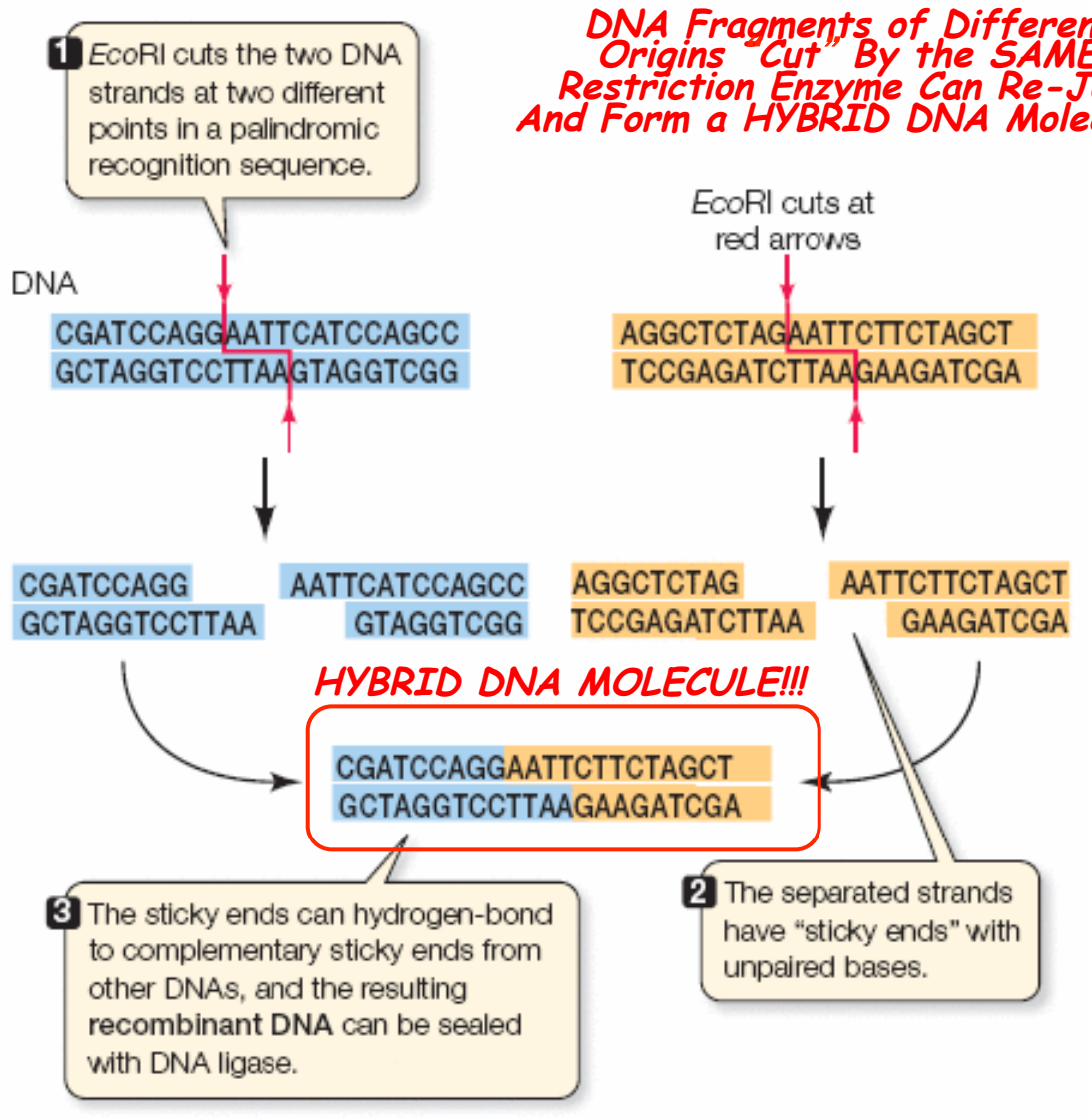


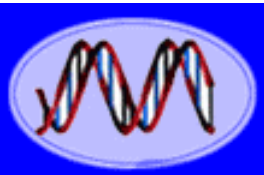
DNA Fingerprinting

Cloning: Ethical Issues and Future Consequences

Plants of Tomorrow

Restriction Enzymes Are Proteins That "Cut" DNA Into Pieces At Specific Sequences





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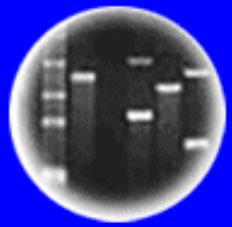

DNA Fingerprinting

Cloning: Ethical Issues and Future Consequences

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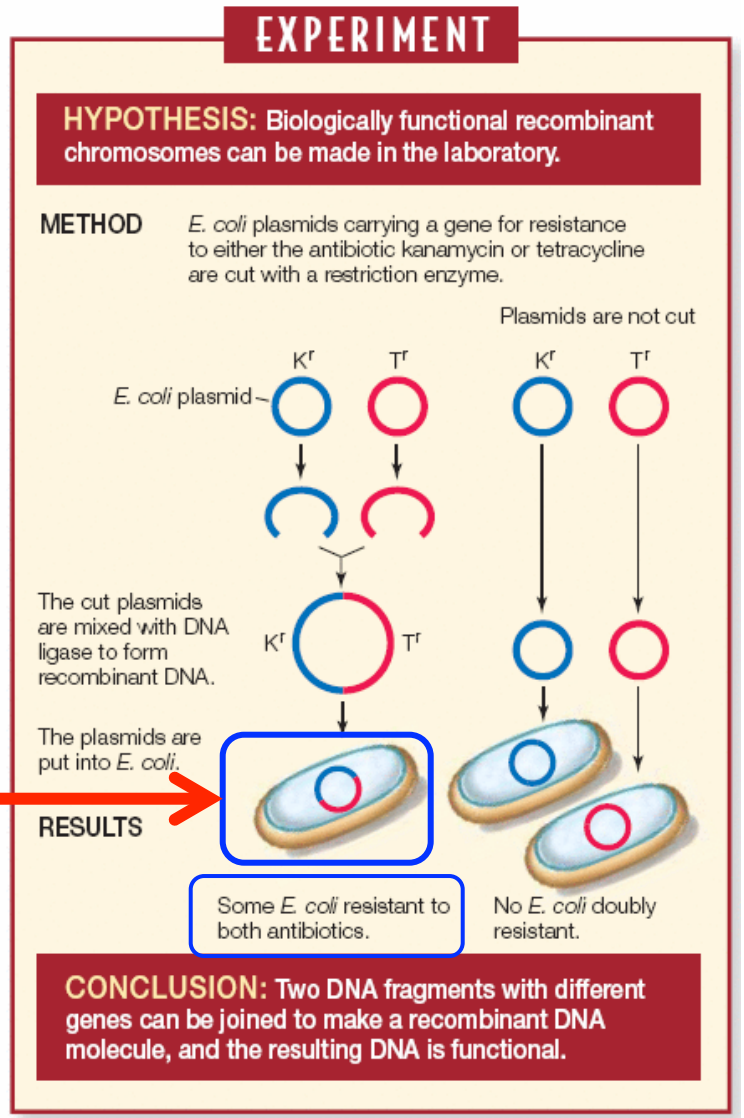
Genetic Engineering Technology Can Combine DNA (Genes) From Different Sources Leading to New Gene Combinations!!

Genetically Engineered Bacteria!!!



Any Gene Can Be Isolated Using Recombinant DNA

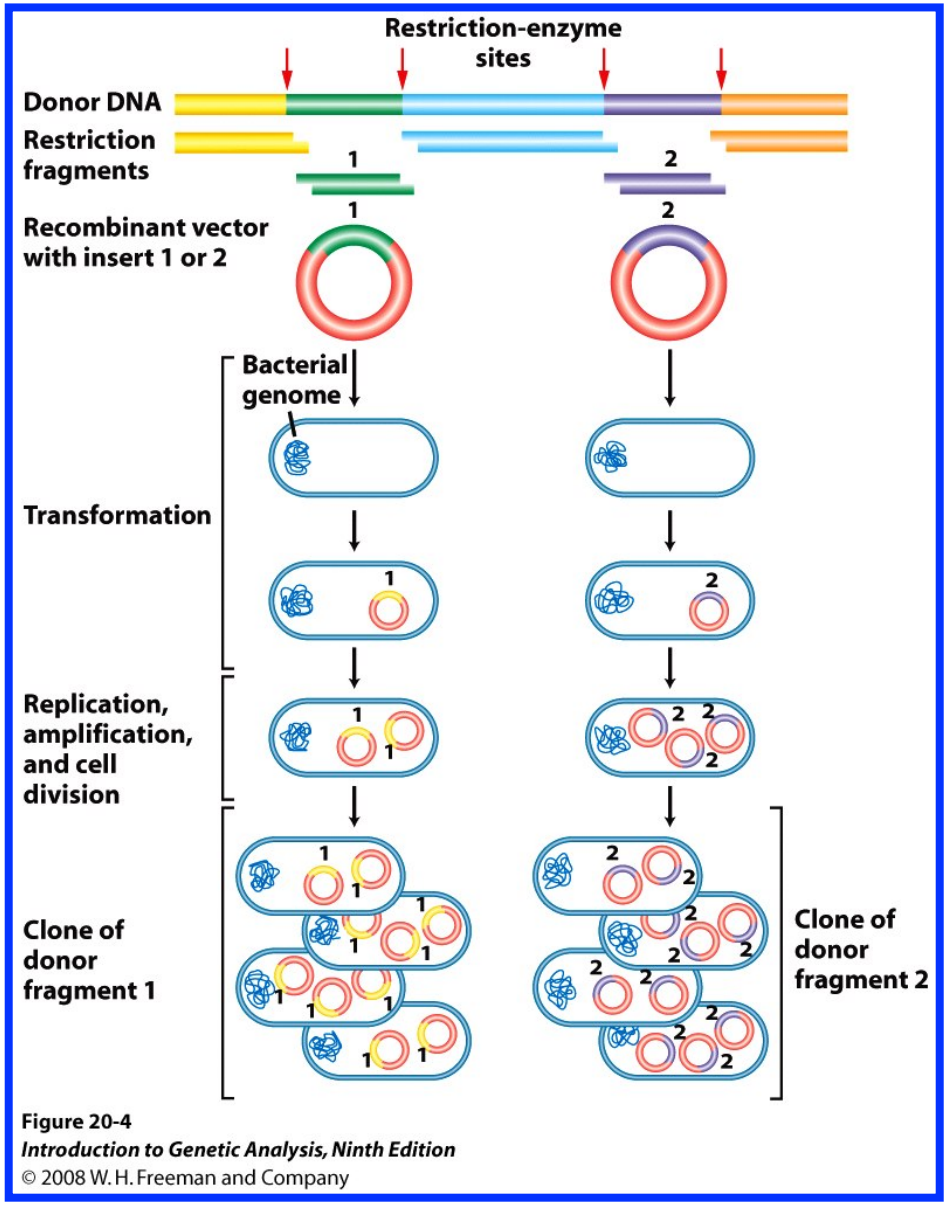
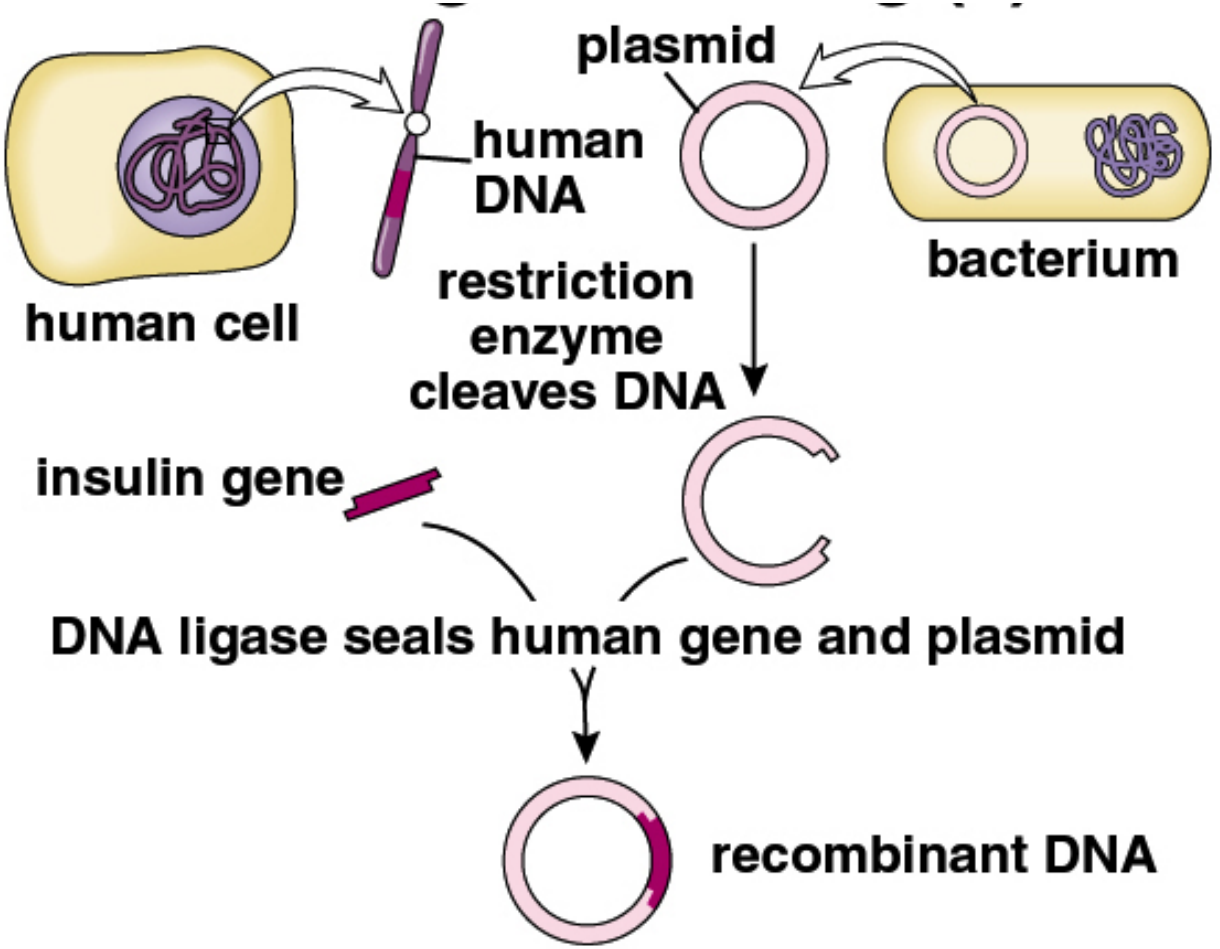
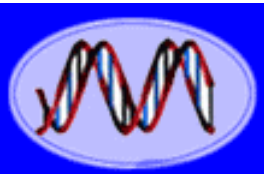


Figure 20-4
Introduction to Genetic Analysis, Ninth Edition

The Human Insulin Gene Can Be Separated From Other Human Genes and Cloned in Bacteria Using Recombinant DNA Methods!





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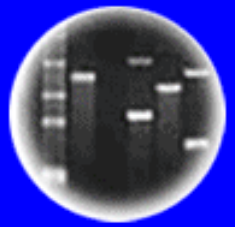

DNA Fingerprinting

Cloning: Ethical Issues
and Future Consequences

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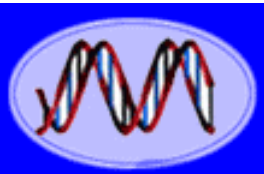
Leading to a REVOLUTION in Technology and Making it Possible For the First Time to Isolate, Manipulate, and Study Genes



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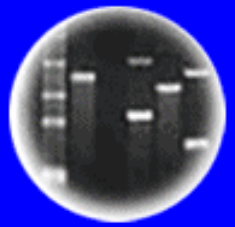


DNA Fingerprinting

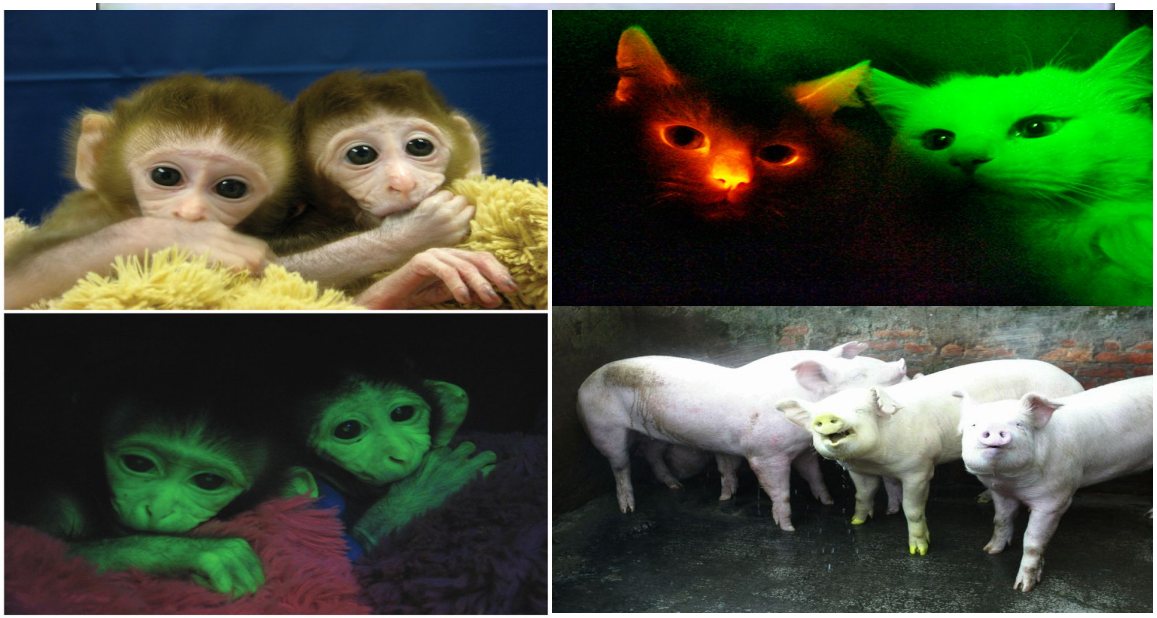
Cloning: Ethical Issues and Future Consequences

Plants of Tomorrow

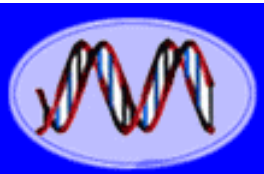
There Are Now No Limits to What Can Be Done With Genetic Engineering!

The Genes of Any Organism Can Be Isolated, Combined With Those of Another Organism, and Made to Function Normally in New Cellular Environments!

For Example: Jellyfish Genes in Monkeys, Bacterial Genes in Plants, Human Genes in Bacteria, etc., etc., etc., etc.



The Origins of Genetic Engineering
1973



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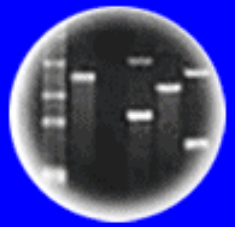

DNA Fingerprinting

Cloning: Ethical Issues
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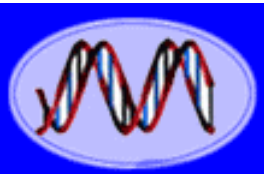
What is Genetic Engineering?
&
What Does It Do?



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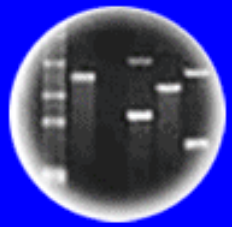

DNA Fingerprinting

Cloning: Ethical Issues
and Future Consequences

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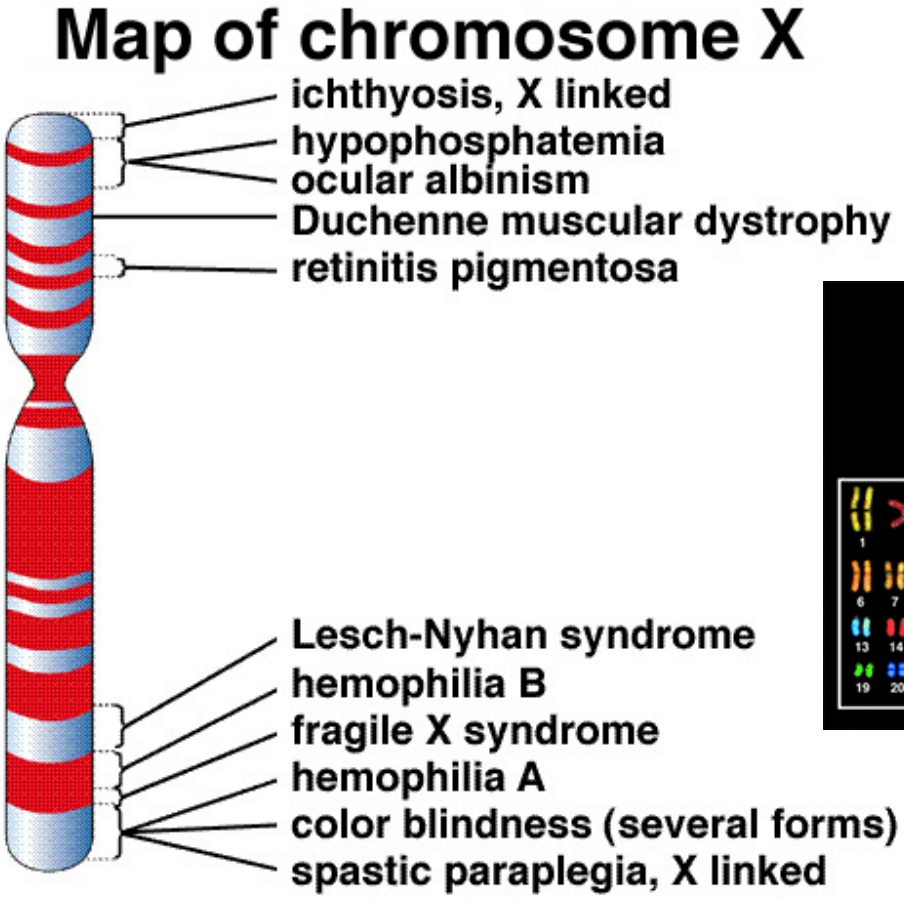
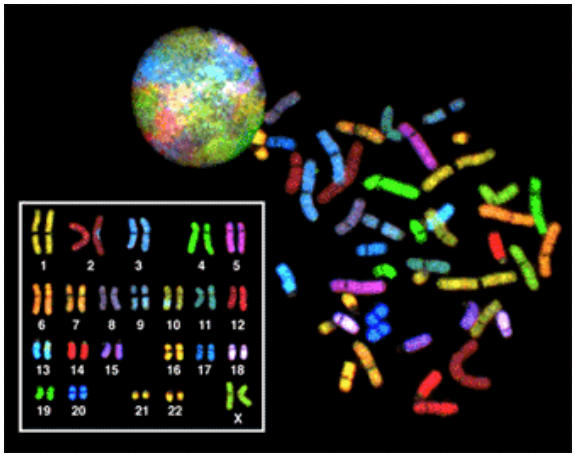
Genomes & Chromosomes Contain Thousands of Genes





How Can a Single Gene Be Studied?

The Era Of DNA Manipulation Means……

1. Specific DNA/Genes Can Be Isolated From Any Organism
2. DNA Segments of Any Kind From Any Organism Can Be Combined
3. Isolated Genes Can Be Re-Inserted Into the Chromosomes of Any Organism and Made to Work
4. Genes and Genomes Can Be Synthesized and Made To Work in Any Organism

There Are No Genetic Limits. All Biological Organisms Use the Same Genetic Rules. The Implications Are Enormous!!

"Why" Clone Genes From An Organism's Genome?

1. PURIFY Individual Genes From the Genome (e.g.,One of 25,000 Human Genes)
2. AMPLIFY The Gene to Obtain Enough DNA For Study
3. Use the Cloned Gene To:
   a) Study Gene Structure & Function (THE Major Use!)
   b) Use to Convert Cells Into Factories To Make Drugs and Pharmaceuticals
   c) Use to Diagnose Genetic Diseases
   d) Use to Identify Individuals (e.g., paternity, forensics)
   e) Use to Correct Genetic Disease
   f) Use to Engineer New Crops and Farm Animals
   g) Synthesize New Genomes and Many Other Uses

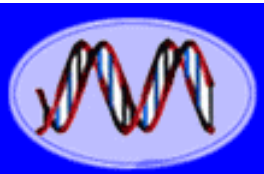
Genetic Engineering Has Lead to New Knowledge About How Cells and Genes Function and Has Lead to Applications That Have Improved Our Lives!!

The Age of DNA & Genetic Engineering Has Affected Our Lives in Many Ways

1. Basic Understanding of Living Processes and Ourselves
2. Basic Understanding of Genes and Their Functions
3. The Era of Genomics and the Sequence of the Human Genome and Those of Other Organisms
4. Basic Understanding of Human Diseases Such as Cancer and Novel New Treatments
5. A Multibillion Dollar Biotechnology Industry
6. New Legal Issues Such as Genetic Privacy, Forensics, and Patents on Genes and Genetically Engineered Organisms
7. An New Understanding of Human Origins and the Diversity of Human Populations (e.g., where we come from)
8. New Understanding of the Evolutionary Relationships Between Organisms (e.g., sequence of mammalian genomes, including mouse, human, dog, cat,chimpanzee)
9. Ability to Sequence the Genomes of Extinct Organisms
10. New Ethical Issues in "How Far" We Should Go in Using Genetic Engineering Technology

Genetic Engineering Technology Has Led to Many New Legal and Ethical Issues

1. Patenting Genes, Cells, & Living Organisms?
2. Regulating Experimentation on DNA, Cells, Transgenic Organisms ("GMOs")?
3. Regulating the Release of Genetically Modified Organisms into the Environment?
4. Labeling of Genetically Modified Foods?
5. Genetic Testing: DNA Databases, Newborn Genetic Screening, Genetic Privacy, Involuntary or Voluntary Testing?
6. Genetic Discrimination?
7. Genetic Enhancement and Eugenics: Right to Enhance Your Child?
8. Gender Selection and Prenatal Diagnosis of Genetic Diseases?
9. Gene Therapy: Correcting Human Genetic Diseases?
10. Human Cloning and Genetic Improvement?
11. Gene Testing Companies (e.g., 23andMe): Liability?
12. Synthetic Genomes: Constructing New Organisms?



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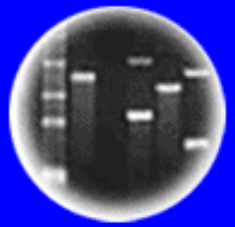

DNA Fingerprinting

Cloning: Ethical Issues
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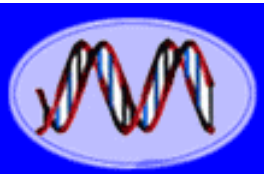
Question Eight

Would You Use DNA Tests To Select the Gender of In Vitro Fertilized Embryos?

a. Yes
b. No



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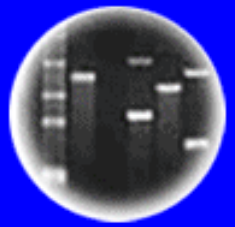

DNA Fingerprinting

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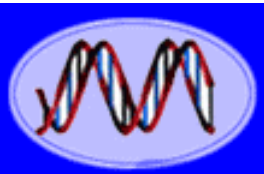
Question Nine

Would You Use DNA Tests To Make Sure That Your In Vitro Fertilized Embryos Did Not Have a Familial Disease Gene (e.g, Cystic Fibrosis)?

a. Yes
b. No



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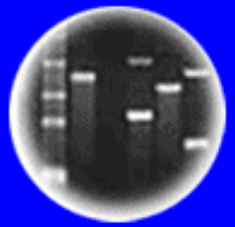

DNA Fingerprinting

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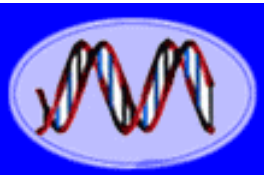
Question Ten

Should We Be Able To Patent Human Disease Genes For Genetic Testing?

a. Yes
b. No



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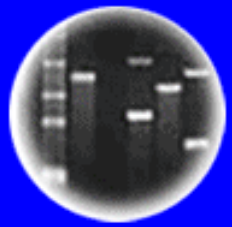

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December 26, 2011

Debate Persists on Deadly Flu Made Airborne

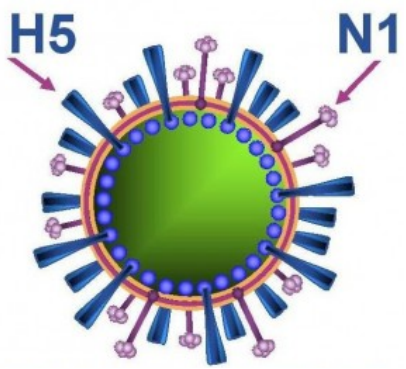
By DENISE GRADY and DONALD G. McNEIL Jr.

The young scientist, normally calm and measured, seemed edgy when he stopped by his boss's office.

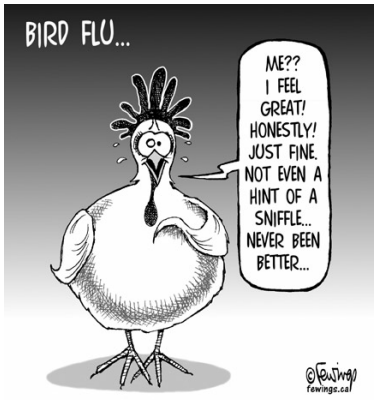
"You are not going to believe this one," he told Ron Fouchier, a virologist at the Erasmus Medical Center in Rotterdam. "I think we have an airborne H5N1 virus."

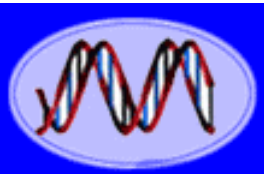
Studies of deadly H5N1 bird flu mutations test scientific ethics

Dutch scientists have created a version of the deadly H5N1 bird flu that's easily transmitted. In an unprecedented move, a U.S. board asks that some details of the research not be published.



Publish?
a. yes
b. no





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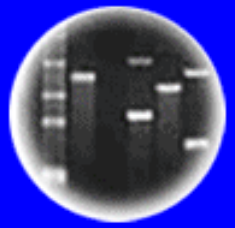

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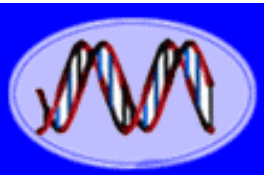
HC70A Winter 2012
Genetic Engineering in Medicine, Agriculture, and Law
Professor Bob Goldberg

Class Announcements
1/10/12



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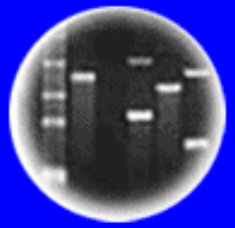

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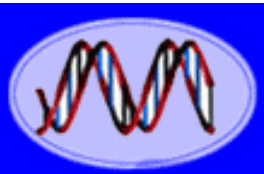
Genetic Engineering in Medicine, Agriculture, and Law

Teaching Fellows

Elaine Chiu
Eden Maloney
Lulu Pantin

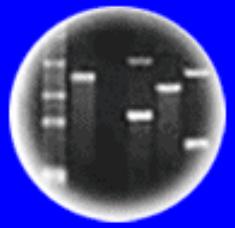
Course Administrators

Jennifer Kwan



DNA
Genetic Code of Life

Entire Genetic Code
of a Bacteria



DNA Fingerprinting

Cloning: Ethical Issues
and Future Consequences

Plants of Tomorrow

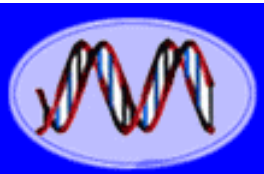
SAS70A Winter 2012 (UC Davis) Genetic Engineering in Medicine, Agriculture, and Law

UC Davis

Professor John Harada

TA – Mallorie Taylor

UCDAVIS
UNIVERSITY OF CALIFORNIA



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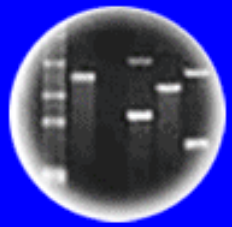

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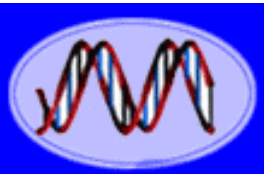
PLSS530 Winter 2012 (Tuskegee)
Biotechnology

Tuskegee
Professor Channapatna Prakash

TUSKEGEE UNIVERSITY



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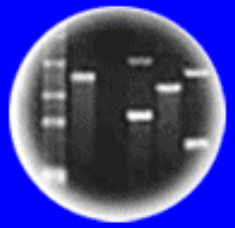

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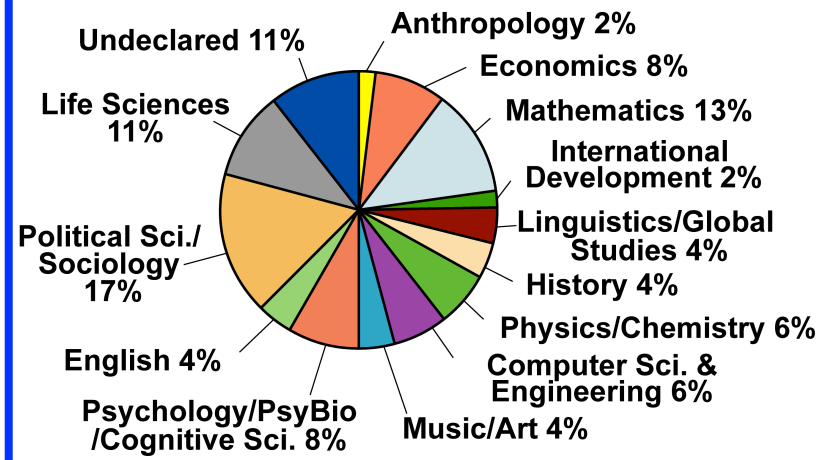
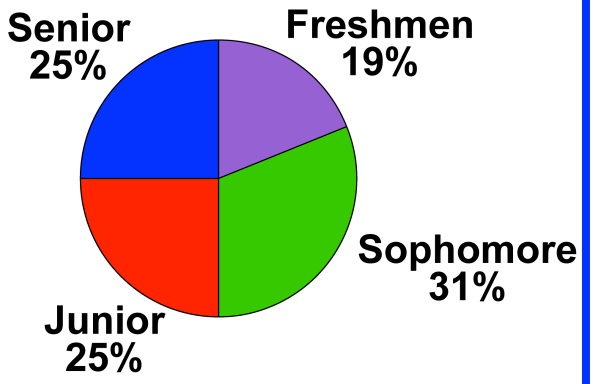
HC70A – A Unique Class!

A New Way To Teach & Learn Science

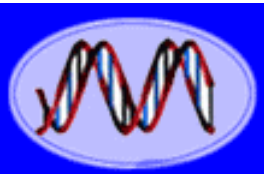
MAJOR



YEAR IN SCHOOL



Long-Distance Learning & Much, Much More…….Details in Syllabus & We'll Discuss on Thursday



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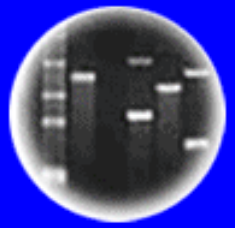

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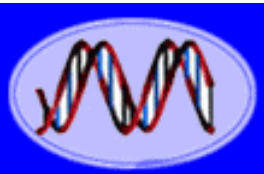
Discussion Tomorrow

A New Language and Learning Approach

- **Recombinant DNA Debate** (SciAm)
- **The Manipulation of Genes** (SciAm)
- **Shaping Life in the Lab** (TIME)

- **Read Papers Handed Out Today & Textbook Chapters 1-3**

- **Be Prepared for a Discussion of the History & Science of Genetic Engineering Providing the Foundation**



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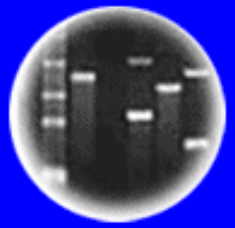

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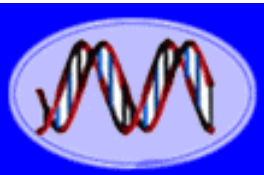
Discussion Instructions

- Come PREPARED!!!!!
- Read Articles Carefully Prior to Discussion
- What's the Question, the Approach, the Results, the Conclusions?
- Study Each Figure/Experiment/Legend-Ask The Same Questions!
- Read Relevant Parts of Text That Relate to Concepts Covered in Articles
- Read Articles ACTIVELY - Look Up Unknown Words/Concepts - Ask Yourself Questions Along the Way - What Does This Mean?!



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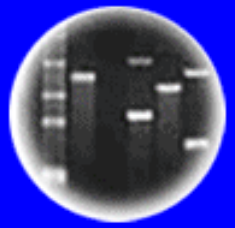

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Stop Part One!!