
DNA
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refer
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The Recipe of Life

Today's key questions:

- What does DNA stand for?
- Where in your body do you find DNA?
- What does DNA look like?

What does DNA stand for?

The letters in DNA stands for…

De-oxy-ribo-***n***ucleic ***A***cid

Paste the "syllables" into your book and write the proper form (without the dashes) into your books:

Properly written without the dashes:

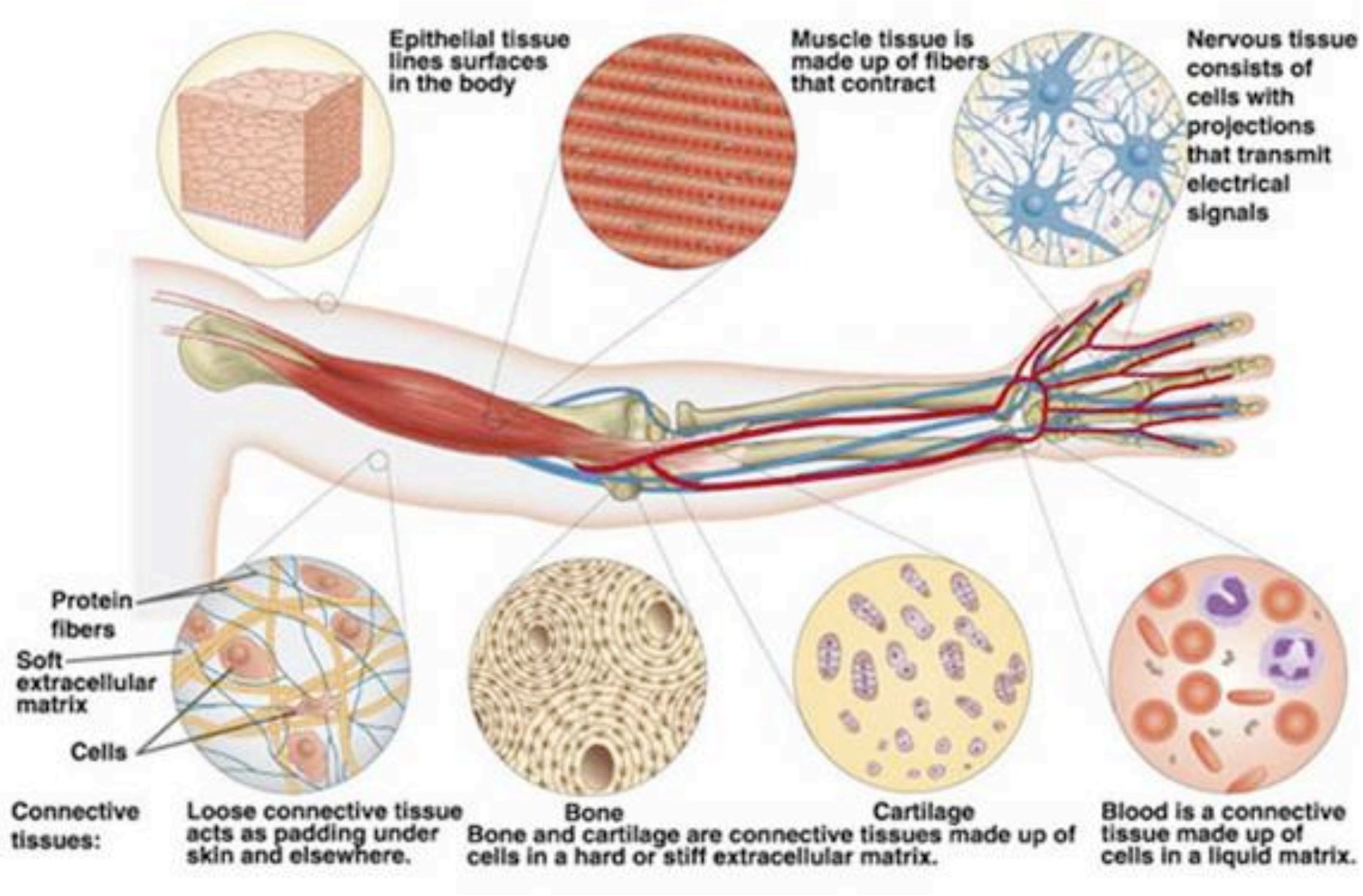
Deoxyribo***n***ucleic ***A***cid

Where in your body do you find DNA?

The human body, and all other living organisms, is made up of tiny units called _____. There are many different types of _____ that make up your body.

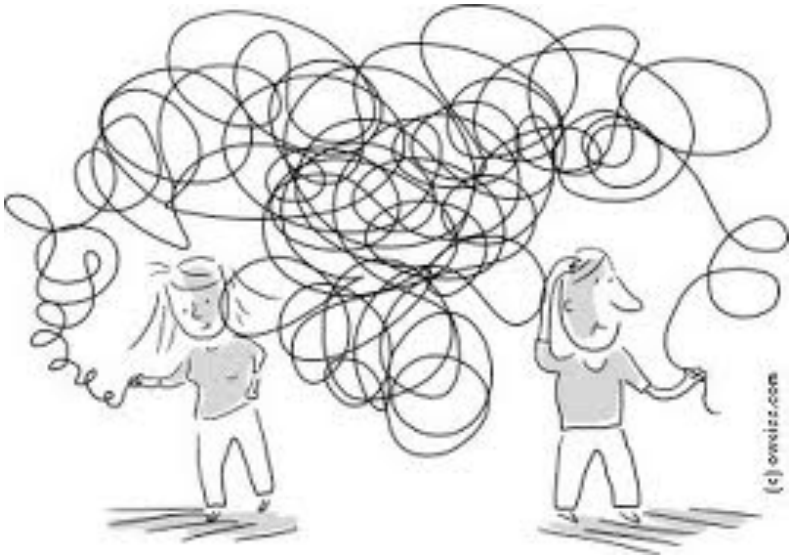
All plant and animal cells have a _____, which is the control centre of the cell, and where most of the DNA is found.

Different type of cells--each new cell is created by a code of instructions in the cell's DNA.



AMAZING DNA FACT

DNA from a single human cell extends in a single thread almost 2 metres long!!!



Each cubic millimetre of your body has over a million cells, so if you extended all the DNA from just a cubic millimetre of your cells, it could reach Brisbane from Hobart!

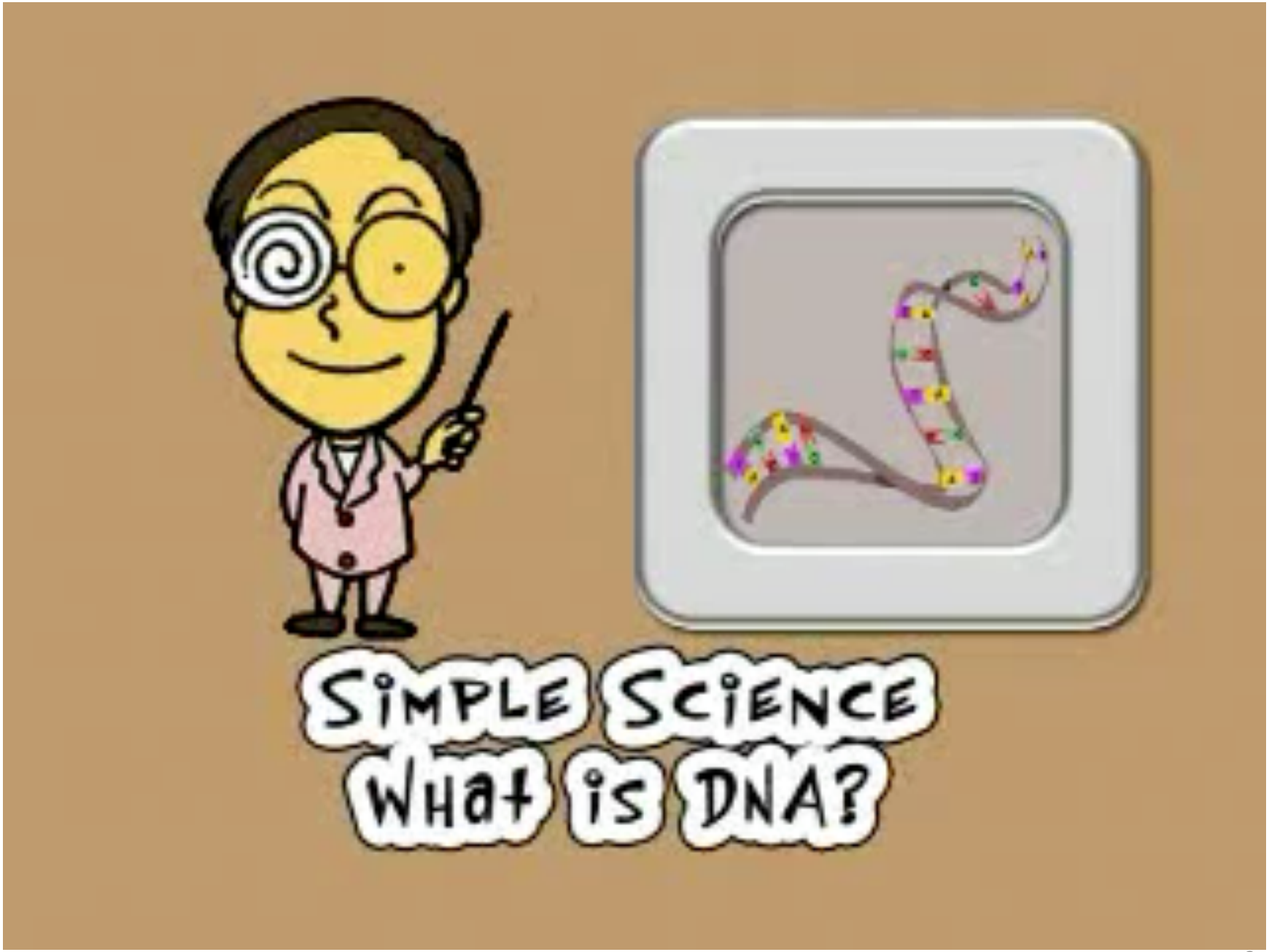
First Task

Describe where you would find DNA.

Draw a diagram of a cell in your book (half a page) and label:

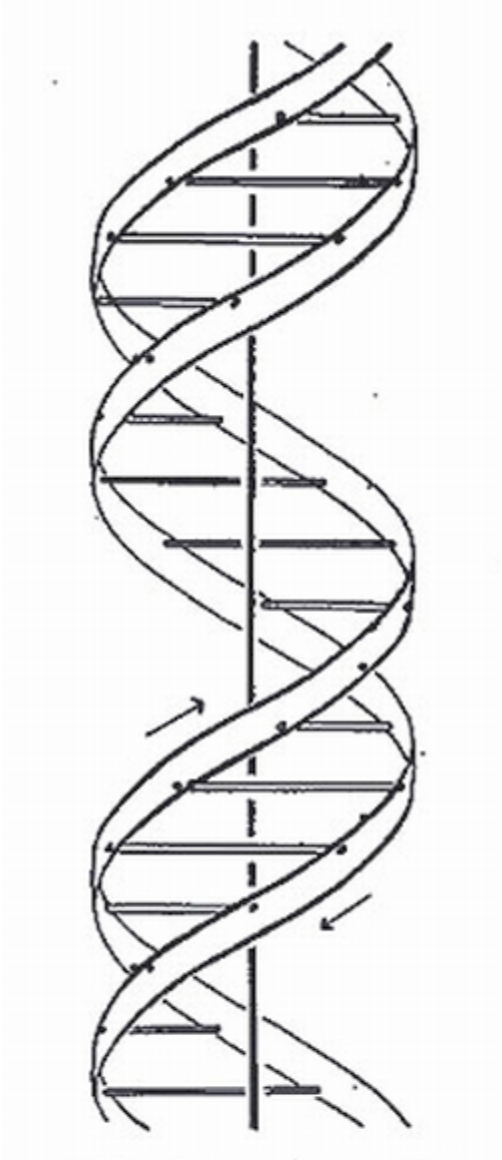
Cell Membrane
Nucleus
DNA

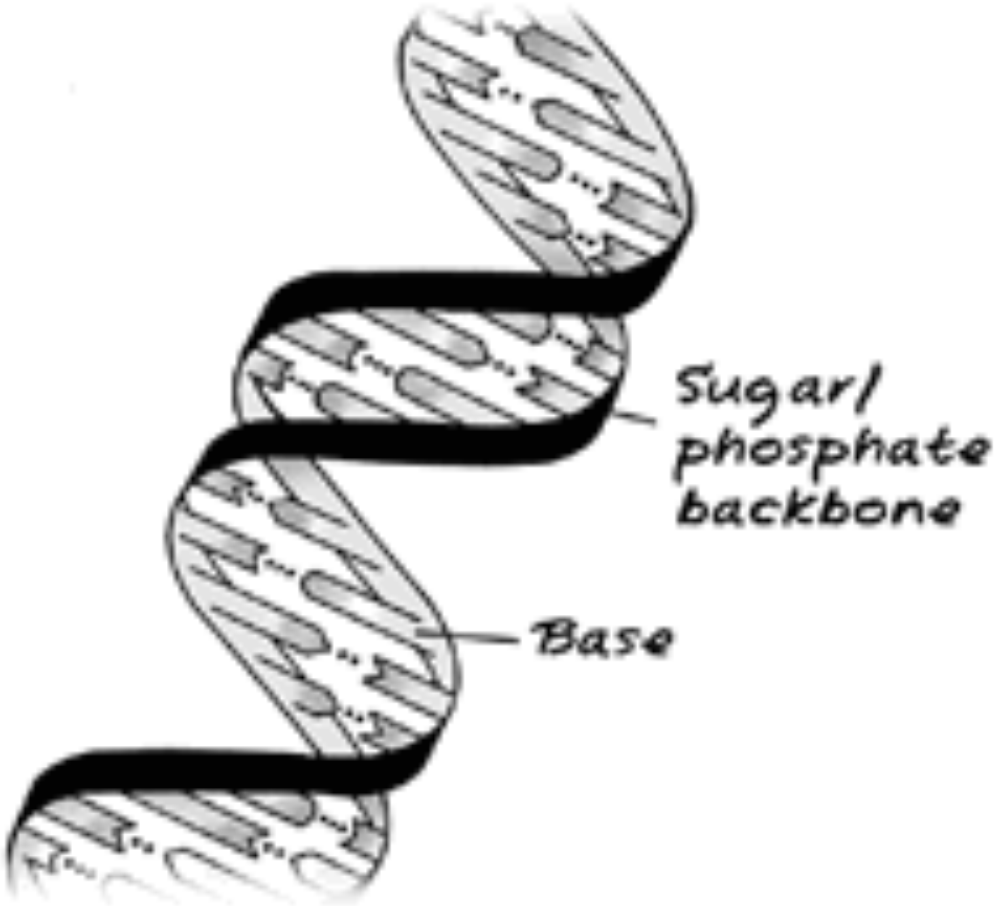
- (Use the books on the side bench to find a diagram of an animal cell)


Simple Science
What is DNA?

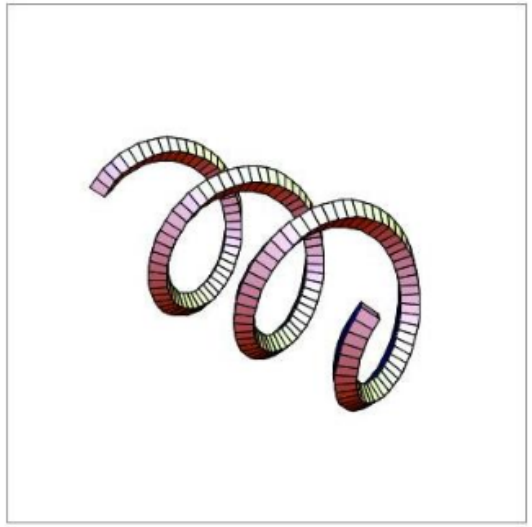
THE DNA SONG

The Shape of DNA--Double Helix





What is a “HELIX”?



he·lix

/ˈhēliks/

Noun

1. An object having a three-dimensional shape like that of a wire wound uniformly around a cylinder or cone.

DNA IS A DOUBLE HELIX (two helices intertwined around a common axis).

Nucleotides

- Each “ladder rung” between the two helixes is composed of two nucleotides. There are four different types which create the code:
- Thymines
- Adenines
- Guanines
- Cytosines

- (colouring activity)

Reflection

In your own words write a **paragraph** that answers the 3 key questions from the start of the lesson.

- What does DNA stand for?
- Where in your body do you find DNA?
- What does DNA look like?

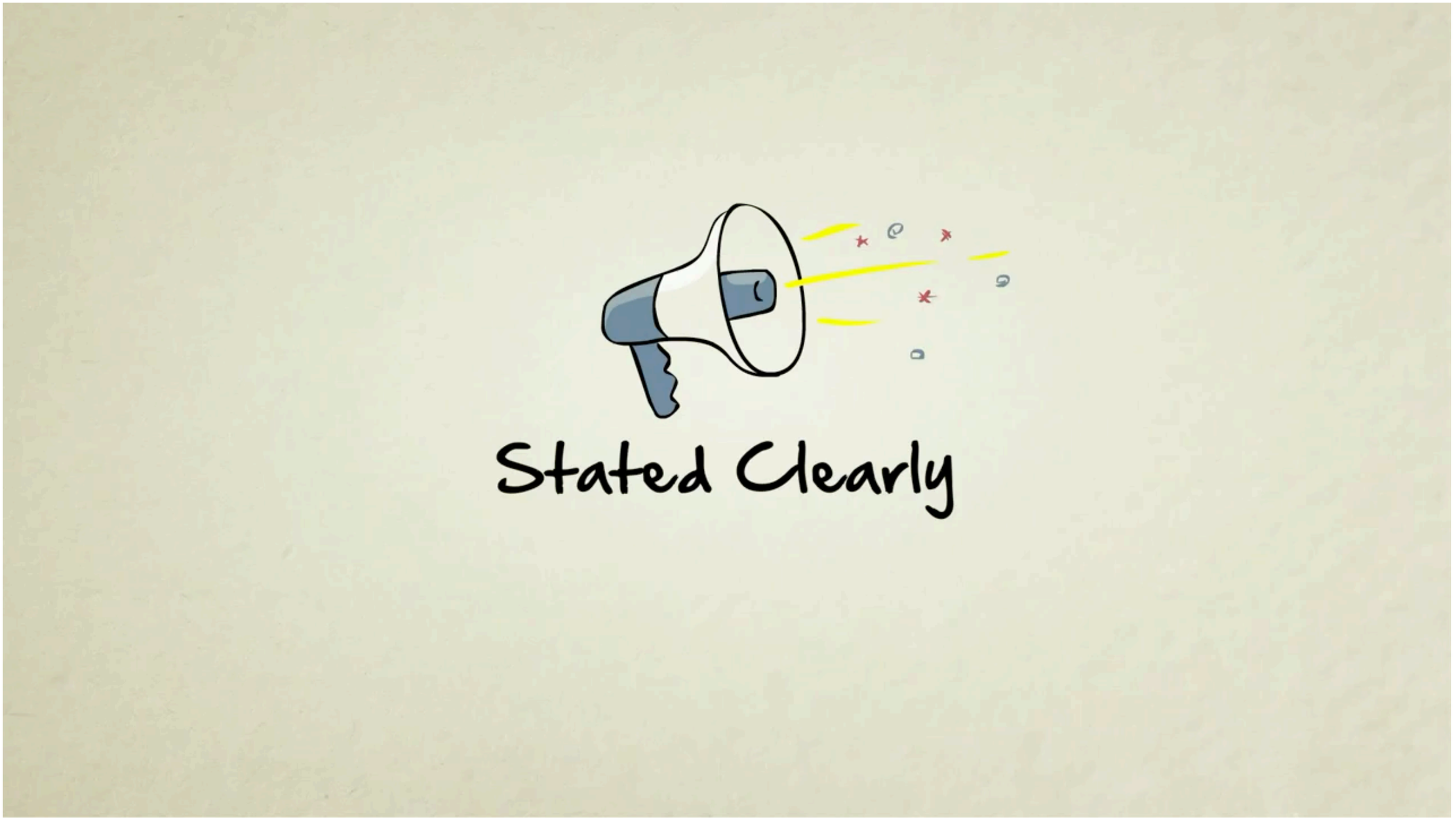
Prior to Bellwork, bring chair up front for discussion.

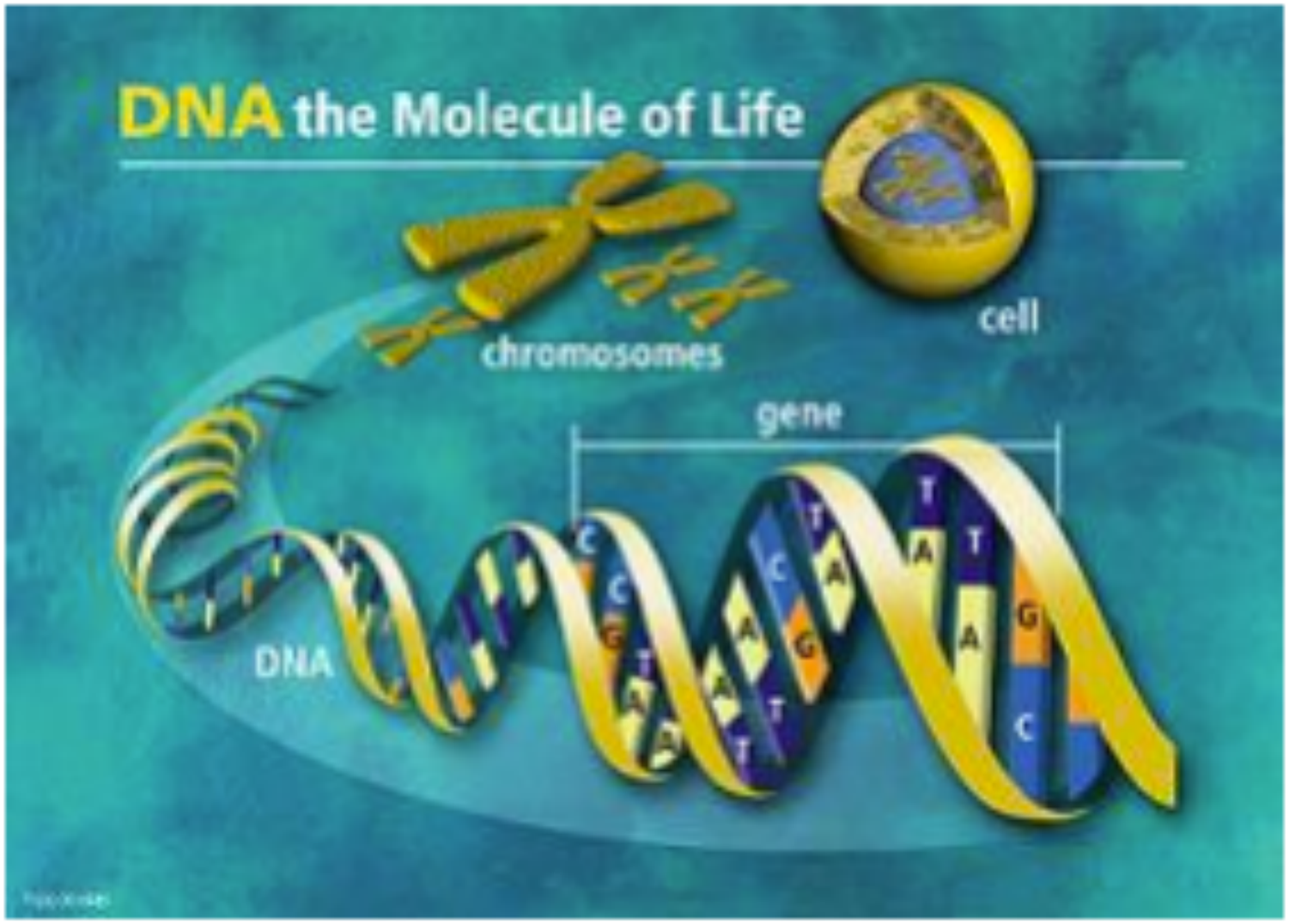
Bell Work

Work in pairs--make a unique face by cutting out eyes, nose, eyebrows, mouth and hair.

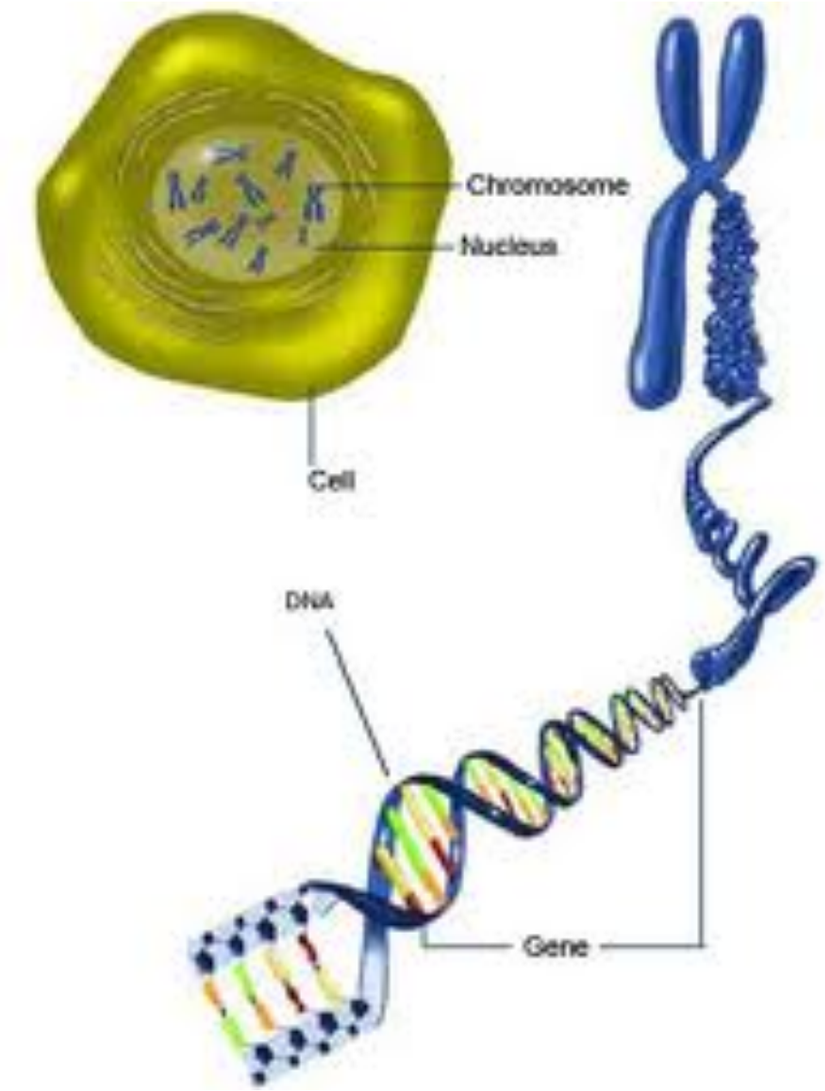
Each feature has a three letter code--record each feature's code as you create your face.

You will later share this code with someone else who will be able to duplicate your face using only the code.


Stated Clearly

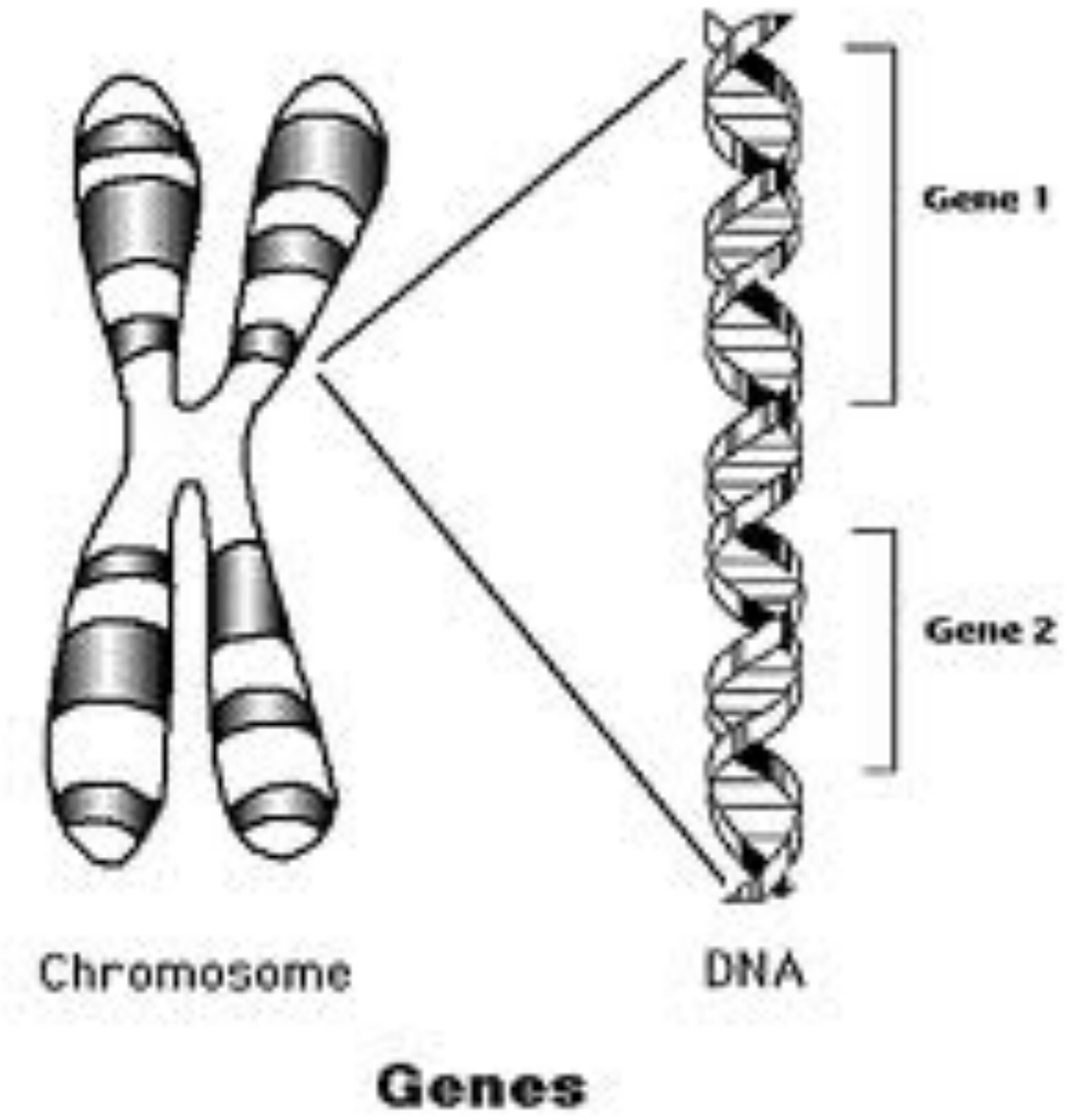


The instructions for creating all the cells in our bodies are found in our DNA.



- Inside the nucleus are some thread like structures called Chromosomes.
- Chromosomes are made up of DNA.

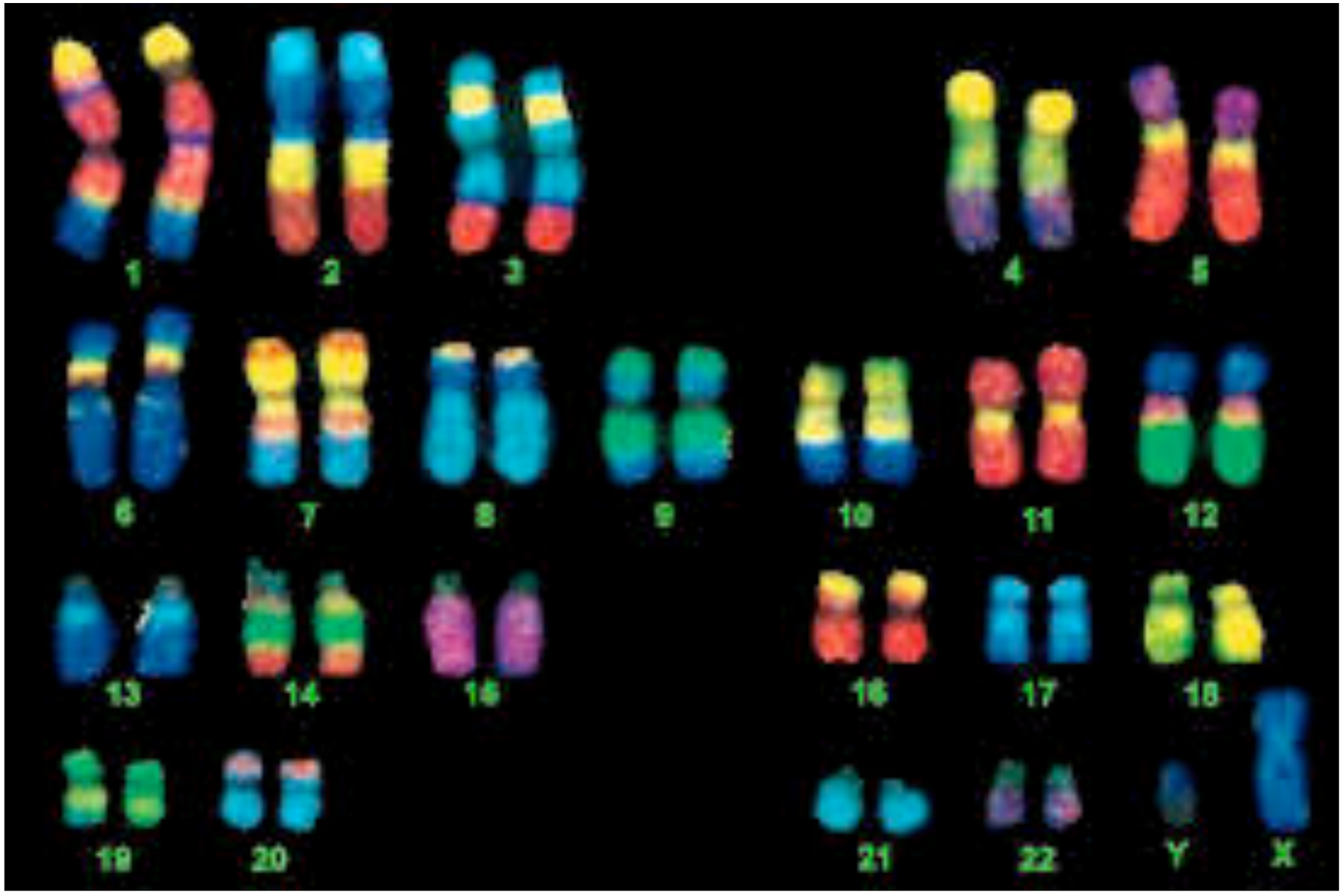
- DNA is a chemical that contains the instructions that mean the cell can make a copy of itself



Genes

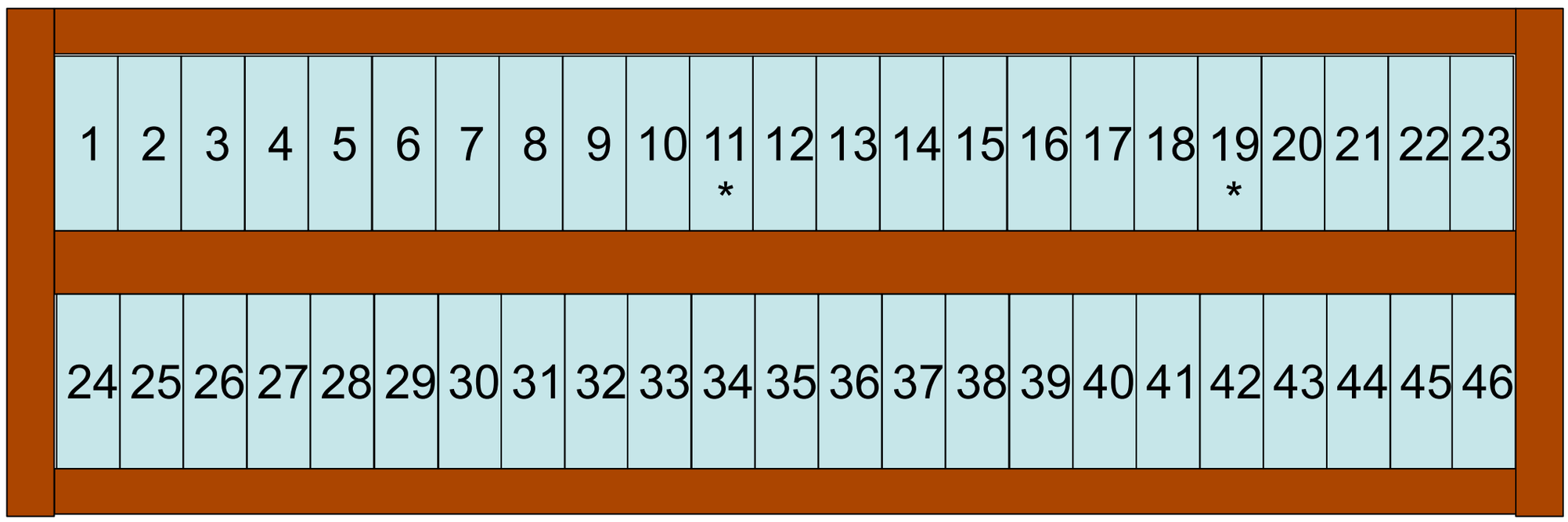
- Sections of chromosomes are called GENES.
- Genes are responsible for an organisms features.
- e.g. we all have a gene for eye colour, a gene for skin colour, and genes for height.

Humans have 23 Pairs of Chromosomes (46 Chromosomes total)



Each Chromosome = Book

Each Chapter = Gene



Example: “Book” (chromosome) 19

Chromosome Number 19

Again around 1,300 – 1,700 Chapters

One chapter tells us what colour to make our eyes.

Another chapter tells us what colour to make our hair.

The DNA strand

Each DNA strand is a double helix. The side (or backbone) of the ladder is made out of **sugar and phosphate**.

The rungs are made out of **nitrogen bases**.

There are 4 nitrogen bases:

A pairs with T and C pairs with G

A **nucleotide** is the combination of 1 sugar, 1 phosphate and 1 nitrogen base.

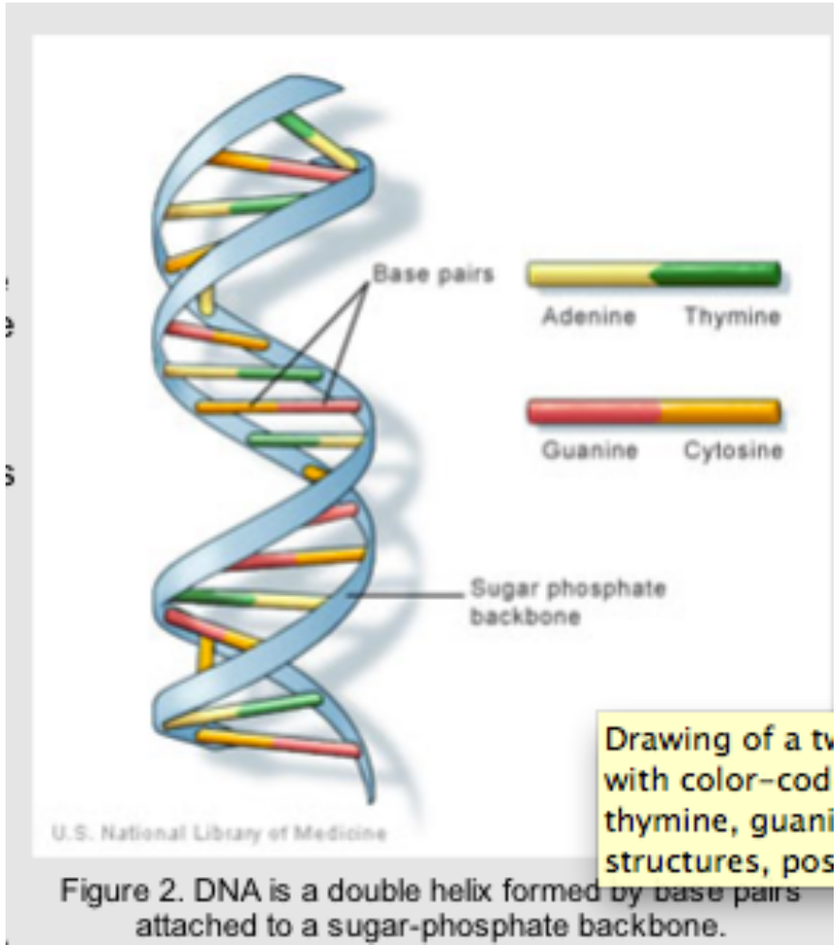


Figure 2. DNA is a double helix formed by base pairs attached to a sugar-phosphate backbone.

So one Gene (Chapter) in the Chromosome (Book) might be written like this -

TTATTTTTTTTTTTTTCCCCCCCCGACCACACACGGGGGGGGCCCCCCCCCCCCCCCAAAAA
AAAAAAAATTTTAAAAAAAATATAATATATTTTTTTTTTCGGGGGGGGGGGGATCAGCTACGATCG
ATCGATCGGGGGGGGGGGGGGGGGGGGCTACGATCGATCGATCATCGTAGCTAGCTAGCTAGCTAG
CTATCATCGATCGACAGTACAGTACTGACTACATCGATCGATCGATCGATCGATCGATCGATCGAT
CGATCGATCATCGATCGATCGATCGATCGATCGATCGATCGATGCATCGATCGATCGATCGATCGA
TCGATCGATCGATCGGGGGGGGGGCGACGACCCCCCCCCCCCAAAAAAAAAAATCGATCG
ATCGATCGATCTAGTCGATCGATGCACGACTACTACATCAGCTAGCTAGCTAGCATCGATGC
ATCGATCATCGACGATTATTTTTTTTTTTTTTTTTCCCCCCCCGACCACACACGGGGGGGGGC
CCCCCCCCCCCCCCAAAAAAAAAAAAAAGTACGATCGACGATCACTAGCATCGATCGATCGAT
TTTTTTTTTTAAAAAAAATATAATATATTTTTTTTTTTCGGGGGGGGGGGGATCAGCTACGATCGATC
GATCGGGGGGGGGGGGGGGGGGGGGCTACGATCGATCGATCATCGTAGCTAGCTAGCTAGCTAT
CATCGATCGATCGATCGATCGATCGATCGATCGACACGAGTCAGTGCAGGCTGTGTCGTGTGTT
GTACCACACCACATCTGCAGTACTGATACTACGACACTATATATTATCATCGATCATCGAGCT
ATCATCATCATGCACGACTACTACATCAGCTAGCTAGCTAGCATCGATGCATCGATCATCGA
CGATTATTTTTTTTTTTTTTCCCCCCCCGACCACACACGGGGGGGGGCCCCCCCCCCCCCCCAA
AAAAAAAAAAATTTTAAAAAAAAATATAATATATTTTTTTTTTCGGGGGGGGGGGGATCAGCTACGA
TCGATCGATCGGGGGGGGGGGGGGGGGGGGCTACGATCGATCGATCATCGTAGCTAGCTAGC
TAGCTATCATCGATCGATCGATCGATCGATCGATCGATCGACACGAGTCAGTGGATCGGGGGGG
GGCGACGACCCCCCCCCCCCCCAAAAAAAAAAATCGATCGATCGATCGATCTAGTCGATCGAT
GCACGACTACTACATCAGCTAGCTAGCTAGCATCGATGCATCGATCATCGACGATTATTTTT
TTTTTTTTTTTTCCCCCCCCGACCACACACGGGGGGGGGCCCCCCCCCCCCCCCCAAAAAAAAA
AAAAGTACGATCGACGATCACTAGCATCGATCGATCGATTTTTTTTTTTTAAAAAAAAATATAATAT

Synthetic dna sequence coding for human insulin-like growth factor ii

WO 1989003423 A1

Publication number	WO1989003423 A1
Publication type	Application
Application number	PCT/GB1988/000832
Publication date	Apr 20, 1989
Filing date	Oct 7, 1988
Priority date ⓘ	Oct 8, 1987
Also published as	EP0380550A1
Inventors	Richard Mark Edwards
Applicant	British Bio Technology
Export Citation	BiBTeX, EndNote, RefMan

Patent Citations (3), Non-Patent Citations (3), Referenced by (7), Classifications (4), Legal Events (7)

External Links: Patentscope, Espacenet

ABSTRACT

Synthetic DNA coding for human Insulin-like Growth Factor II includes sequence (I) and incorporates useful restriction sites at frequent intervals to facilitate the cassette mutagenesis of selected regions. Also included are flanking restriction sites to simplify the incorporation of the gene into any desired expression system.

DESCRIPTION (OCR text may contain errors)

SYNTHETIC DNA SEQUENCE CODING FOR HUMAN INSULIN-LIKE GROWTH FACTOR II

This invention relates to synthetic genes coding for IGF-II.

Human serum contains at least two insulin-like growth factors (IGFs), so called because of their limited homology with insulin. IGF-I or somatomedin C is a mitogen that mediates the growth effects of growth hormone, predominantly throughout childhood and adolescence. The role of the related protein IGF-II is more obscure though in situ hybridisation has revealed that both IGF-I and IGF-II mRNA are produced predominantly in cells of mesenchymal origin. This suggests that both IGFs may be involved in paracrine action on multiple cell types

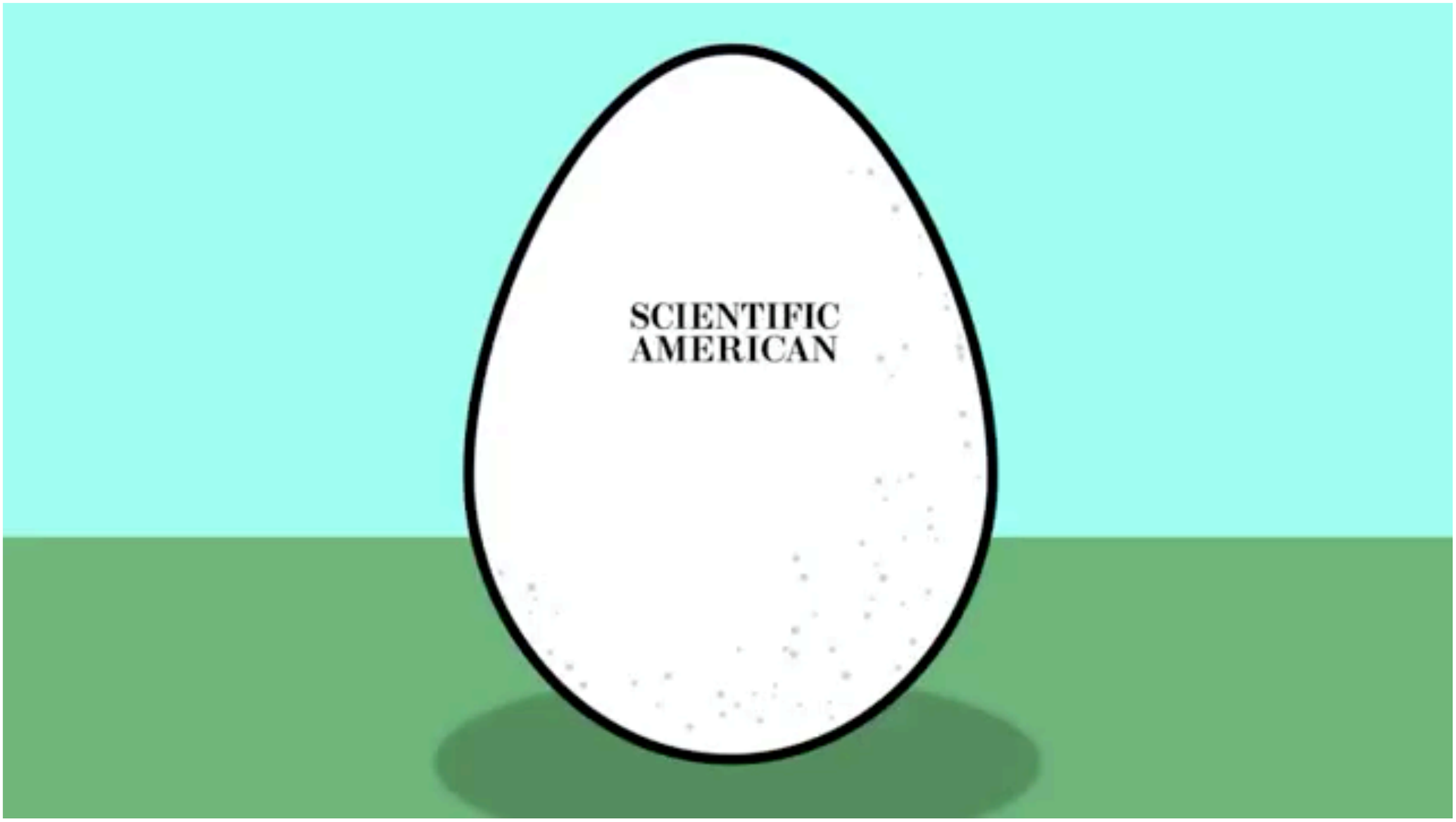
CLAIMS (OCR text may contain errors)

1. DNA coding for IGF-II and having restriction sites for the following enzymes

SphI, NsiI, NdeI, SacI, PstI. BstEII, NheI, XbaI, PvuII, FspI and BamHI.

2. DNA including the following sequence:

ATG GCA TAC CGC CCG AGC GAG ACC CTG TGC GGT GGC GAG C
GTA GAC ACT CTG CAG TTC GTT TGT GGT GAC CGT GGC TTC TAC
TTC TCT CGT CCT GCT AGC CGT GTA TCT CGC CGT TCT AGA GGC
ATC GTT GAA GAG TGC TGT TTC CGC AGC TGT GAT CTG GCA CTC
CTC GAA ACT TAC TGC GCA ACT CCA GCA AAA TCC GAA TAA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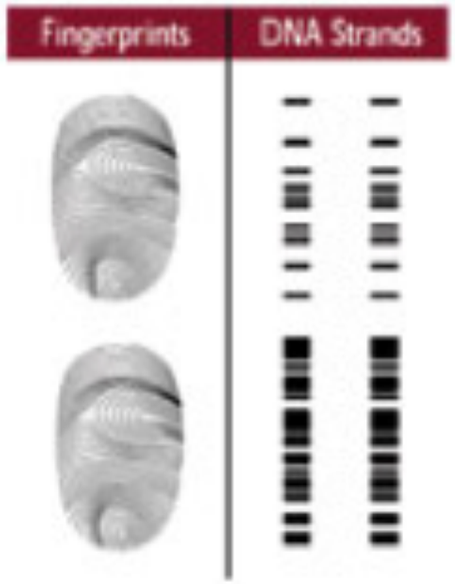
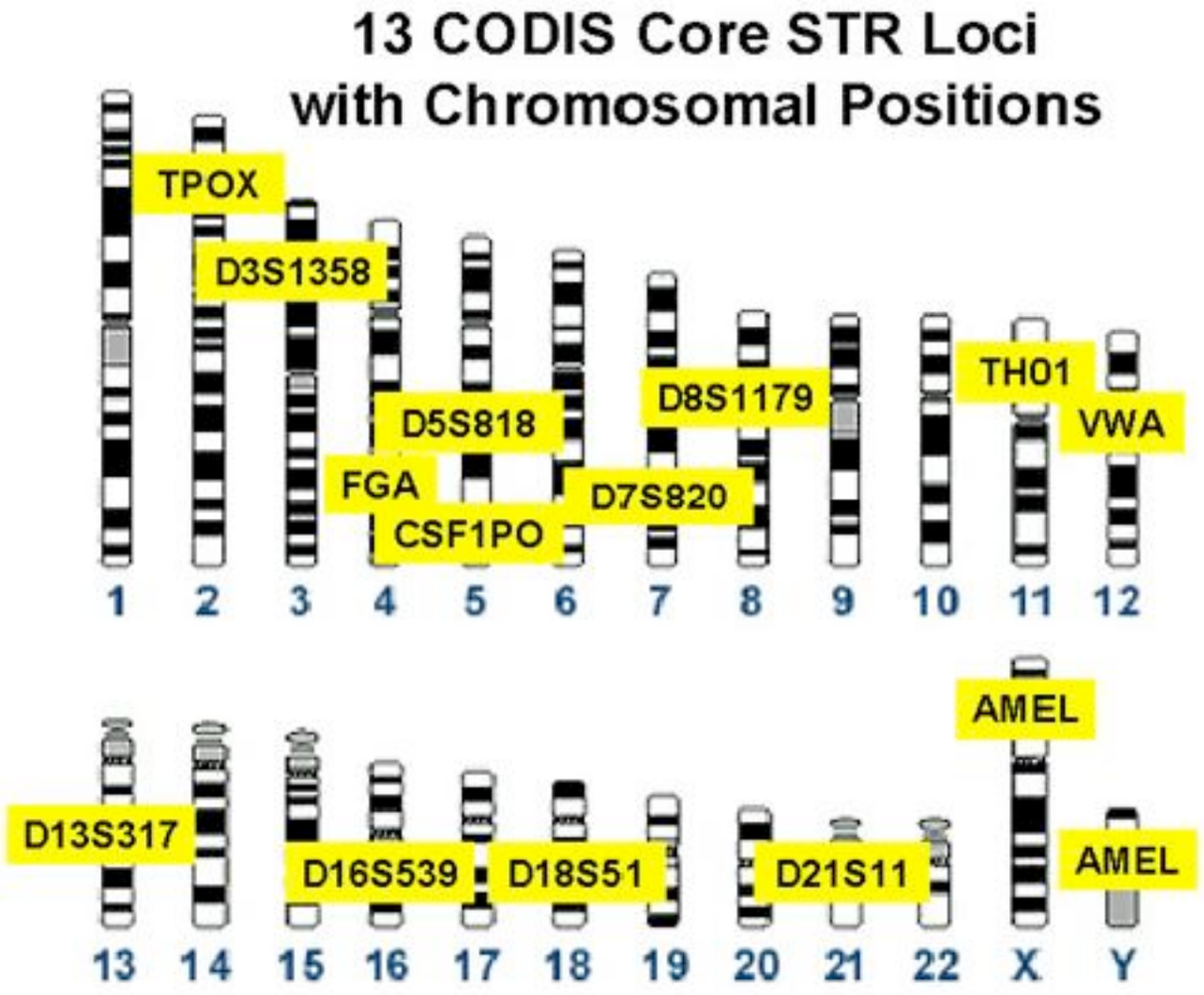
Activity--DNA Forensics

A robbery takes place at a bank. As the thief escapes the building, a security guard grabs one of the bank robber's gloves. The bank robber leaves the scene in a phone service van. The phone company identifies three employees who may have been in the vicinity of the bank at the time of the robbery. All employees deny robbing the bank. Can you think of some waythat the bank robber could be identified from among the three individuals?



DNA evidence is more reliable than fingerprints at identifying people.



The random probability that one of your CODIS sites matches with someone else's is about one in 10 (1/10). Therefore, the probability of two CODIS sites matching is 1/10*1/10 = 1/100 (one in 100). The chance of three CODIS sites matching randomly is 1/10*1/10*1/10= $(1/10)^3$ = 1/1000 (one in 1,000).

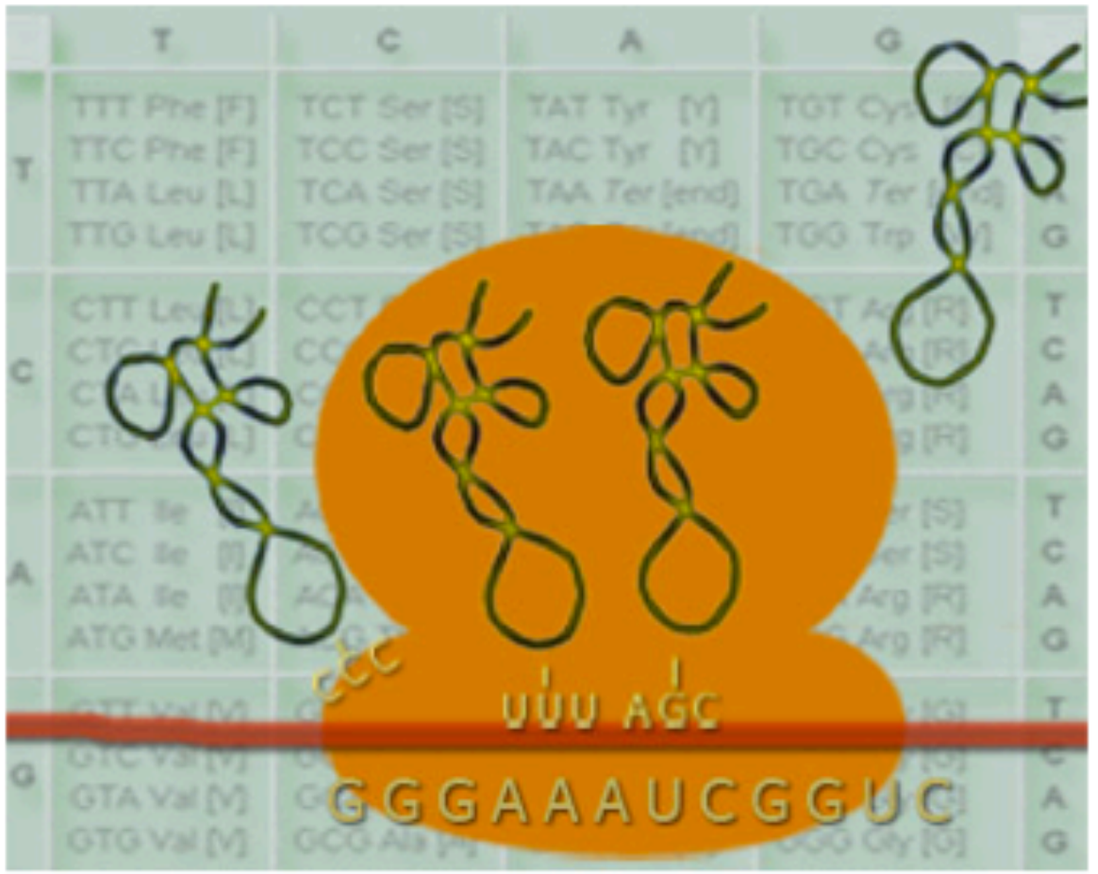
The random chance that all 13 CODIS sites match is $(1/10)^{13}$ = one in 10,000,000,000,000. The chance of being struck by lightning in your lifetime is, roughly, one in 1,000,000. So you are 10 million times more likely to be struck by lighting than you are to have the same 13 CODIS sequences as another person. This is what makes DNA profiling so certain.

1. Divide the class into pairs of students, and pass out a worksheet to each team.
2. Assist students as they complete their worksheets.
3. Have teams conclude by writing on their worksheets which suspect their DNA profiling implicates in the robbery.
4. Have the teams with the correct answer describe how they arrived at their conclusion. (Answer: Suspect 2 seems likely based on a match with four CODIS sites).
5. Have students calculate the likelihood that suspect 2, even though he matches four CODIS sites, is not the owner of the hair in the bank robber's glove. (Answer: $(1/10)^4$ = 1 in 10,000, not good enough – need more CODIS site data)
6. Have students act as biomedical engineers and analyze the results of the DNA profiling for the police investigators as described in the post-assessment activity.

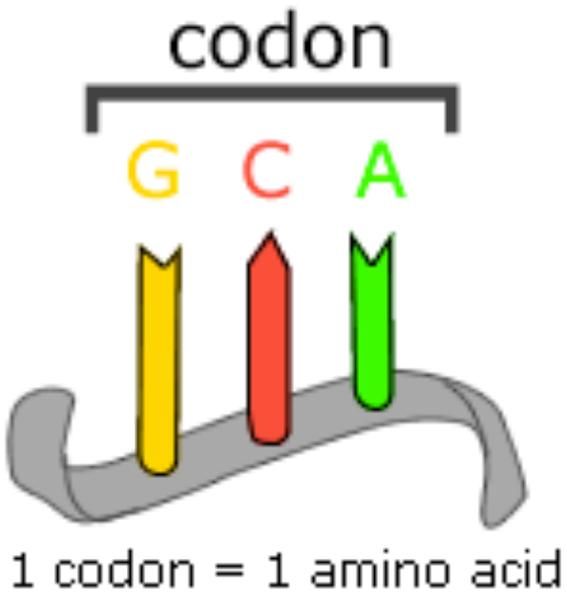
Concept 22

DNA words are three letters long.

The genetic code had to be a "language" — using the DNA alphabet of A, T, C, and G — that produced enough DNA "words" to specify each of the 20 known amino acids. Simple math showed that only 16 words are possible from a two-letter combination, but a three-letter code produces 64 words. Operating on the principle that the simplest solution is often correct, researchers assumed a three-letter code called a codon.



Research teams at University of British Columbia and the National Institutes of Health laboriously synthesized different RNA molecules, each a long strand composed of a single repeated codon. Then, each type of synthetic RNA was added to a cell-free translation system containing ribosomes, transfer RNAs, and amino acids. As predicted, each type of synthetic RNA produced a polypeptide chain composed of repeated units of a single amino acid. Several codons are "stop" signals and many amino acids are specified by several different codons, accounting for all 64 three-letter combinations.



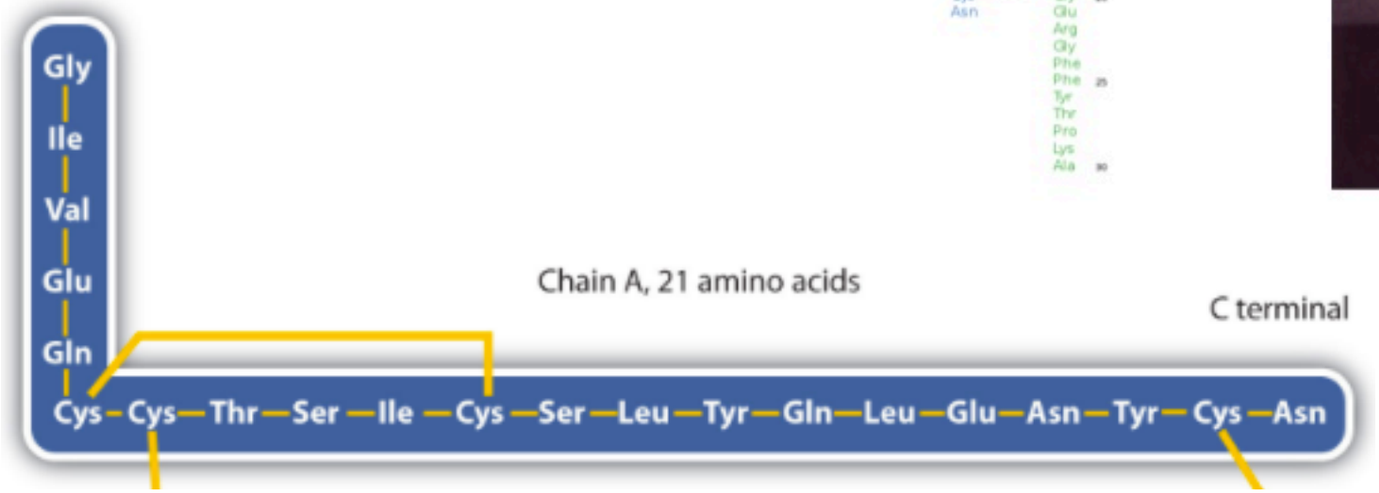
Standard genetic code

1st base	2nd base								3rd base
	T		C		A		G		
T	TTT	(Phe/F) Phenylalanine	TCT	(Ser/S) Serine	TAT	(Tyr/Y) Tyrosine	TGT	(Cys/C) Cysteine	T
	TTC		TCC		TAC		TGC		C
	TTA	(Leu/L) Leucine	TCA		TAA	Stop (*Ochre*)	TGA	Stop (*Opal*)	A
	TTG		TCG		TAG	Stop (*Amber*)	TGG	(Trp/W) Tryptophan	G
C	CTT		CCT	(Pro/P) Proline	CAT	(His/H) Histidine	CGT	(Arg/R) Arginine	T
	CTC		CCC		CAC		CGC		C
	CTA		CCA		CAA	(Gln/Q) Glutamine	CGA		A
	CTG		CCG		CAG		CGG		G
A	ATT	(Ile/I) Isoleucine	ACT	(Thr/T) Threonine	AAT	(Asn/N) Asparagine	AGT	(Ser/S) Serine	T
	ATC		ACC		AAC		AGC		C
	ATA		ACA		AAA	(Lys/K) Lysine	AGA	(Arg/R) Arginine	A
	ATG[A]	(Met/M) Methionine	ACG		AAG		AGG		G
G	GTT	(Val/V) Valine	GCT	(Ala/A) Alanine	GAT	(Asp/D) Aspartic acid	GGT	(Gly/G) Glycine	T
	GTC		GCC		GAC		GGC		C
	GTA		GCA		GAA	(Glu/E) Glutamic acid	GGA		A
	GTG		GCG		GAG		GGG		G

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

1949-Insulin Sequence

- **The first protein to be sequenced was insulin, by Frederick Sanger, in 1949. Sanger correctly determined the amino acid sequence of insulin, thus conclusively demonstrating that proteins consisted of linear polymers of amino. In 1958 he won the Nobel Prize for this achievement.**



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

RNA G G U A U C G U G C A A U G U U G C A C U U C C A U U

Ami gly .|ile .| val.| gln.| cys. | cys | thr | ser | ile

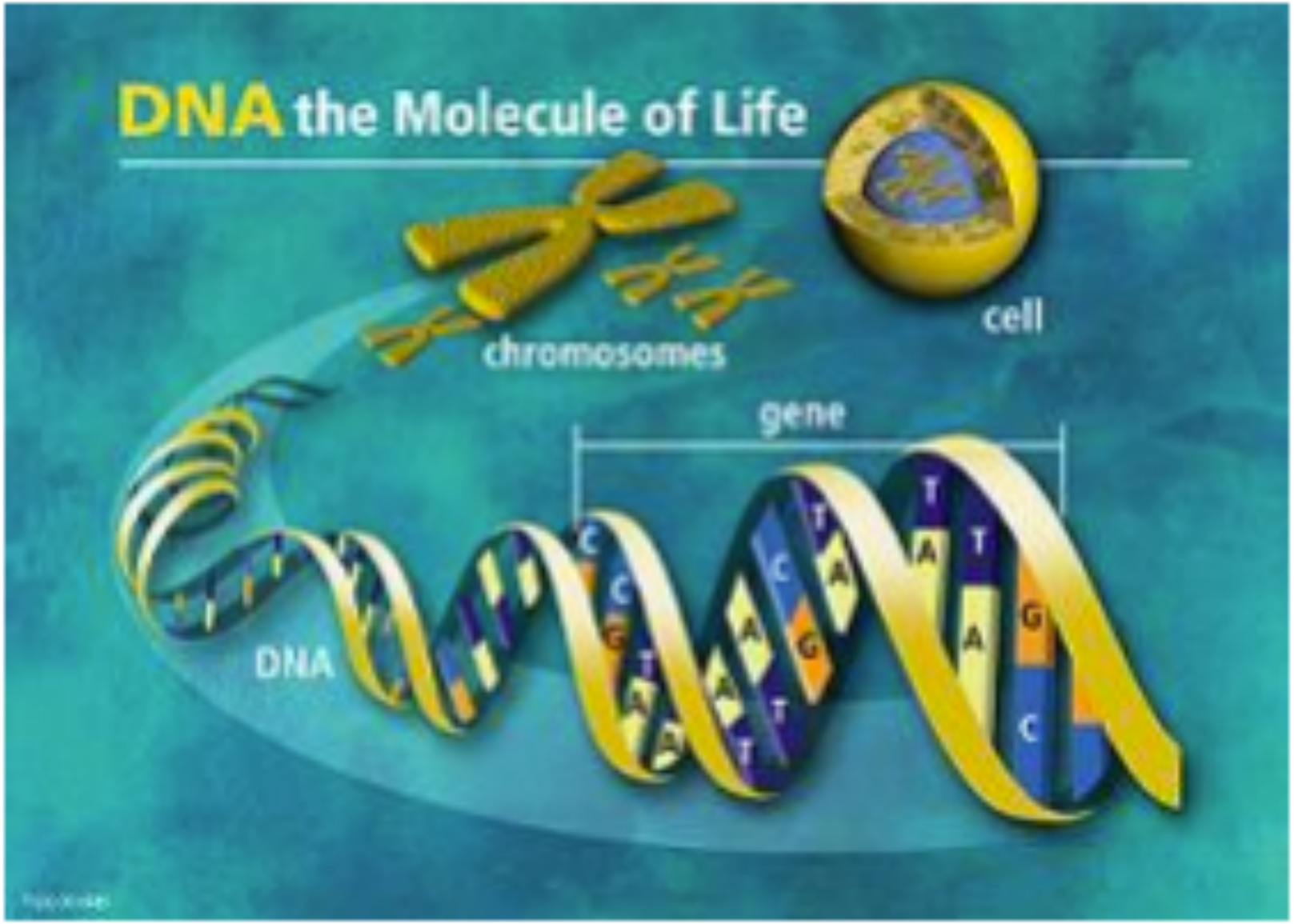
Enter class and be part of the cell membrane.

See if you can identify:

Cell Nucleus

Ribosome

DNA

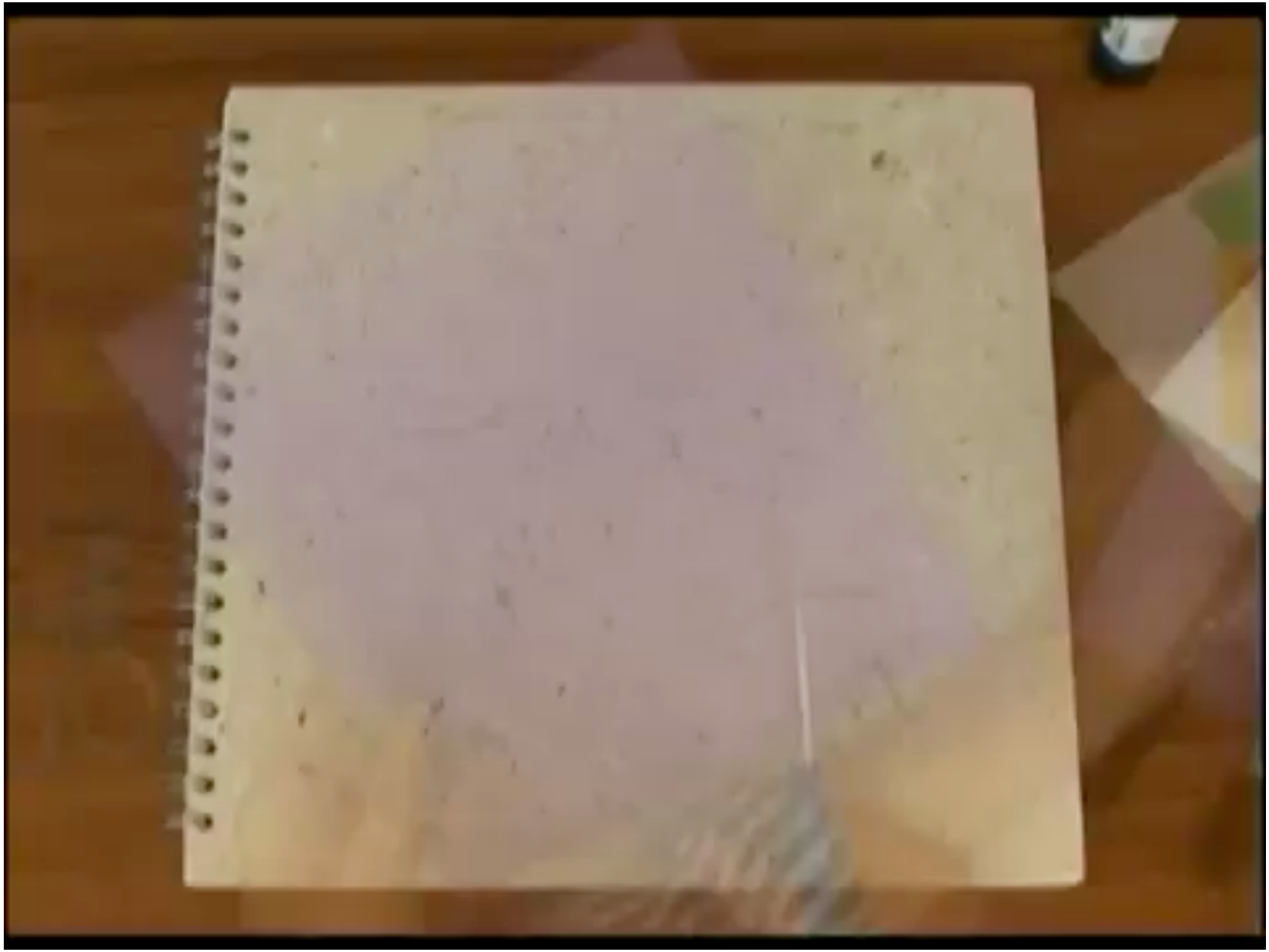


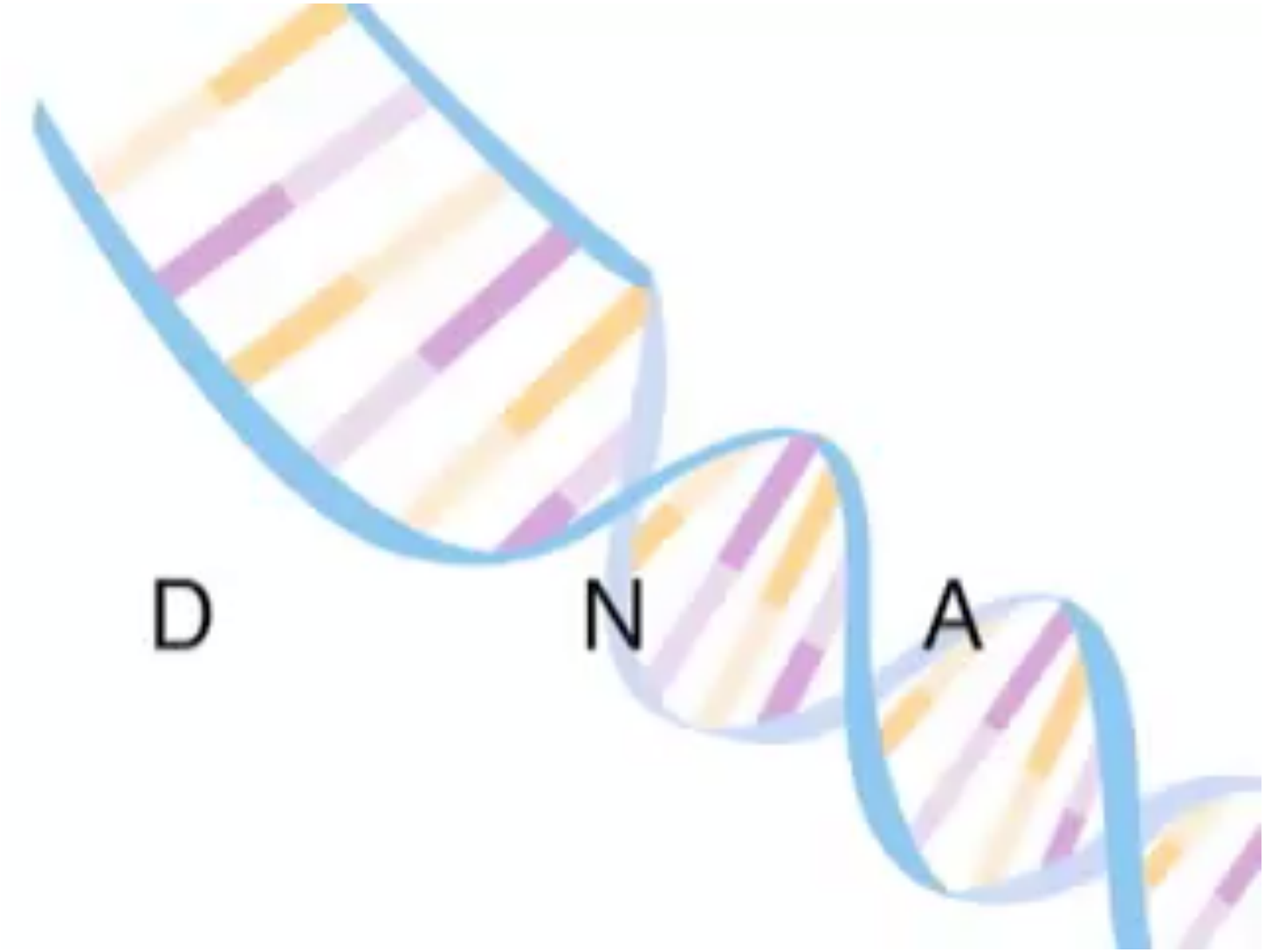
The instructions for creating all the cells in our bodies are found in our DNA.

DNA EXTRACTION LAB TODAY

Today's key questions:

- How do we get DNA out of a cell?
- How do we practice safe lab techniques?
- (Lab Coats, Eye Protection)

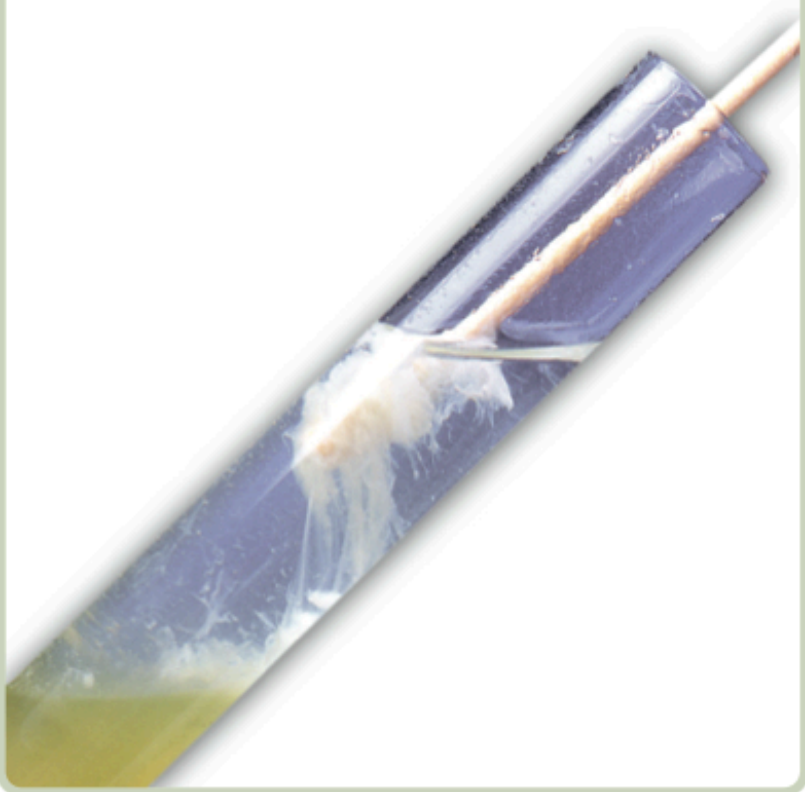



D
N
A

Getting the DNA out of cell

- Break the cell membrane (detergent)
- Separate the histone proteins from the DNA (using meat tenderiser)
- Precipitate the DNA out of the solution (ethanol).

Finish



What is that Stringy Stuff?

DNA is a long, stringy molecule. The salt that you added in step one helps it stick together. So what you see are clumps of tangled DNA molecules!

DNA normally stays dissolved in water, but when salty DNA comes in contact with alcohol it becomes undissolved. This is called precipitation. The physical force of the DNA clumping together as it precipitates pulls more strands along with it as it rises into the alcohol.

You can use a wooden stick or a straw to collect the DNA. If you want to save your DNA, you can transfer it to a small container filled with alcohol.

NAME OF LAB	DATE	PURPOSE	SCIENTISTS NAME
STEP 1	STEP 2		

SKETCH OF STEP 1	SKETCH OF STEP 2
SKETCH OF STEP 3	ETC.

Questions

- What does your extracted DNA look like?
- Why did we add detergent?
- Why do we gently stir in stead of being rough?
- What are three safety rules you must follow during this and why?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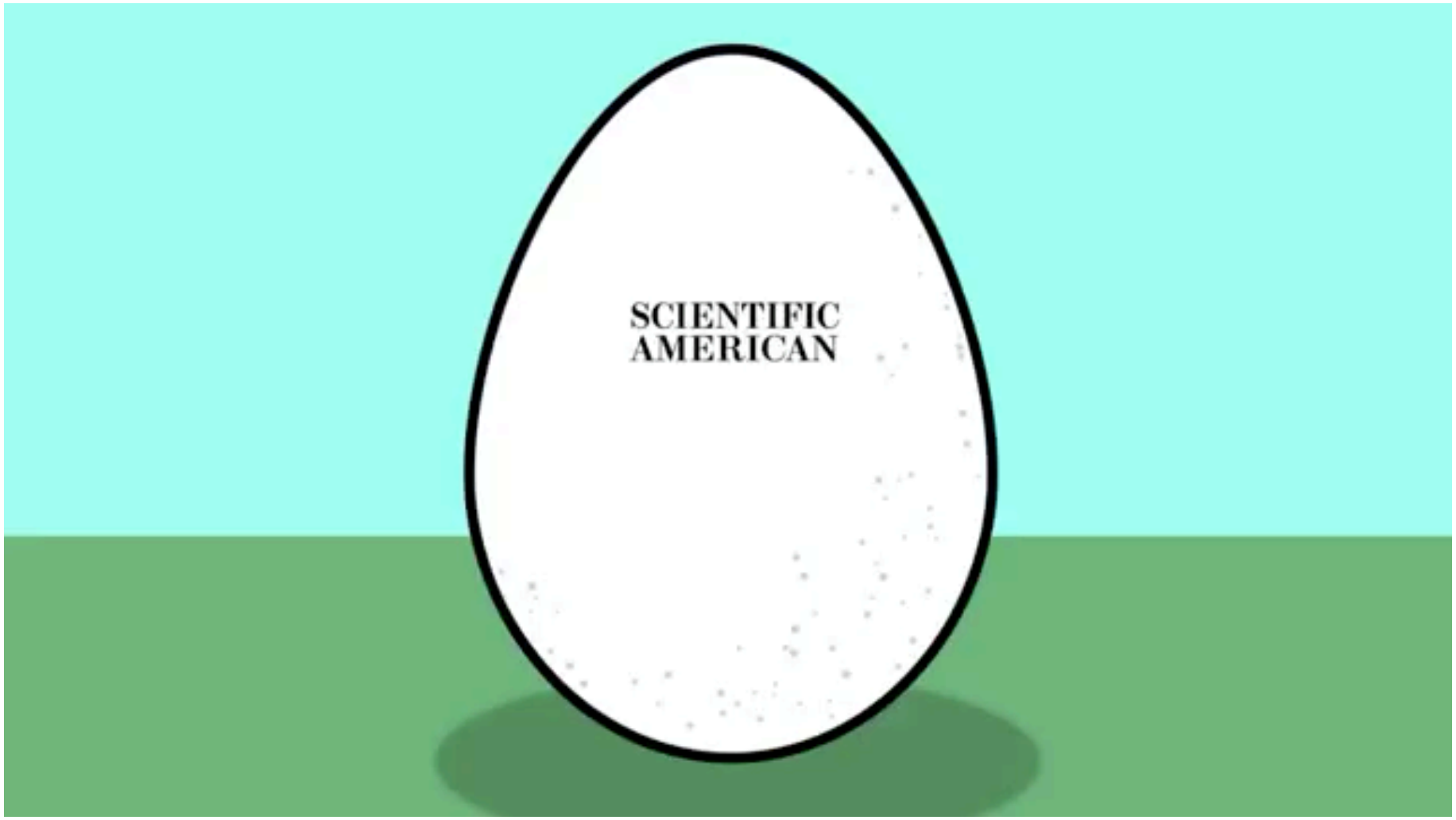
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Next Lesson-Translation and Transcription

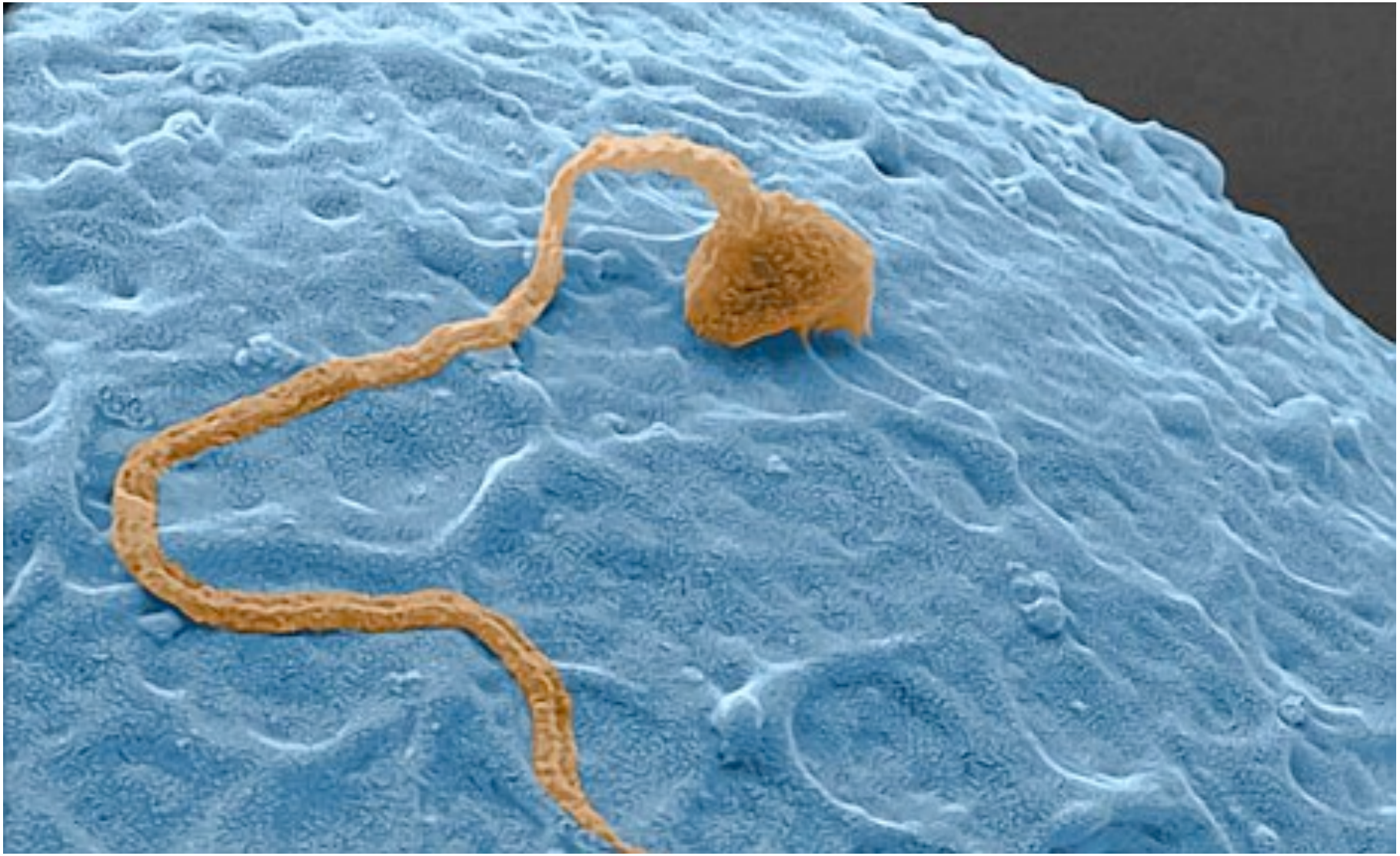
NAME OF LAB	DATE	PURPOSE	SCIENTISTS NAME

SKETCH OF STEP 1	SKETCH OF STEP 2
SKETCH OF STEP 3	SKETCH OF STEP 4
SKETCH OF STEP 5	SKETCH OF STEP 6
SKETCH OF STEP 7	SKETCH OF STEP 8

Bell work

- Explain the terms below using your own words…
  - Nucleus
  - Chromosome
  - Double helix

- How can you break down the cell membrane when collecting DNA?



Key Questions

- What are the types of cell division?
- Why is the difference between mitosis and meiosis?
- How do we get DNA from our parents?

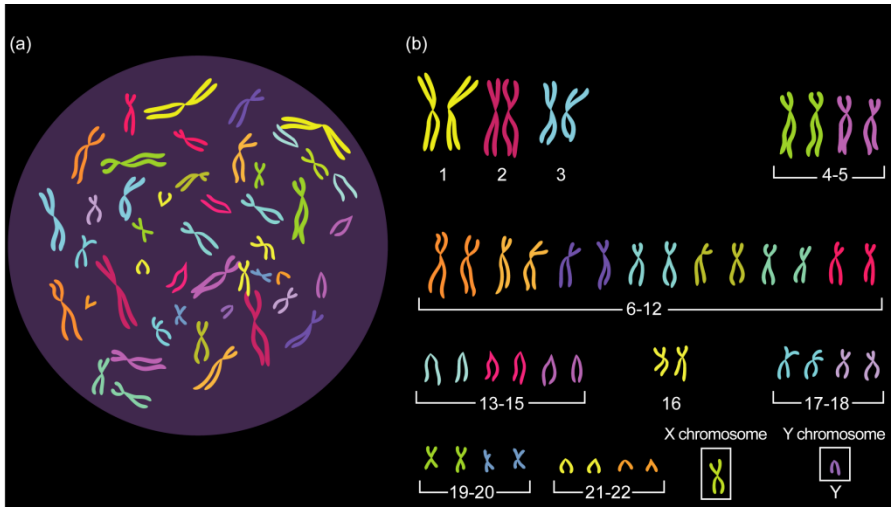
Chromosomes

- Neatly packaged DNA
- Sections of chromosomes are called genes.


www.dnalc.org

Chromosomes

- Humans have 46 chromosomes in each cell.
- You are born when two gametes join.
- You get 23 chromosomes from your ma's gamete (egg) and 23 from your pa's gamete (sperm).



Mitosis

- Mitosis-->cell division for growth and repair.

- Mitosis--> cells split and create identical copies.

- Cells produced by mitosis have the **same** number of chromosomes and the **same genetic information**.

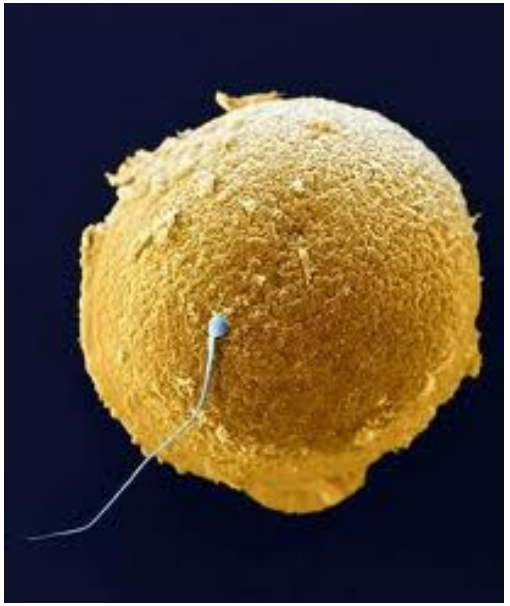
Meiosis

- Meiosis is a type of cell division that produces GAMETES:

  FEMALES: Ovum (egg) cells

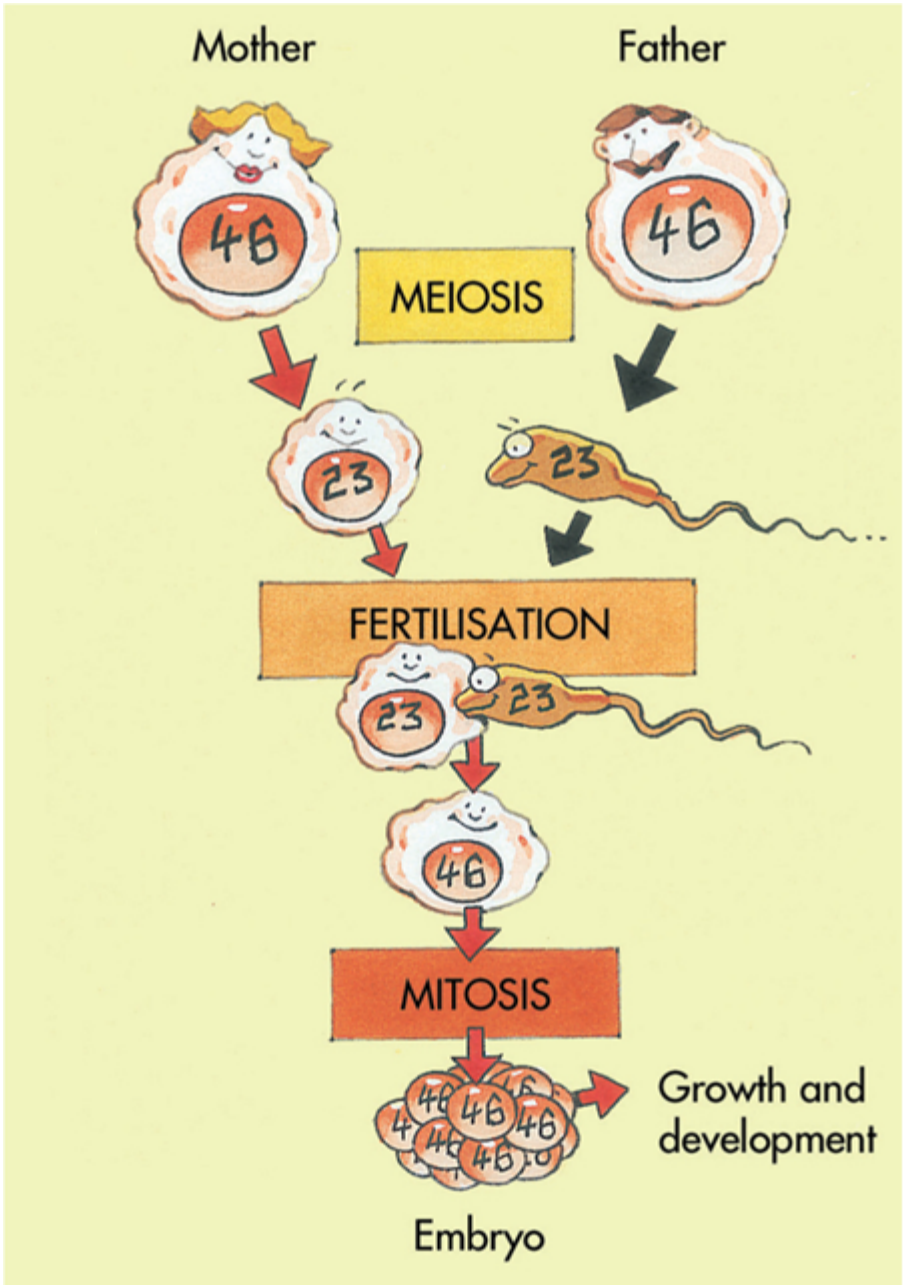
  MALES: sperm cells

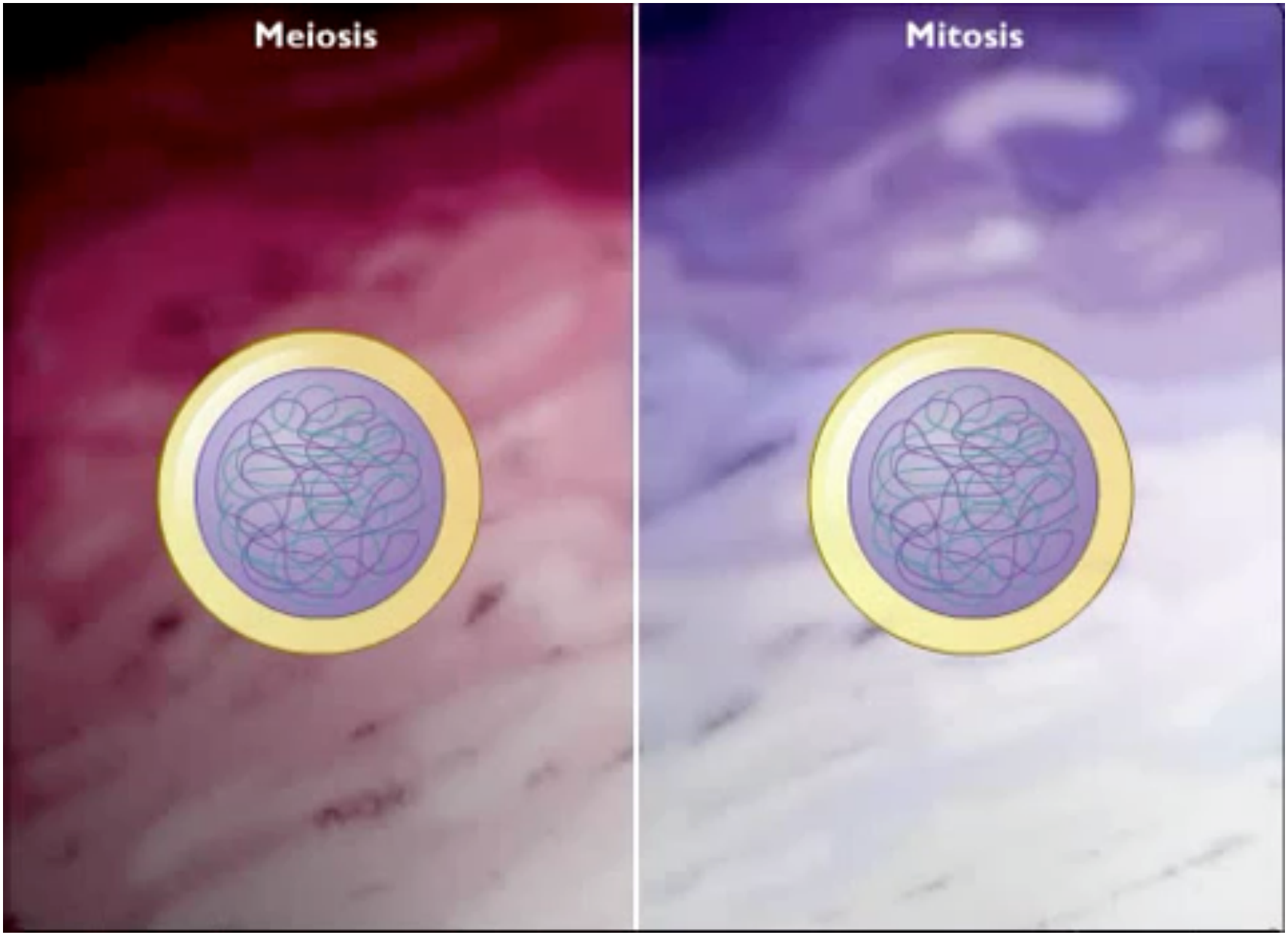
  (called HAPLOID GAMETES because they have half the normal number of chromosomes).



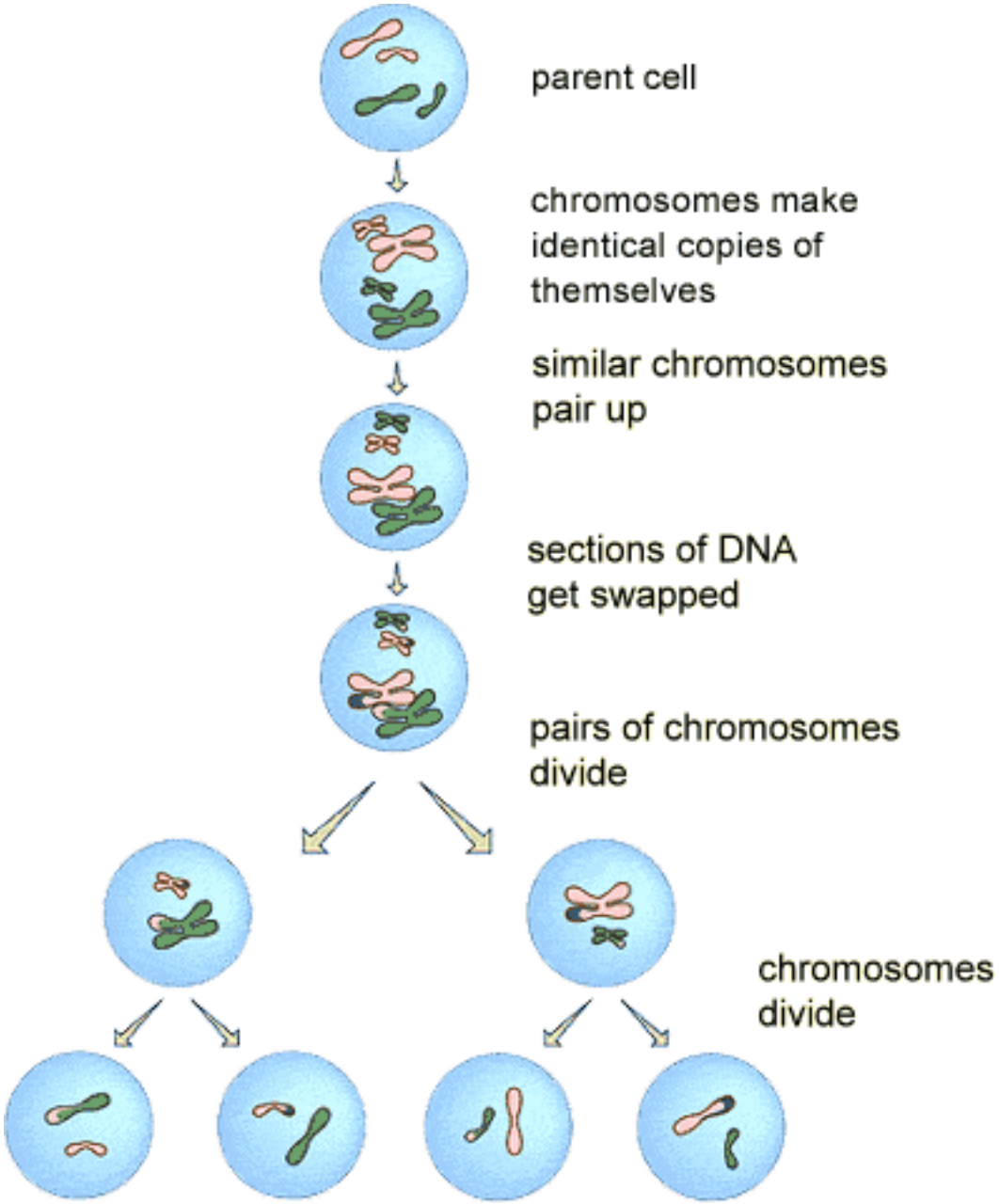
- Pairs of HAPLOID GAMETES (i.e. sperm and egg) combine to form a normal cell (a DIPLOID CELL).
- Meiosis creates genetically unique gametes with **different genetic information** by mixing up chromosomes,and is a source of **DNA variation**.

How is DNA passed on?




Meiosis
Mitosis

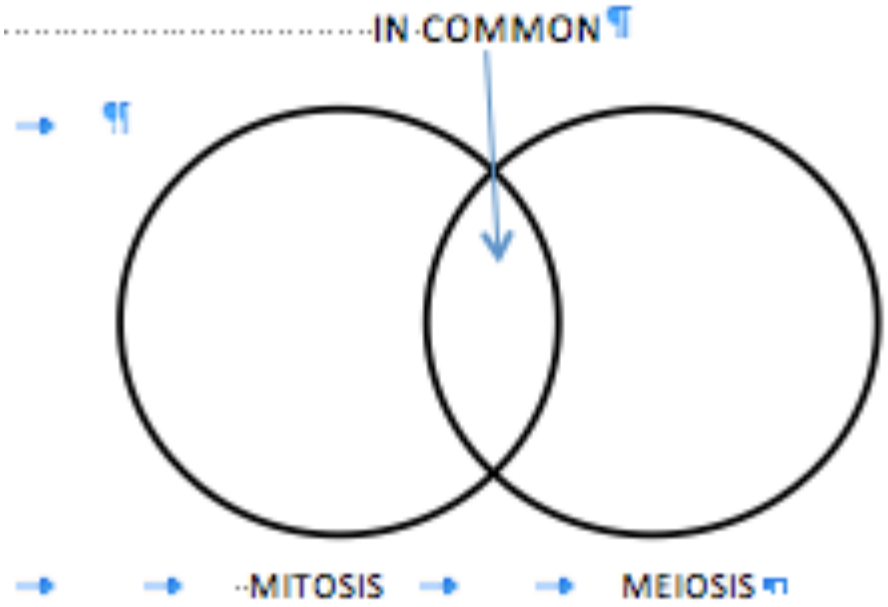
Meiosis


parent cell
chromosomes make identical copies of themselves
similar chromosomes pair up
sections of DNA get swapped
pairs of chromosomes divide
chromosomes divide

	Mitosis	Meiosis
Genetic Information	Identical to parent cell.	Mixing of genes from each chromosome pair in parent.
Daughter cells	Two identical diploid cells (pairs of chromosomes)	Unique haploid cells (single set of chromosomes) called gametes.
Role	Produces cells for growth and tissue repair.	Produces gametes (e.g. ovum or sperm) for reproduction.

Mitosis and Meiosis Venn Diagram

On A3 paper draw two large circles that overlap. This should take up the whole page and should look like the diagram below. Label one MITOSIS, the other MEIOSIS and the middle IN COMMON.



Cut out each of the squares on the small sheet and place them in either the mitosis circle (if it only relates to mitosis), the meiosis circle (if it only relates to meiosis), or the middle (if it relates to both).

Task

1. Use your notes to explain the main differences between **mitosis** and **meiosis.**

2. Use books to research and draw diagrams for:

- The **phases of mitosis in order**
- The **phases meiosis in order**

3. What is the difference between a **Haploid** cell and a **Diploid** cell, in terms of number of **Chromosomes**?

BELL WORK--use notes from last class to fill in the blanks:

Type of cell division:	**MITOSIS**	_____
DNA replicates?	YES	YES
Divisions	_____	_____
Genetic Information	_____ parent cell.	_____ parent cell.
Daughter cells	_____	_____
Role in animal body	Produces cells for growth and tissue repair.	Produces gametes (e.g. ovum or sperm).

HINTS (not necessarily in order): "MEIOSIS" "Four." "Two." "Two identical diploid cells." "Four unique haploid cells." "Different than..." "Same as..."

	Mitosis	Meiosis
DNA replicates?	YES	YES
Divisions	One	Two
Genetic Information	Same as parent cell.	Different than parent cell.
Daughter cells	Two identical diploid cells.	Four unique haploid cells.
Role in animal body	Produces cells for growth and tissue repair.	Produces gametes (e.g. ovum or sperm).

Key Questions:

How do traits get passed on from generation to generation?

How can a blue eyed child be born to two parents with brown eyes?

What is a "dominant" and "recessive" gene?

Three tasks today:

- Individually research heredity in your science textbooks and write answers to questions from the text.

- Group investigation on the genetic makeup of students in our class to discover dominant traits.

- Review of Meiosis.

First Task: INDIVIDUAL WORK WITH QUIET VOICES

- Carefully read p. 58-60 of *Secondary Science* and copy and complete questions 1-7 on p. 60 in your books.

The following words might be used more than once:

DOMINANT GENETICS PARENTS HEREDITY RECESSIVE CHARACTERISITCS

ENVIRONMENT APPEAR DISPLAY PEA PARENT

- Now read the section "Genes" on p. 61, and copy and complete questions 8-15 on p. 61 in your books.

The following words might be used more than once:

BLUE HEREDITY GENES CHARACTERISITC

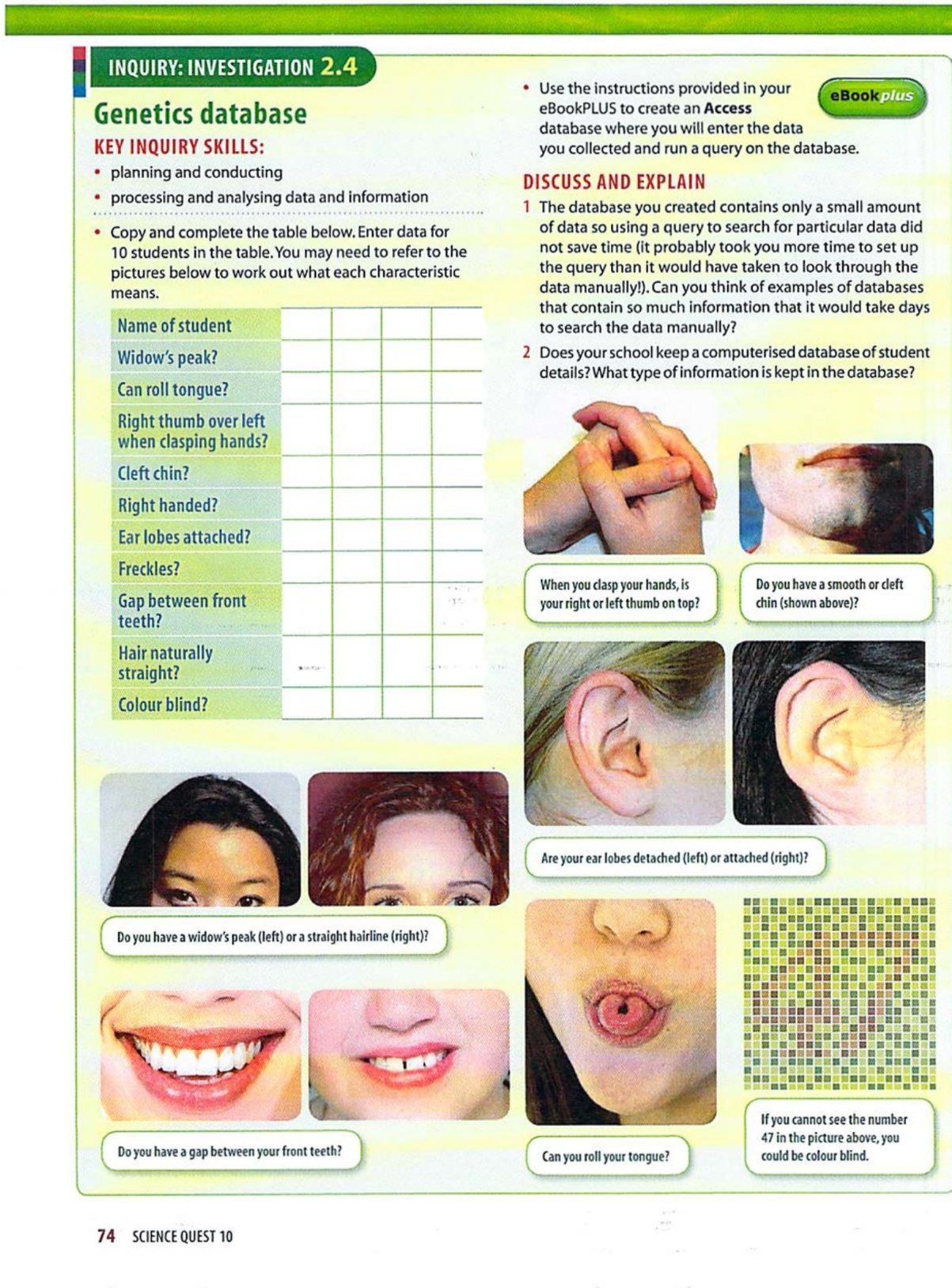
TWO BROWN BOTH PARENTS

Second Task:

- In groups of 2 or 3, survey at least 10 other members of the class using the survey sheets provided.

- Do not write on the survey sheets; instead, each group member should create a table in their own book and compile your group's survey information. Title the table, "Science Class Genetic Database".

- By looking at the data you have gathered, choose which characteristic for each pair you think is dominant and which is recessive and note in your table.



INQUIRY: INVESTIGATION 2.4

Genetics database

KEY INQUIRY SKILLS:

- planning and conducting
- processing and analysing data and information

- Copy and complete the table below. Enter data for 10 students in the table. You may need to refer to the pictures below to work out what each characteristic means.

Name of student				
Widow's peak?				
Can roll tongue?				
Right thumb over left when clasping hands?				
Cleft chin?				
Right handed?				
Ear lobes attached?				
Freckles?				
Gap between front teeth?				
Hair naturally straight?				
Colour blind?				

- Use the instructions provided in your eBookPLUS to create an **Access** database where you will enter the data you collected and run a query on the database.

eBookplus

DISCUSS AND EXPLAIN

1 The database you created contains only a small amount of data so using a query to search for particular data did not save time (it probably took you more time to set up the query than it would have taken to look through the data manually!). Can you think of examples of databases that contain so much information that it would take days to search the data manually?

2 Does your school keep a computerised database of student details? What type of information is kept in the database?

When you clasp your hands, is your right or left thumb on top?

Do you have a smooth or cleft chin (shown above)?

Are your ear lobes detached (left) or attached (right)?

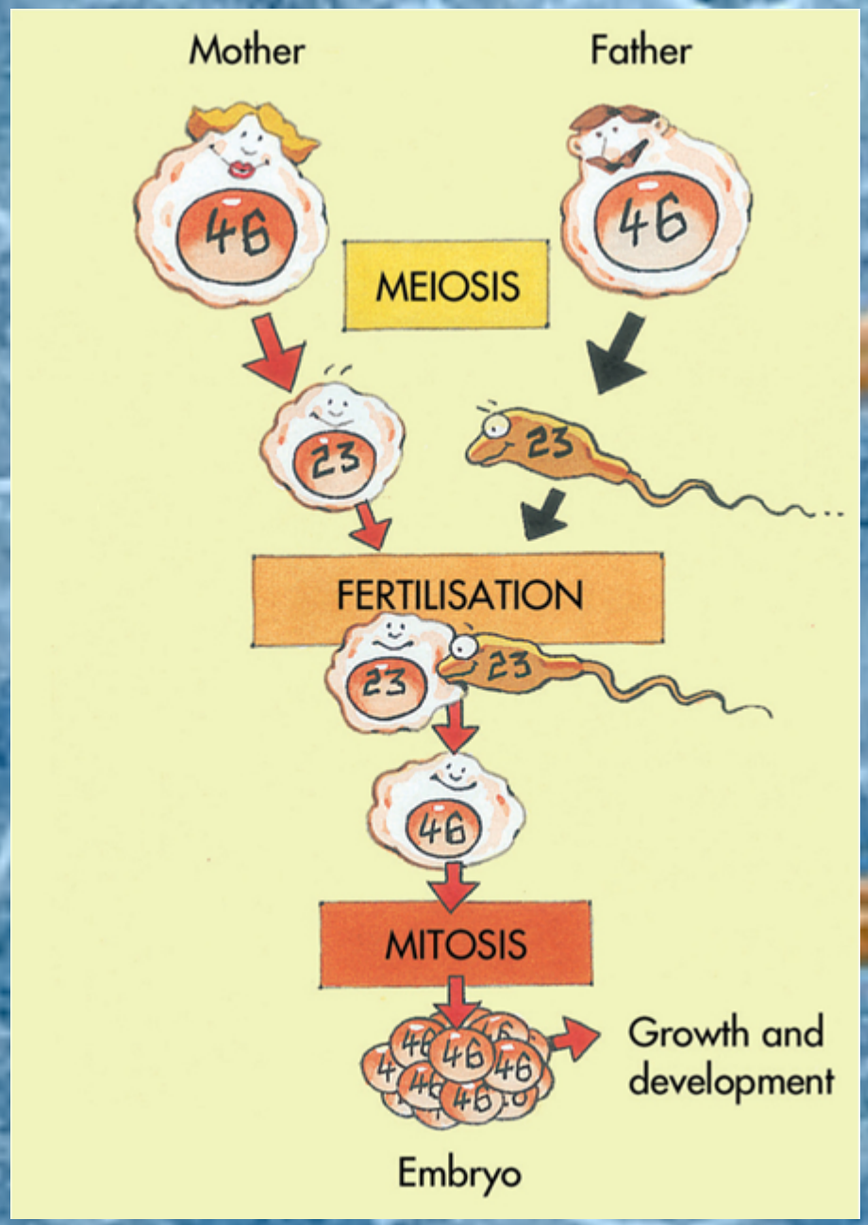
Do you have a widow's peak (left) or a straight hairline (right)?

Do you have a gap between your front teeth?

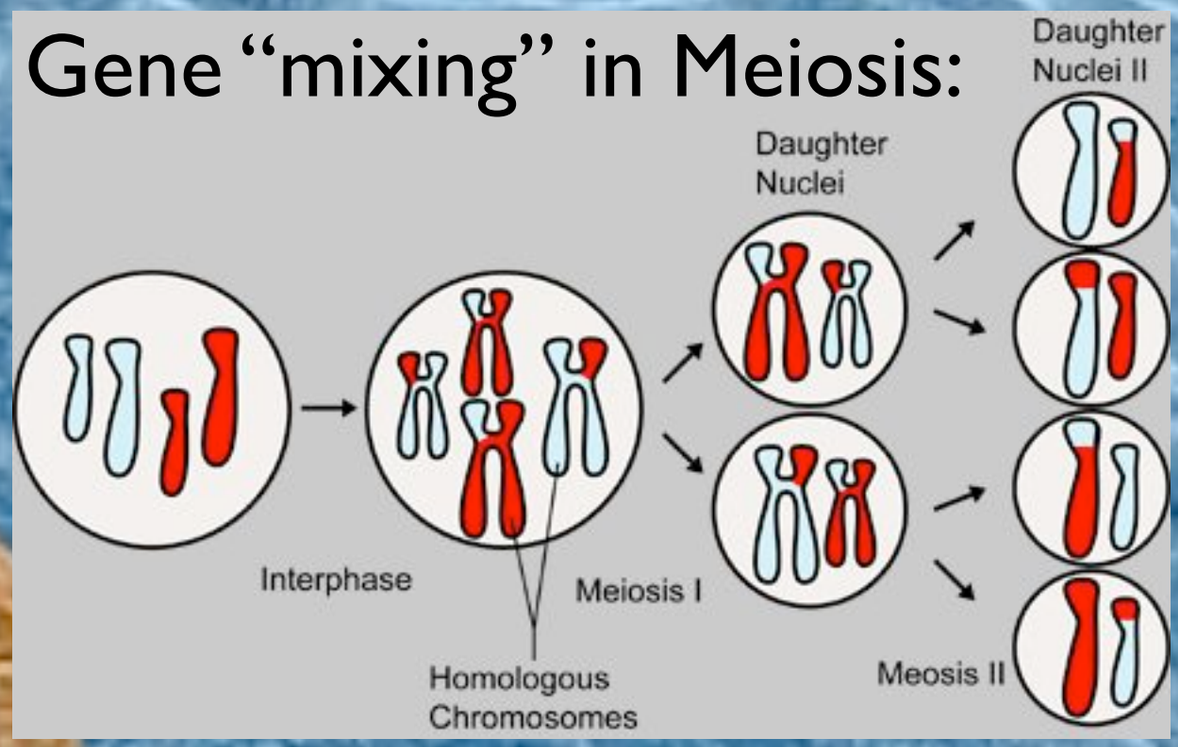
Can you roll your tongue?

If you cannot see the number 47 in the picture above, you could be colour blind.

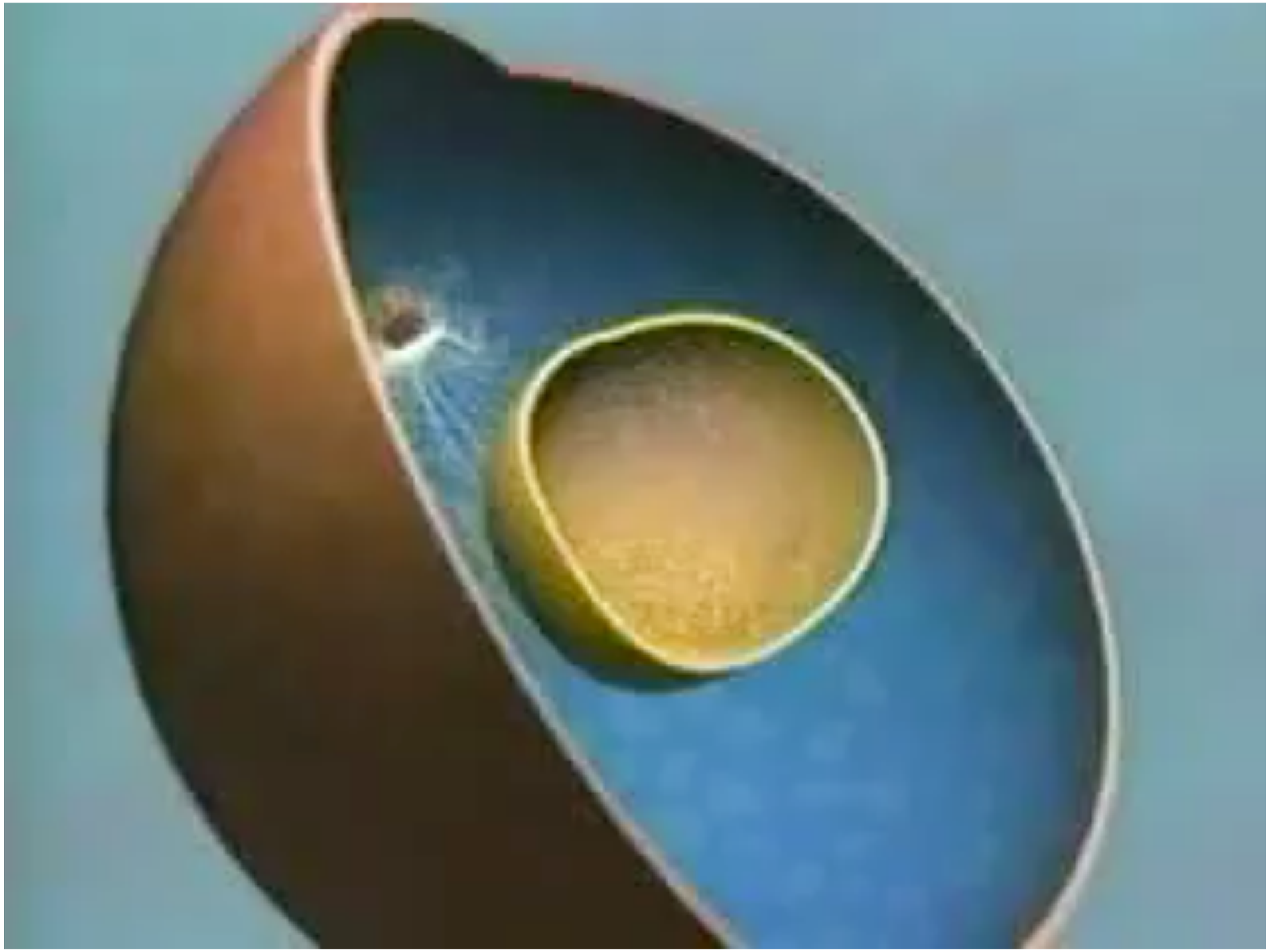
Review of Meiosis, the process which creates egg and sperm cells.



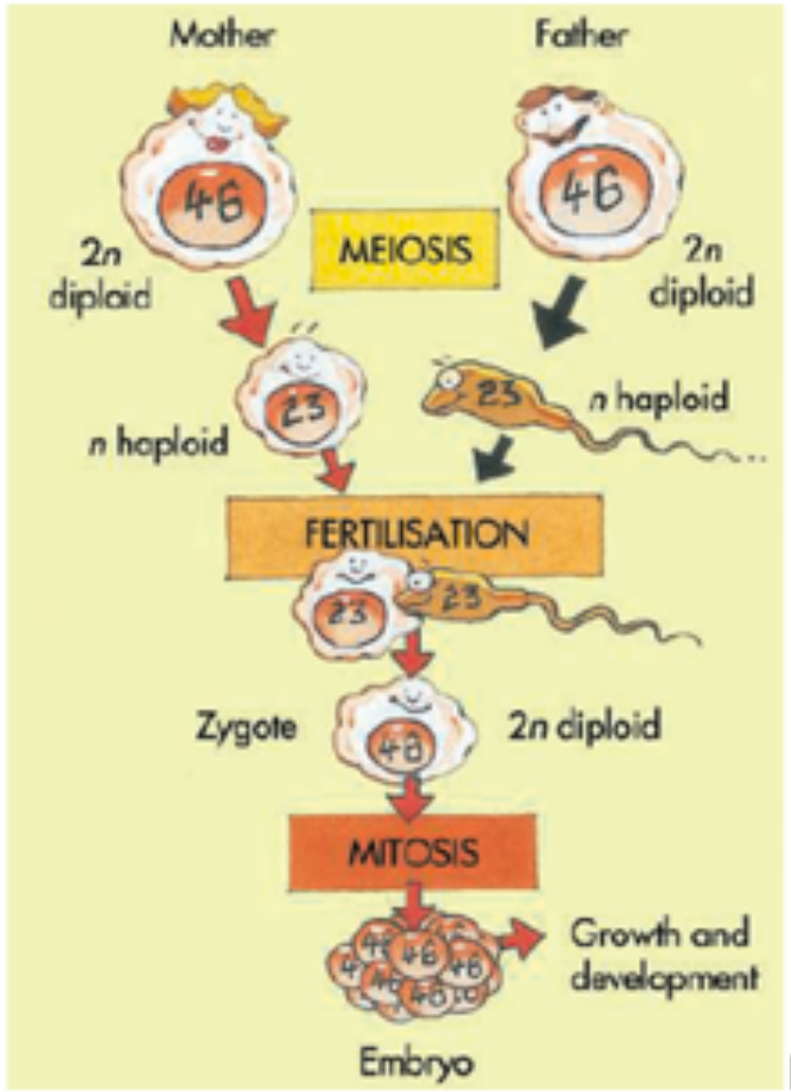
Gene "mixing" in Meiosis:

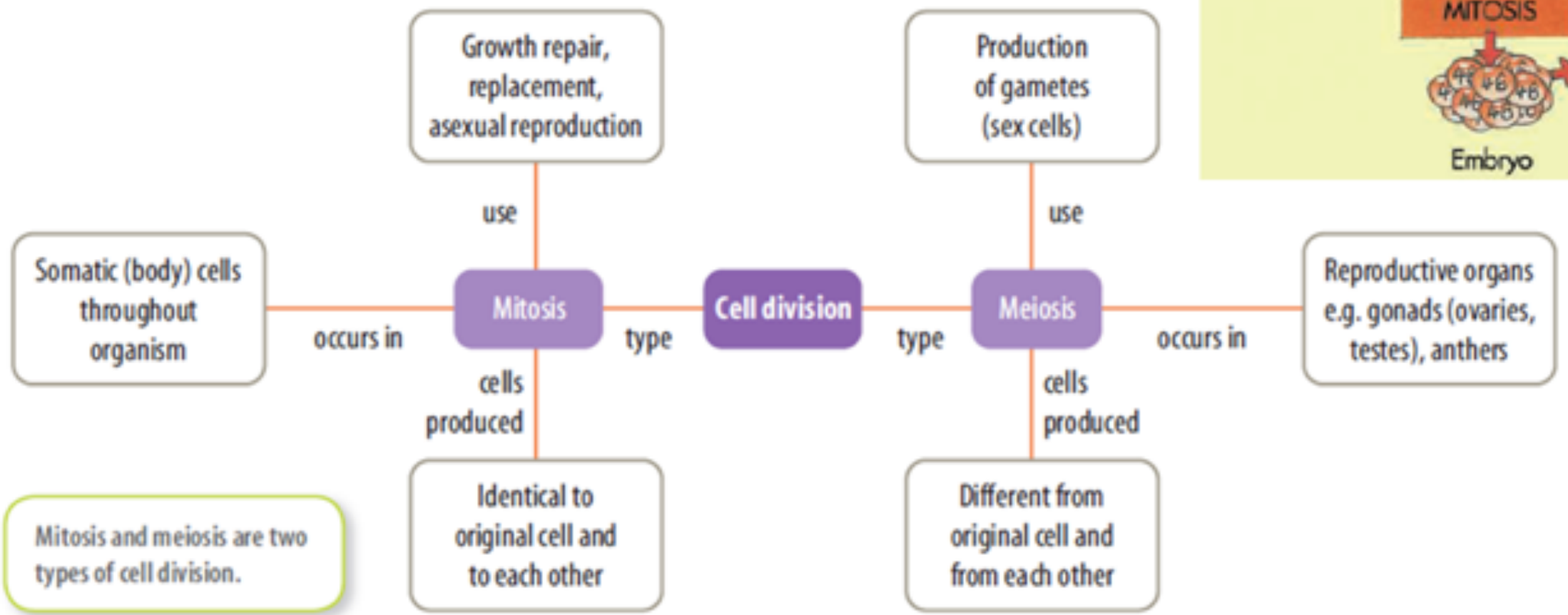


Meiosis: the genetic mixing of the chromosomes inherited by parents to create genetically unique gametes. The gametes produced by Meiosis will determine your offspring's characteristics.



Use the flow chart below and the illustration at right to write two paragraphs--the first paragraph explains the difference between Mitosis and Meiosis, and the second paragraph explains how both processes are part of new life.





Next Lesson: How Recessive and Dominant Genes can be transferred from grandparents to grandchildren.

Homework:

Article & questions.

Reread, "A Brief Guide to Genetics" .

REMEMBER YOUR TERM 1 EFFORT AND ORGANISATION GRADE IS INFLUENCED BY YOUR HOMEWORK EFFORT.

BELLWORK—Fill in the blanks (copy in book)

Use these word in the blanks below:

dominant ***genetics***

inheritance ***recessive***

Genetic features can be _____ or _____.

The passing on of characteristics from one generation to the next is called_____.

The study of inheritance is called_____.

Genetic features can be **dominant** or **recessive**.

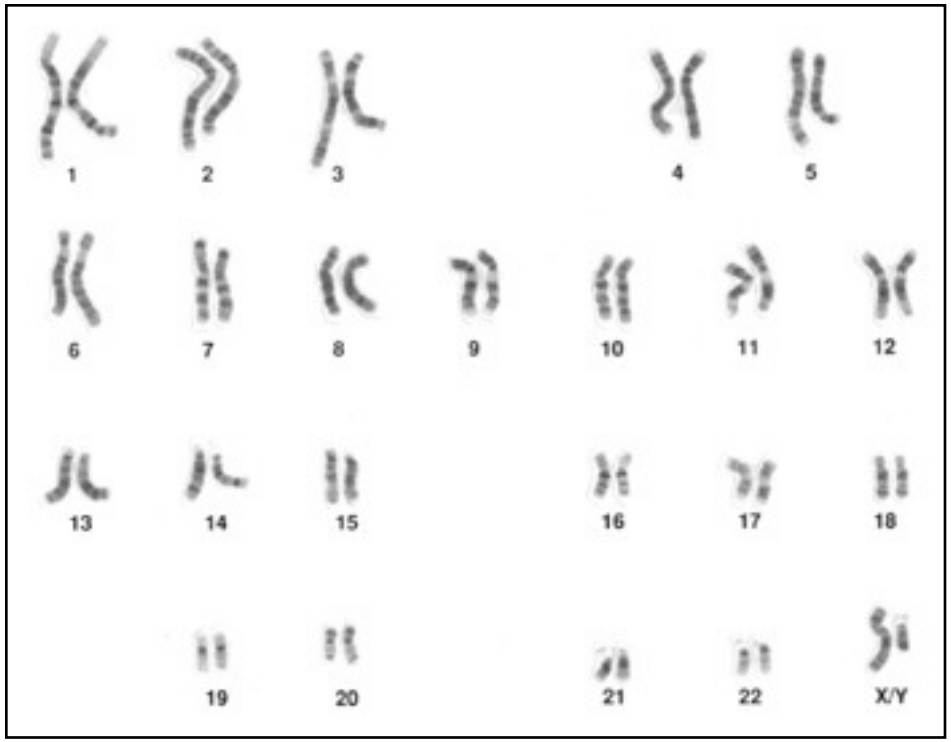
The passing on of characteristics from one generation to the next is called **inheritance.**

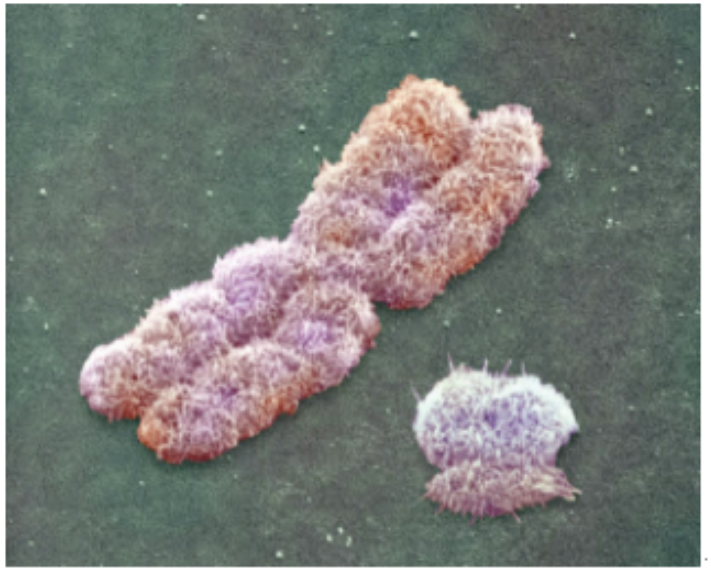
The study of inheritance is called **genetics.**

- Lesson Objectives
- —What is a **Genome**?
  - Difference between a **genotype** and **phenotype**
  - **Alleles** come in pairs, one usually dominant

Your Genome

(23 pairs of chromosomes)





XY chromosomes

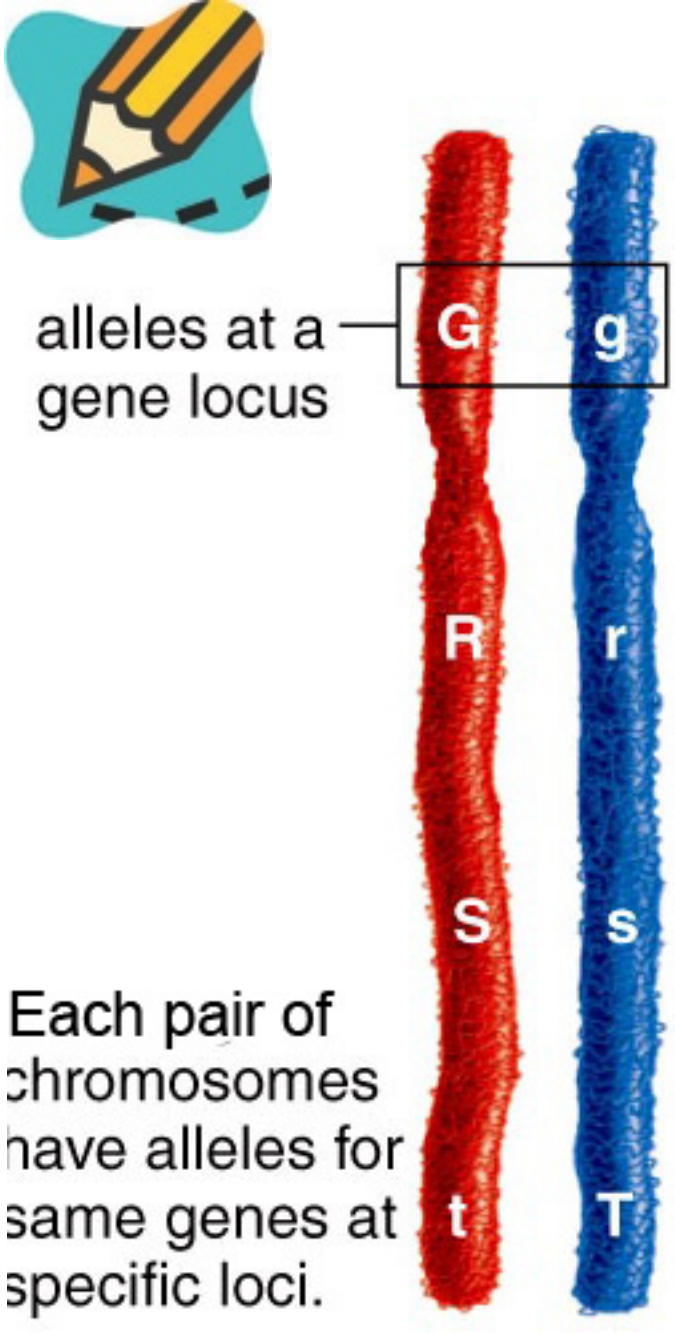
Your sex (male or female) is determined by the chromosome #23 pair (either XX or XY). Women have two X chromosomes. Men have an X and a Y chromosome.

Genotype - the two similar genes in a chromosome pair.

- *We use pairs of letters to show genotypes (i.e. Gg or GG).*
- *The letters refer to a gene type (i.e. brown hair =B).*
- *Capital letters are used for dominant genes; small letters are used for recessive genes.*

Homozygous genotype= letters the same.

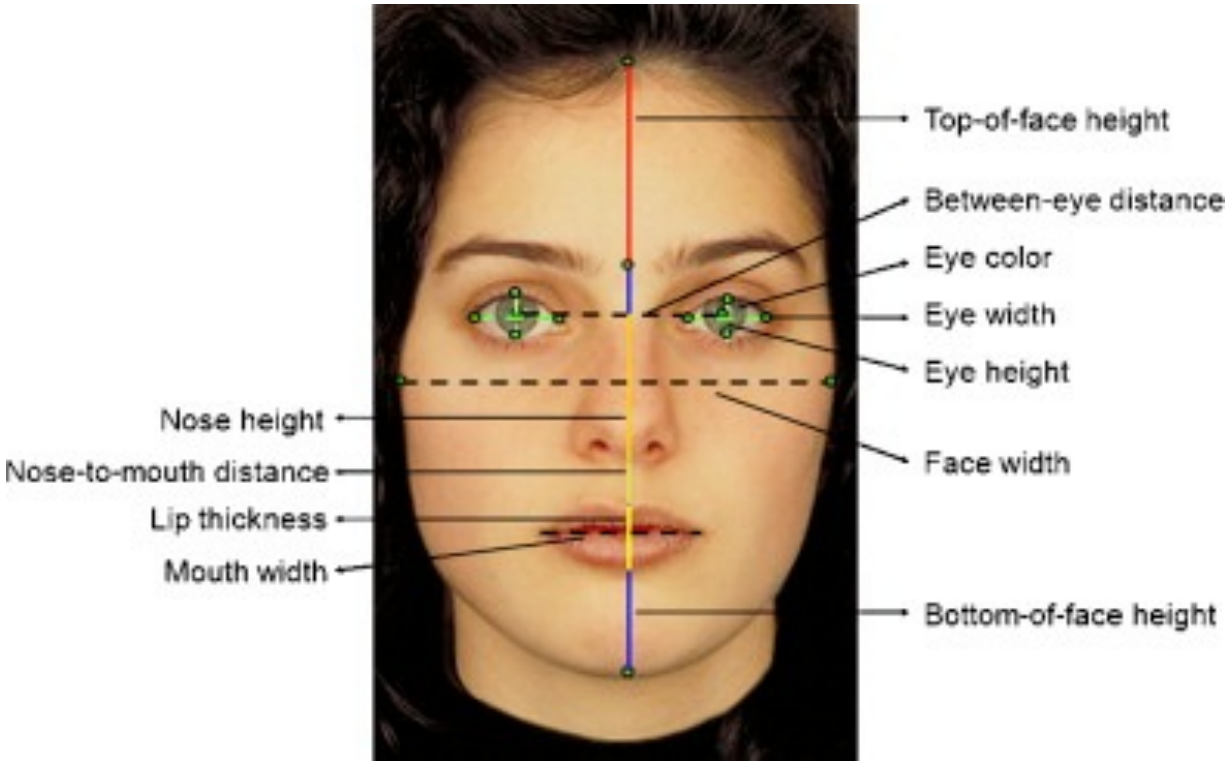
Heterozygous genotype=letters different.



- The passing on of characteristics from one generation to the next is called **inheritance**.
- Some characteristics can be **dominant** or **recessive**.
- An **allele** is a short code for one characteristic.
- You get two alleles, one from each parent. We show each allele using a letter.

- **CAPITAL LETTER = dominant**
- **lower case = recessive**

Phenotype -The physical characteristics or features (eg. Blue eyes or brown eyes)



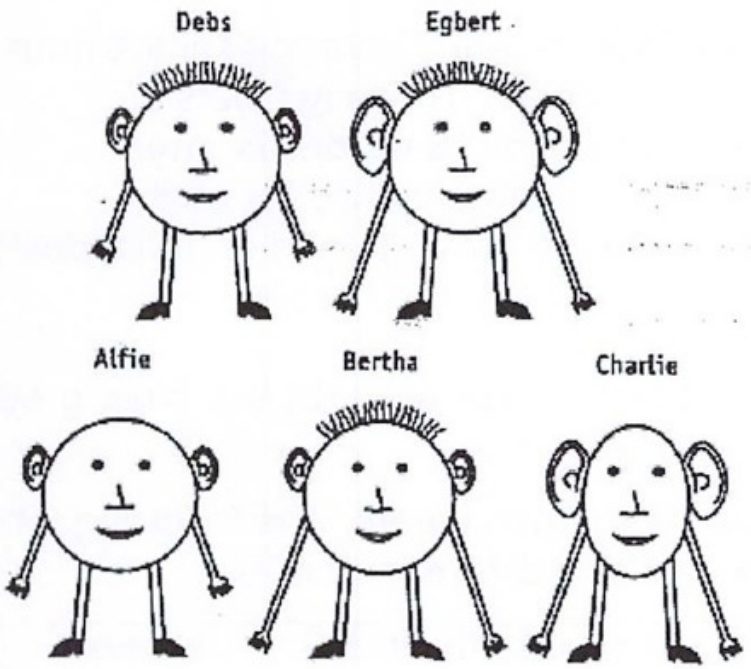
Think: **Ph**enotype=**Ph**ysical characteristic.

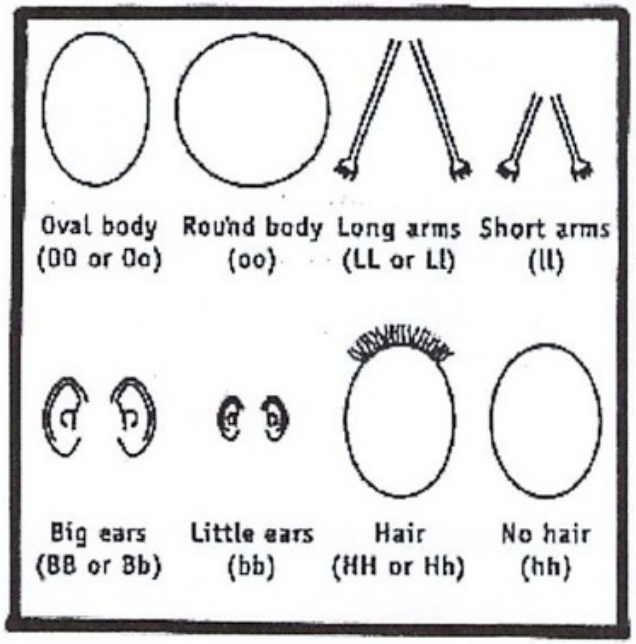
Genotype=**gen**etic code (with dominant or recessive genes)

Task (20 minutes)

- Determining Genotype and Phenotype

2. Pictured below is a family and the different characteristics they possess. Fill in the table on the genotype and phenotype of the different family members.



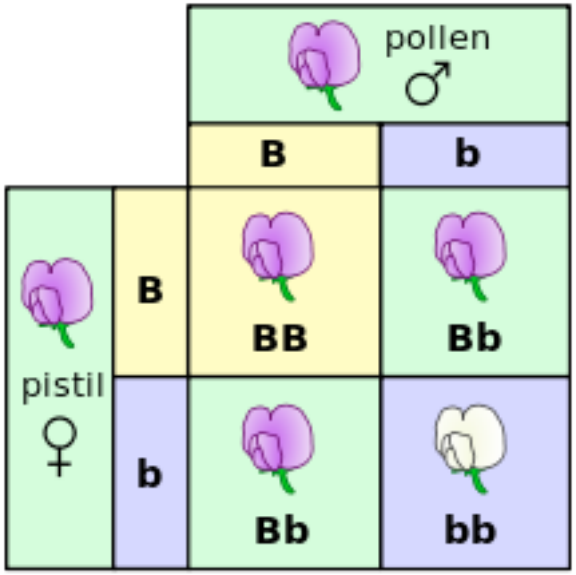


An **allele** is a short code for one characteristic. You get two alleles, one from each parent. We show each allele using a letter.

CAPITAL LETTER = dominant

lower case = recessive

B= purple (dominant)
b= white (recessive)



Exit Pass

Fill out the table with the choices below

Name	Example	Definition
Phenotype		
Genotype		
Allele		

A or a

AA, Aa, aa

Black hair or Blonde hair

Genetic code for a characteristic shown by pair of letters

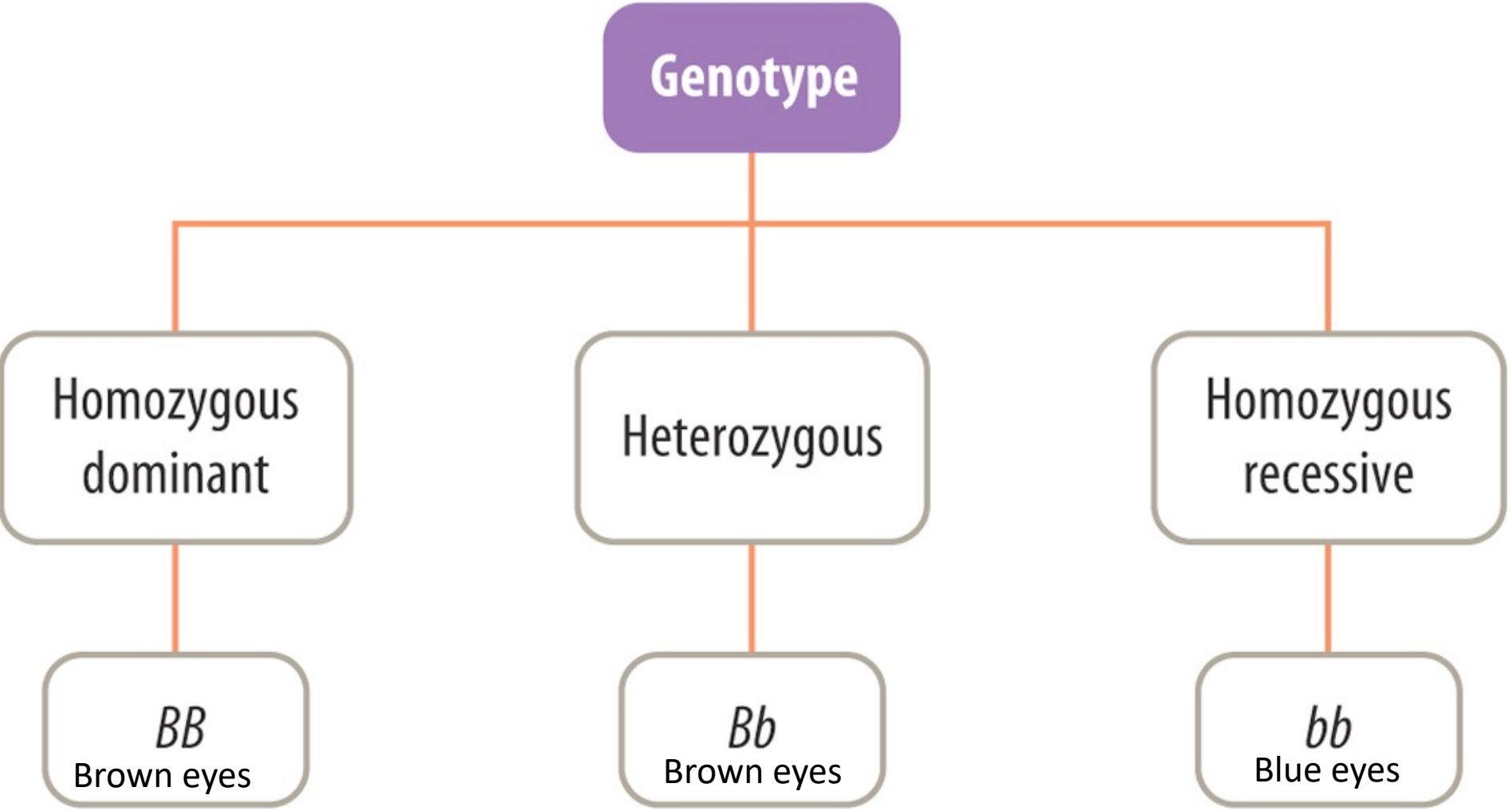
Single code from one parent shown one letter

Physical characteristic shown in you

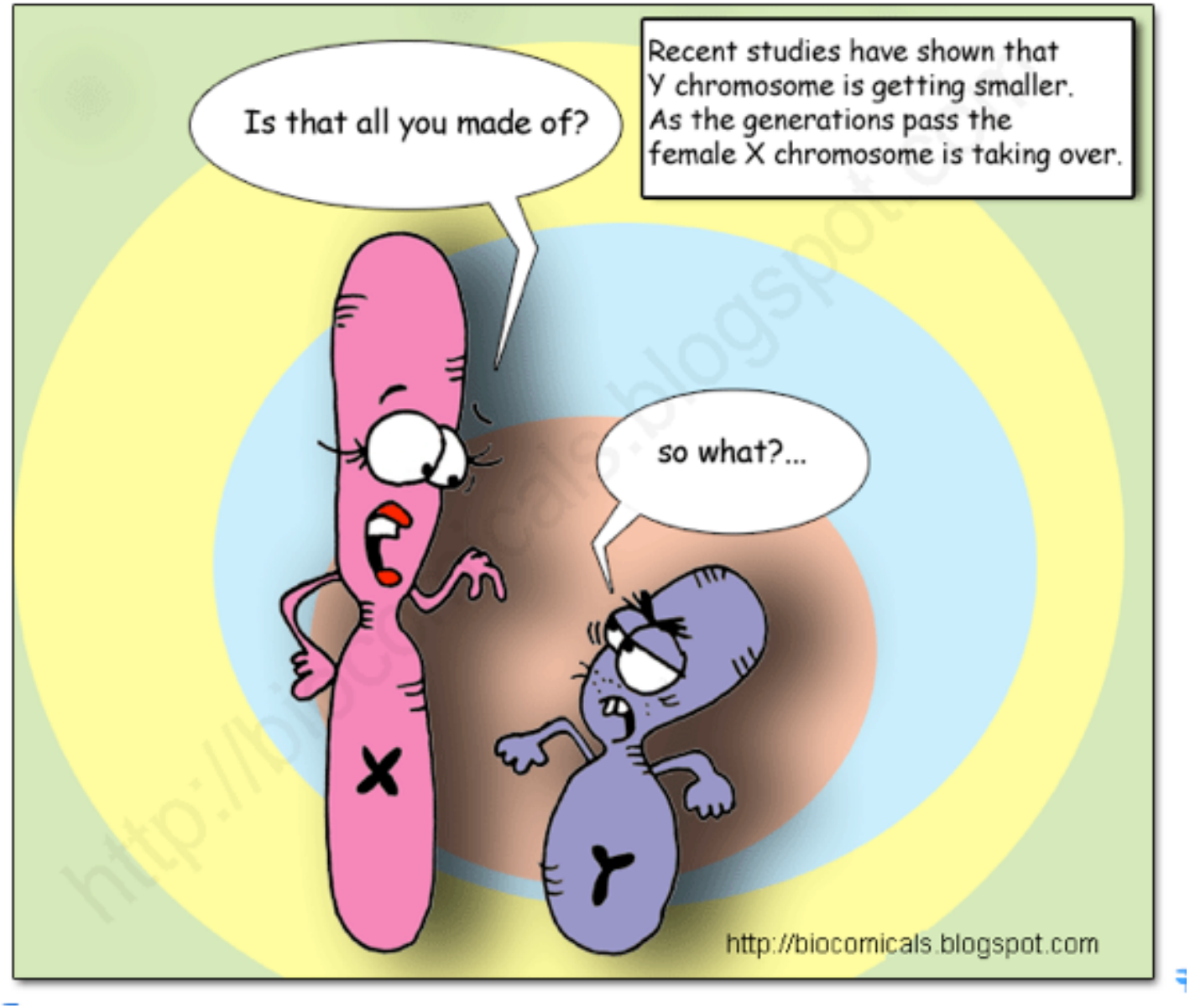
- Design an investigation that will test the characteristics of week's growth of a barley seed.
  - You will have access to barley seeds, cotton wool, petri dish
  - and cling film
  - You need to decide…
    - How much water
    - How many seeds
    - how much cotton wool

B = Brown eyes (Dominant)

b = Blue eyes (recessive)



Phenotype is either BROWN eyes or BLUE eyes



Only 80 genes (of the 25,000 total) are found in the human Y chromosome, of which 19 are for specific male traits, such as sperm production. The X chromosome has over 2000 genes.

Henry VIII (1491-1547)

Hermit’s Hermits (1960’s)

Sample Test Questions

1. Explain the difference between *genetics* and *inheritance*.
2. Explain the difference between *genotype* and a *phenotype*.
3. Explain the difference between *homozygous* and *heterozygous*.
4. Is the genotype Tt heterozygous or homozygous? Why?
5. Use the terms dominant and recessive to explain why a genotype of Bb would give brown eyes.

Punnett Square

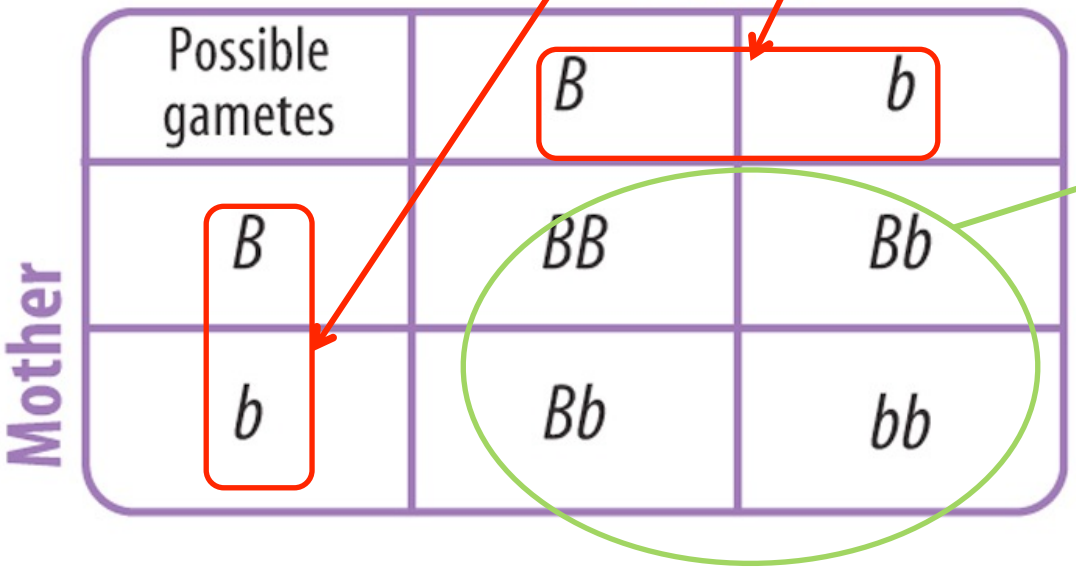
A Punnett square shows the chance of each possible genotype for the offspring (child) of two parents.

It was developed by Reginald Punnett during the early 20th century.

Punnett square for $Bb \times Bb$

B = allele for brown eyes

b = allele for blue eyes



Possible genotypes for offspring

Offspring probabilities

Genotype: $\frac{1}{4}$ *BB*: $\frac{1}{2}$ *Bb*: $\frac{1}{4}$ *bb*

Phenotype: $\frac{3}{4}$ brown eyes: $\frac{1}{4}$ blue eyes

Punnett square $Bb \times bb$

B = allele for brown eyes

b = allele for blue eyes

Possible gametes	B	b
b	Bb	bb
b	Bb	bb

Possible genotypes for offspring

Offspring probabilities

Genotype: $\frac{1}{2}$ Bb: $\frac{1}{2}$ bb

Phenotype: $\frac{1}{2}$ brown eyes: $\frac{1}{2}$ blue eyes

Questions

1. Why is the square used to for genetics called a 'Punnett' square
2. What does a Punnett square show?
3. Use the information below to answer the following questions:

Tt x Tt (T = Tall , t = short)

Ss x SS (S = straight, s = curly)

Dd x dd (D = dark, d = light)

a) Name the six phenotypes shown
b) Which genotypes could give a tall phenotype?
c) Which genotype would give a light phenotype?
d) How could get a curly phenotype?
e) Draw 3 Punnett square showing the crosses above.

Bell Work

Use the words to fill out the table.

Name	Example	Definition

Phenotype

Genotype

Allele

A or a

AA, Aa, aa

Black hair or Blonde hair

Genetic code for a characteristic shown by pair of letters

Single code from one parent shown one letter

Physical characteristic shown in you

- Lesson Objectives
  - Be able to identify genotypes, phenotypes and alleles
  - Be able to use a Punnett square

INQUIRY: INVESTIGATION 2.4

Genetics database

KEY INQUIRY SKILLS:

- planning and conducting
- processing and analysing data and information

- Copy and complete the table below. Enter data for 10 students in the table. You may need to refer to the pictures below to work out what each characteristic means.

Name of student				
Widow's peak?				
Can roll tongue?				
Right thumb over left when clasping hands?				
Cleft chin?				
Right handed?				
Ear lobes attached?				
Freckles?				
Gap between front teeth?				
Hair naturally straight?				
Colour blind?				


Do you have a widow's peak (left) or a straight hairline (right)?


Do you have a gap between your front teeth?

- Use the instructions provided in your eBookPLUS to create an **Access** database where you will enter the data you collected and run a query on the database.

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DISCUSS AND EXPLAIN

1. The database you created contains only a small amount of data so using a query to search for particular data did not save time (it probably took you more time to set up the query than it would have taken to look through the data manually!). Can you think of examples of databases that contain so much information that it would take days to search the data manually?
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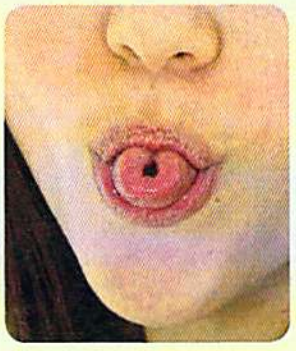

Can you roll your tongue?

If you cannot see the number 47 in the picture above, you could be colour blind.

Exit Pass

Fill out the table with the choices below

Name	Example	Definition
Phenotype		
Genotype		
Allele		

A or a

AA, Aa, aa

Black hair or Blonde hair

Genetic code for a characteristic shown by pair of letters

Single code from one parent shown one letter

Physical characteristic shown in you

Bell Work

Write **one sentence** for each of the following topic areas.

- **DNA location**
- **DNA structure**
- **Mitosis and Meiosis**
- **Dominant and recessive genes**
- **Genotype and phenotype**
- **Punnett squares**

Additional Questions

1. What is a Punnett Square used for?
2. Explain the difference between *genotype* and a *phenotype*.
3. Explain the difference between *homozygous* and *heterozygous*.
4. Is the genotype Tt heterozygous or homozygous? Why?
5. Use the terms dominant and recessive to explain why a genotype of Bb would result in brown eyes.

TEST WEDNESDAY

Genetics and Inheritance Test

Part I: Multiple Choice

1. DNA is found in
   a. Only hair
   b. Hair and saliva only
   c. Every cell
   d. Fingernails only

2. DNA stands for
   a. National Dyslexic Association
   b. Deoxyribonucleic acid
   c. Diribonucleus Amino's
   d. Destructive Nuclear Apples

3. DNA is in the shape of
   a. A double helix
   b. A ladder with spirally bits
   c. A double helion
   d. A triple helix

4. Adenine bonds with
   a. Cytosine
   b. Guanine
   c. Thymine
   d. All of the above

5. DNA is a molecule because...
   a. It's shape is the twisted ladder
   b. It is made from many atoms
   c. Atoms are the same as molecules
   d. Many molecules joined together make an atom

6. DNA's backbone contains
   a. Sugar and Caffeine
   b. Sugar and Phosphate
   c. Nucleic Acid
   d. Ribonucleic's

7. What is a phenotype?

8. During mitosis cells are split into ___ and have ___ DNA
   a. Two, the same
   b. Four, different
   c. Two, different
   d. Four, the same

9. How many chromosomes does the average human being have?
   a. 50
   b. 48
   c. 46
   d. 23

10. Which of the following could not be a genotype?
    a. Aa
    b. AA
    c. Ab
    d. aa

11. In sheep, white (W) is dominant over black (w). If two white sheep are crossed can they produce black offspring?
    a. Yes, if one parent is heterozygous
    b. No, one parent must be black
    c. Yes, if both parents are heterozygous
    d. Yes, if both parents are homozygous

12. How do we indicate that a trait is recessive?
    a. A capital letter
    b. Always the letter 'a'
    c. It is not possible to show
    d. A lower case letter

13. In pea plants, the gene for tall stems (*T*) is dominant over the gene for short stems (*t*). The phenotype for a pea with the gene combination *Tt* is...
    a. Tall Stems
    b. Short Stems
    c. Medium-sized Stems

Genetics and Inheritance Test

Part II: Short Answer

1. The gene for a long nose (*N*) is dominant over the gene for a short nose (*n*).

   a) What genotypes could a long-nosed person have? _____
   b) What genotypes could a short-nosed person have? _____
   c) If a long-nosed person with genotype *Nn* has a child with a person who has a short nose, what is the chance of the child having a long nose? Show your reasons using a ***Punnet square***.

[6 marks]

2. Draw a Punnett squares below for butterflies where B = blue wings and b = white wings, giving the percentage chance of each cross having blue wings.

   a) Bb x BB

   b) A heterozygous blue wing and white winged organism

% of blue wings = _____

% of blue wings = _____

[6 marks

3. Explain why recessive characteristics are more rare than dominant characteristics. Use Punnett squares in your explanation. _____

Part III: Extended Answer

How do you inherit traits from your ancestors?

Below Standard	***At Standard***	***Above Standard***
Your essay includes ***brief descriptions of only some*** of the sections below: • Location of DNA • Structure of DNA • Mitosis and meiosis • Dominant and recessive genes • Genotypes and phenotypes • Punnett squares	Your essay includes a ***description of all or most*** of the sections below: • Location of DNA • Structure of DNA • Mitosis and meiosis • Dominant and recessive genes • Genotypes and phenotypes • Punnett squares	Your essay includes ***detailed descriptions*** of the sections from *At Standard*. Your essay also ***flows fluently*** from one section to the next, answering the ***topic question***.

DNA Location	DNA Structure
What does DNA stand for? Where in your body is DNA found? Give details	What does it look like? Scientific name? Backbone and rungs?
Mitosis and Meiosis	**Dominant and Recessive Genes**
Why do our cells go through each process? What are some differences between these processes?	How does DNA make our traits? (proteins) What is a chromosome? What is a chromosome? How many chromosomes do we have? When do we see dominant and recessive traits?
Genotype and Phenotype	**Punnett Squares**
What is the difference between genotype and phenotype? Homozygous/Heterozygous	What information is in a Punnett square? Why do scientists use Punnett squares?

Homozygous genes	TT or tt
Heterozygous genes	Tt
Heritable characteristics	Caused by copies of two genes
Phenotype	Appearance of an organisms trait, e.g. short, tall, brown, blue.
Genotype	Combination of an organisms alleles represented by letters, e.g TT, Tt or tt.
Traits	Genes or characteristics
Punnett square	A tool used to help predict the offspring of a genetic cross
Alleles	Different forms of a gene

Recessive	Genetic variations that are hidden represented by lower case letter
Dominant	Variations that hide other variations, represented by a capital letter
Filial	Something that relates to a son or daughter
F1 or F2 generation	First or second generation of an offspring
Acquired trait	An ability that is learned rather that inherited
Incomplete dominance	Where alleles exist that are neither dominant or recessive over the other.