CHROMOSOMES & CELL DIVISION

Topic 4

Year 10 Biology
TOPIC 4 – CHROMOSOMES & CELL DIVISION

Things to cover:
1. Chromosomes
2. Karyotypes – inc. chromosomal disorders
3. Cell division – inc. mitosis, meiosis & fertilisation

Work to do:
1. Worksheet - Dividing To Multiply
2. Worksheet – Karyotyping Activity
3. Textbook Qs – Ex 2.1 p54 – Q1, 3, 5, 10
4. Textbook Qs – Ex2.4 p70 – Q5, 8, 11, 13, 14

Ideas to know:
- Gene
- Allele
- Chromosomes
- Chromatids
- Centromere
- Autosomes
- Sex chromosomes
- Karyotyping
- Chromosomal disorder
- Trisomy
- Monosomy
- Down syndrome
- Mitosis
- Meiosis
- Parent cell
- Daughter cell
- Gamete
- Haploid
- Diploid
- Fertilisation
- Zygote
• When the cell is preparing to divide, its DNA becomes tightly __________________ into ___________________.
• It needs to coil so that it fits into the nucleus!
• Human DNA is __________________ and is squeezed into the nucleus which is only ___________________.
• Multiply that by the 50-75 trillion cells in the body!!!

• __________________ can be found within the nucleus of every cell.
• The chromosomes are in 23 pairs. These pairs are called __________________ ___________________.

• Each chromosome is made of __________________ called ___________________.
• The two chromatids are held together at the ___________________.
• These chromosomes are only visible when a cell is ___________________ or in the ___________________ of dividing.
- Of the 23 pairs:
  - 23 chromosomes (1 set) come from dad’s ________________ cell
  - 23 chromosomes (1 set) come from mum’s ________________ cell

- Of the 23 pairs:
  - ________________ are ________________:
    - code for non-sexual ________________
  - ________________ are ________________:
    - code for both ________________ and ________________ characteristics
    - can be either a ________________ chromosome or a ________________ chromosome

- Females have ________________ chromosomes (_______)
- Males have ________________ chromosome (_______)
KARYOTYPING

- Chromosomes look different from each other:
  - eg. _____________________, _____________________ and _____________________
    _____________________ when _____________________
- They can be easily _____________________ out & paired up
- This process is called _____________________.
- Dividing cells are treated, stained, put on slides and photographed, cut up and
  _____________________ into _____________________.
- It is used by geneticists to investigate _____________________ _____________________.

- Disorders arise when there are _____________________ chromosomes or
  _____________________ chromosomes.

- For example:
  - **Down syndrome** = _____________________
    3 copies of chrom.21 (___________________)
  - **Turner's syndrome** = _____________________
    only one X (___________________)
  - **Klinefelter syndrome** = _____________________
    2Xs, 1Y (___________________)
  - **Cri-du-chat syndrome** = _____________________
    A _____________________ of an arm from chrom.5 (___________________)
KARYOTYPING
The body's cells need to **divide** in order to make the organism **grow**.

There are 2 types of cell division:
1. ________________
2. ________________

**Mitosis**:
- Mitosis is used for:
  - G ________________
  - A ________________
  - T ________________ and
  - E ________________
- **Remember: GATE**
- Forms ____ new cells
- Starts with a ________________ and **produces** ________________
- New daughter cells are ________________ to the original
- New cells have the ________________ as the parent cell
  ie. ________________ chromosomes = ____ chromosomes
- Most ________________ replicate this way
- **Remember – Mi**TOsis for **TOES**!

**Meiosis**:
- Forms _____ new cells
- Starts with a body cell and produces ________________
- Daughter cells are ________________ to the original
- New cells have ________________ the number of chromosomes as the parent cell
  (ie. ________________)
- Meiosis ________________ of the chromosomes at ________________
Meiosis:
- Human gametes only have **23 chromosomes**.
- Gametes are said to be ______________________ cells – containing half the chromosome number of the normal ______________________ body cells.
- This means that they have only **one** ______________________ from each ______________________ pair in the parent cell.

- The gametes produced are ______________________.

**Why is it important to produce genetically unique gametes?**
- It ensures ______________________ ______________________ within a species.
- It means that siblings may share some characteristics but will not be identical (unless they are ______________________!)

Fertilisation:
- Fertilisation is the stage of sexual reproduction when ______________________ ______________________. This is the first step in the creation of a new life.
- When an **egg cell** is fertilised by a **sperm cell**, it becomes a ______________________.
- This zygote divides by ______________________ many times and becomes an ______________________.
- The embryo continues to grow and develop into a ______________________.
1. Fit the following terms into a mini mind map:
   - DIPLOID
   - HAPLOID
   - FERTILISATION
   - MITOSIS
   - MEIOSIS
   - SOMATIC CELL
   - GAMETE
   - CELL DIVISION

2. Cancer is one of the most common diseases of developed countries.

   **Do some research** in order to answer the following questions:
   
   (a) Describe what happens to cells when they become cancerous. (2)
   
   (b) What genetic event causes this to happen to the cells? (1)
   
   (c) An agent that causes cancer is called a carcinogen. Give 3 examples of carcinogens. (3)
   
   (d) Explain the different between benign and malignant tumours. (2)
In this activity, you will use a computer model to look at chromosomes and prepare a karyotype. You will diagnose patients for abnormalities and learn the correct notation for characterizing karyotypes.

Site 1: www.biology.arizona.edu

Click on Karyotyping under Human Biology and read the Introduction page:

1. What causes a dark band on the chromosome?

2. What is a centromere?

Patient Histories: *Click on Patient Histories. You will be completing a karyotype for Patient A, B & C

**Patient A (Click on the link to "Complete Patient A's Karyotype")**

*Match the chromosome to its homolog. After all the matches are complete you'll analyse your patient. (Scroll down to view your completed karyotype).

3. What is patient A's history (summarize)

4. How many total chromosomes are in your karyotype - count them

   The last set of chromosomes is the sex chromosomes, if you have two large chromosomes, your patient is XX (female), one large and one small indicates and XY (male). What sex chromosomes does your patient have

   Which chromosome set has an extra +

5. What diagnosis would you give this patient (what disease)?

**Patient B - click on the link to go to Patient B and repeat the above process.**

6. What is Patient B’s history (summarize)

7. How many total chromosomes are in your karyotype - count them

   What sex chromosomes does your patient have

   Which chromosome set has an extra +

8. Finish the notation for this patient's karyotype: 47 X

9. What is the diagnosis?
10. What is patient C's history (summarize)? ________________________________

11. How many total chromosomes are in your karyotype - count them ________
   - What sex chromosomes does your patient have ________
   - Which chromosome set has an extra + _______

12. Write out the correct notation for this karyotype. ________

13. What is the diagnosis? ____________________________________________

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Site 2: Genetic Science Learning Center (http://learn.genetics.utah.edu/)

Go to "Chromosomes and Inheritance" --> "How Do Scientists Read Chromosomes"
(Find the answers to the following questions in this area. Browse all sections)

1. What are the three key features used to read chromosomes?
   ______________________________
   ______________________________
   ______________________________

2. Sketch or describe: metacentric, submetacentric, acrocentric

3. Got to “Make a Karyotype” - Try it yourself - Create your own karyotype - turning on hints is okay.
   - Check this box when your karyotype is complete
   - What did you find difficult about matching the chromosomes? ________________________________

4. Go to – “Using Karyotypes to Predict Genetic Disorders”
   - What is trisomy? ____________________________________________
   - What is monosomy? __________________________________________
   - What is a terminal deletion? _____________________________________
5. On the same page, click on the links to find the chromosome abnormality and the symptoms for each of the following disorders. *(If you get stuck, you can always use Google)*

Cri Du Chat

Turner Syndrome

Klinefelter Syndrome

Williams Syndrome