

INHERITANCE:

MEIOSIS AND THE GENERATION OF GENETIC DIVERSITY.

- This card game is a good way to illustrate the concept of **inheritance**.

- The children will learn what is **genetic diversity** (i.e. why do we all look different to each other) and how it is generated.

- The activity has been tested successfully in the classroom (and in Science Festivals) for children from P3.

What we are going to learn:

- **Why do we look a bit like our mum and dad?**

Concepts of **inheritance** and **genes**:

- Our **genes** determine how we look like.
- We get half our genes from mum and half from dad.

- **Why do we look a bit different from our parents/brothers/sisters?**

- We each get a different combination of genes from our parents:
- **Genes get shuffled (like cards in a deck) so brothers/sisters get slightly different combinations of genes. THAT MAKES EVERY ONE OF US UNIQUE.**

- THE WORKSHOP: MAKE YOUR OWN FRUIT FLY.

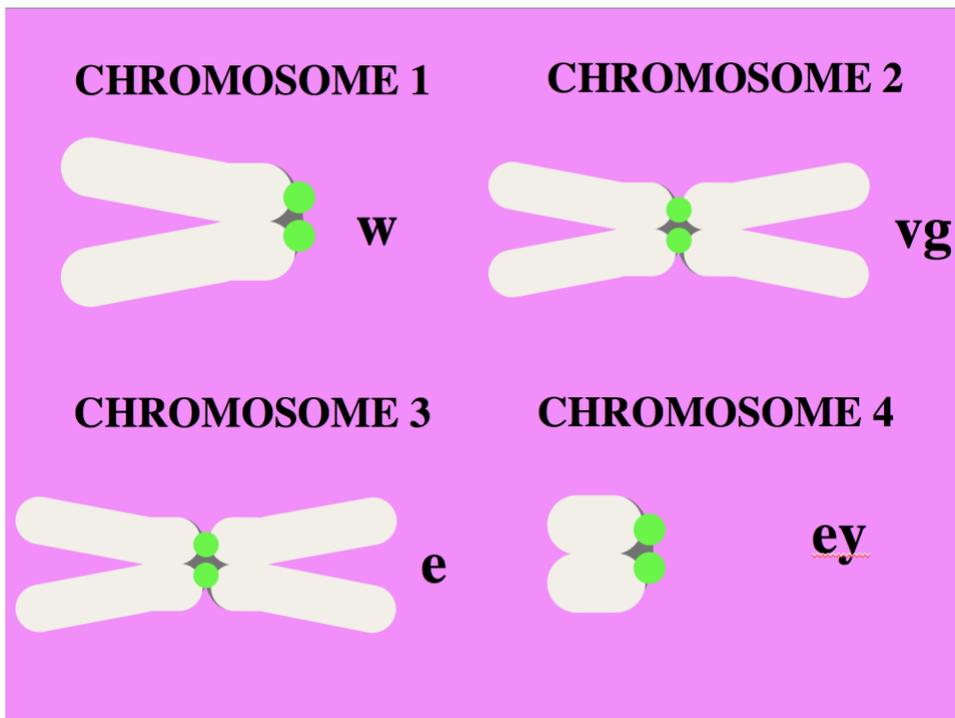
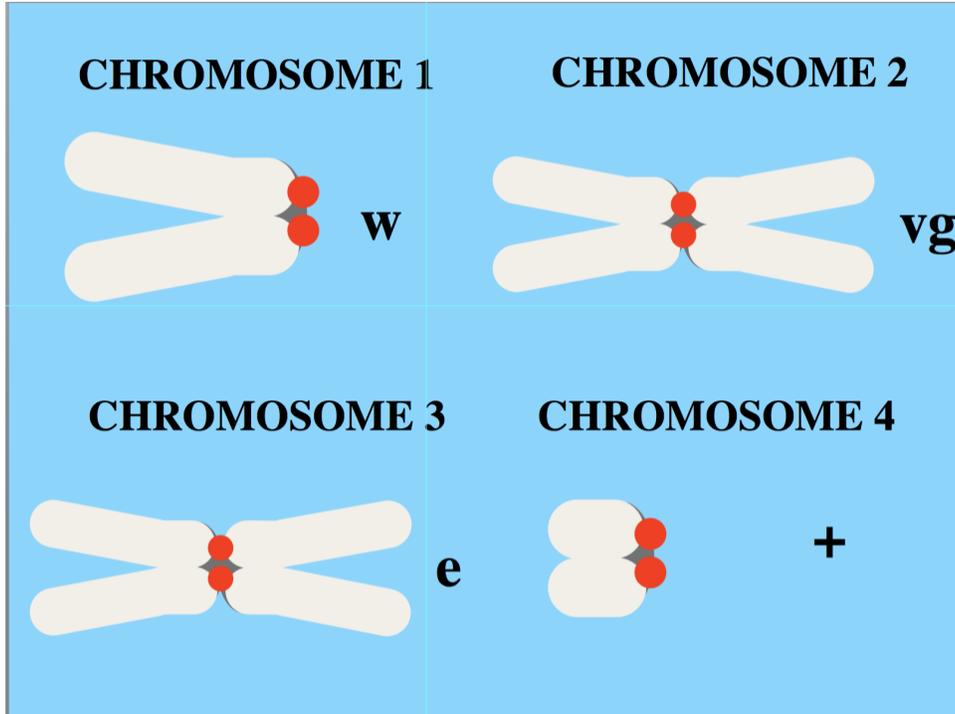
MATERIALS (per child or group):

- Laminated “chromosome” cards (template provided).
- “How will your fly look?” sheets (template provided).
- Results table sheet (template provided).
- Materials to build the fruit flies:
 - Play dough (Recipe for homemade play dough provided) – yellow and dark brown/black colour.
 - Red/white buttons of different sizes to make the eyes of the flies.
 - Pipe cleaners/ plastic curtain hooks to make the wings of the flies.
 - Coloured matchsticks for the legs of the flies.

“Make your own fruit fly” is game for the classroom based on the Genetics of **fruit flies** (*Drosophila melanogaster*), a widely used model organism in biomedical research.

Genes are contained in **chromosomes** inside the cell. Fruit flies have only four pairs of **chromosomes** (as opposed to 23 pairs in humans). So it is a much simpler system to use to explain inheritance.

Each card represents a **chromosome** (paternal chromosomes printed in blue card, maternal chromosomes in pink card).



Chromosomes contain the **genes** that will determine how the fly will look like (**phenotype**). Each card (**chromosome**) carries either a “normal”-or “most common”-copy (noted by **+**) or a mutant copy of a gene (noted by the gene name abbreviation).

EXAMPLE:

Most fruit flies have red eyes (+) but some mutants have white eyes:



Mutant

Most fruit flies have yellow bodies (+) but some mutants have dark bodies



Mutant

1 – Each child (or team) will receive four pink “chromosome cards” (X, 2, 3 and 4) from the **mother** fly and four blue cards from **dad** fly.

2 – They will arrange the chromosomes in pairs (X-X, 2-2, 3-3, 4-4).

3.- They will “decipher the genetic code” according to the table provided by the teacher.

Combinations (table provided):

| | FATHER | MOTHER | | YOUR FLY |
|--------------|----------|----------|---|--|
| CHROMOSOME 1 | + | + | = |  Red Eyes |
| CHROMOSOME 1 | + | <u>W</u> | = |  Red Eyes |
| CHROMOSOME 1 | <u>W</u> | + | = |  Red Eyes |
| CHROMOSOME 1 | <u>W</u> | <u>W</u> | = |  white eyes |

| | FATHER | MOTHER | | YOUR FLY |
|--------------|-----------|-----------|---|---|
| CHROMOSOME 2 | + | + | = |  Normal wing |
| CHROMOSOME 2 | + | <u>vg</u> | = |  Normal wing |
| CHROMOSOME 2 | <u>vg</u> | + | = |  Normal wing |
| CHROMOSOME 2 | <u>vg</u> | <u>vg</u> | = |  Short wings |

| | FATHER | MOTHER | | YOUR FLY |
|--------------|----------|----------|---|---|
| CHROMOSOME 3 | + | + | = |  Normal body colour |
| CHROMOSOME 3 | + | <u>e</u> | = |  Normal body colour |
| CHROMOSOME 3 | <u>e</u> | + | = |  Normal body colour |
| CHROMOSOME 3 | <u>e</u> | <u>e</u> | = |  ebony body colour |

| | FATHER | MOTHER | | YOUR FLY |
|--------------|-----------|-----------|---|--|
| CHROMOSOME 4 | + | + | = |  Normal sized eyes |
| CHROMOSOME 4 | + | <u>ey</u> | = |  Normal sized eyes |
| CHROMOSOME 4 | <u>ey</u> | + | = |  Normal sized eyes |
| CHROMOSOME 4 | <u>ey</u> | <u>ey</u> | = |  small eyes |

4.- The children will write down on their results table **how their fly will look like:**

How will your fly look like?:

| | FATHER | MOTHER | | YOUR FLY |
|--------------|--------|--------|---|----------|
| CHROMOSOME 1 | | | = | |
| CHROMOSOME 2 | | | = | |
| CHROMOSOME 3 | | | = | |
| CHROMOSOME 4 | | | = | |

And build their fly accordingly:



5.- All the flies can then be displayed together. There will be lots of different-looking flies, coming from the same mum and dad. **Discuss: Generation of genetic diversity.**

6.- For older children, the teacher can introduce the concepts of **natural selection and evolution.**

Example: **vg** (vestigial mutant, small wings) flies have shorter wings, they are much worse at flying/moving and they will be easier prey for birds. Flies with normal wings will have a better opportunity to survive and have baby flies (so their genes will be selected and will be more abundant in the next generations).



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BENCHMARKS: Suggested links

EARLY LEVEL:

Inquiry and investigative skills

- Explores and observes through play.
- Asks questions arising from play activities.
- Makes simple predictions of what might happen.
- Makes suggestions about what to do to answer the selected question.

FIRST LEVEL:

Curriculum Organisers:

Inheritance

Experiences and Outcomes for planning learning, teaching and assessment:

By comparing generations of families of humans, plants and animals, I can begin to understand how characteristics are inherited.

Benchmarks to support practitioners' professional judgement:

- Uses their own experiences to illustrate how inherited characteristics are passed from one generation to the next.
- Knows that genetic information determines characteristics such as colour of eyes and shape of petals.
- Demonstrates understanding of the variations within family groups.

SECOND LEVEL

Curriculum Organisers: Inheritance

Experiences and Outcomes for planning learning, teaching and assessment:

- By exploring the characteristics offspring inherit when living things reproduce, I can distinguish between inherited and non-inherited characteristics.

Benchmarks to support practitioners' professional judgement:

- Knows that genetics is the study of inherited characteristics and that inherited characteristics are carried on genes and can sometime skip a generation.
- Explores and categorises characteristics into inherited (eye and hair colour, height and right/left handedness) and non-inherited (native language spoken and favourite colour).
- Describes how every living thing has its own DNA fingerprint.