Chromosome Theory of Inheritance

A brief history of modern genetics

Before 1860

- Development of microscopy
- Elucidation of cell theory
- Publication of “The origin of species” by Charles Darwin in 1859

Before 1860

~1600 Janssen & Janssen, father & son lay claim to the invention of the compound microscope

Soon after cellular structure of plants and animals were recognized

Significant improvements in glass quality & lens manufacturing lead to

Recognition of separate organelles within cells

Before 1860

Cell theory: Cells and their nuclei were the basic units of structure and function in living organisms

Lineage theory: Cells are derived from pre-existing cells (i.e. all cells trace back to one original cell)

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1860 - 1940

- Publication of Mendel’s work in 1866
- Discovery of chromosomes and their behavior and rediscovery of Mendel’s work in 1900

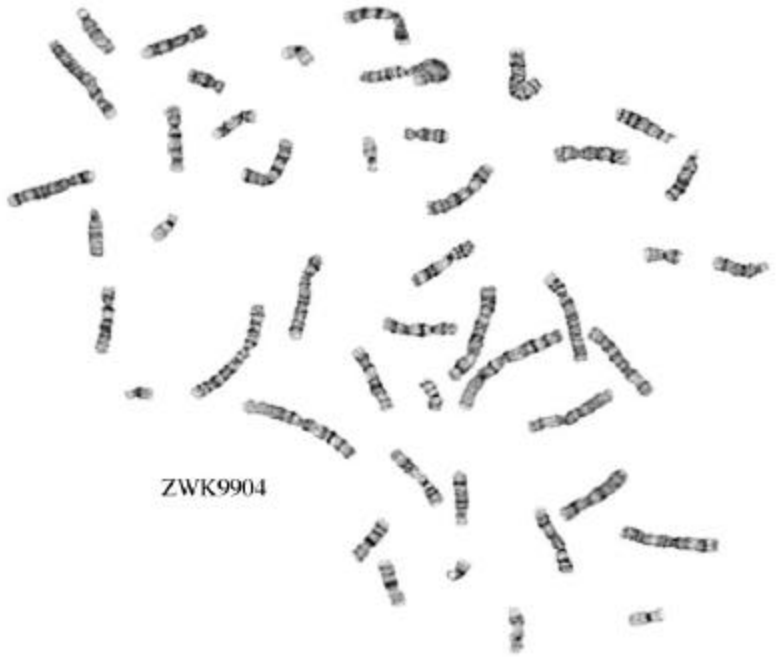
1860 - 1940

Mendel's Laws of Genetics

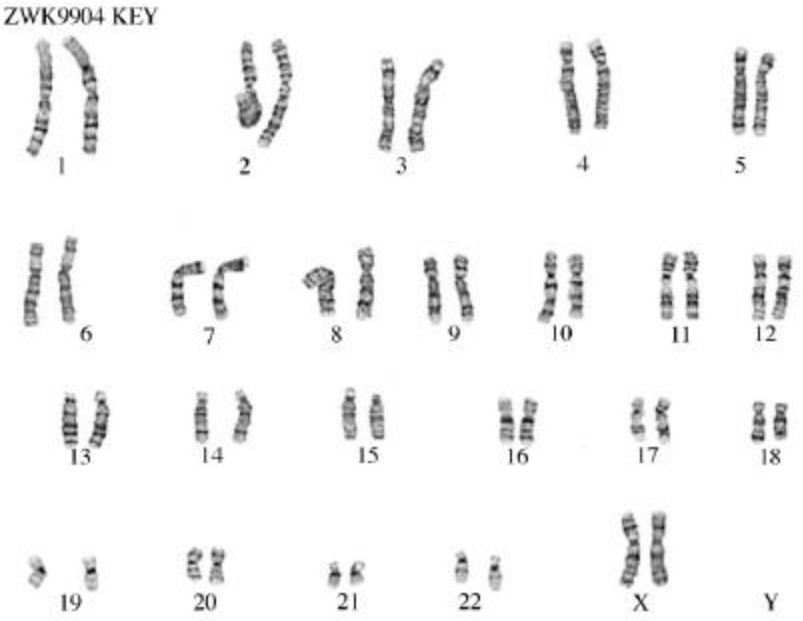
1. Alleles are different forms of the same gene that segregate during gamete formation (Law of Segregation)

2. Alleles of different genes segregate independently (Law of independent assortment)

Human chromosomes

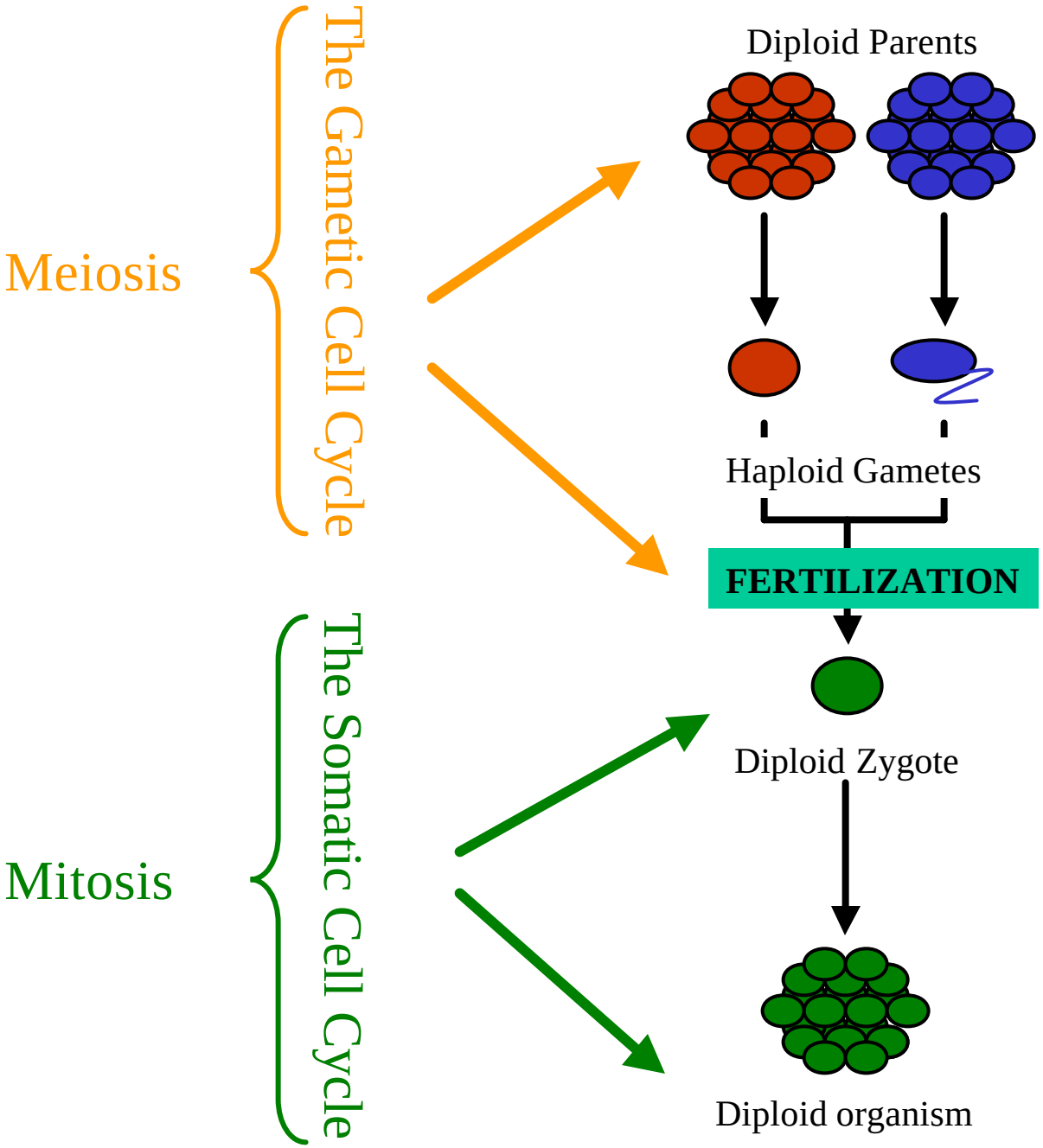


Actual cell



Karyotype

http://worms.zoology.wisc.edu/zooweb/Phelps/karyotype.html

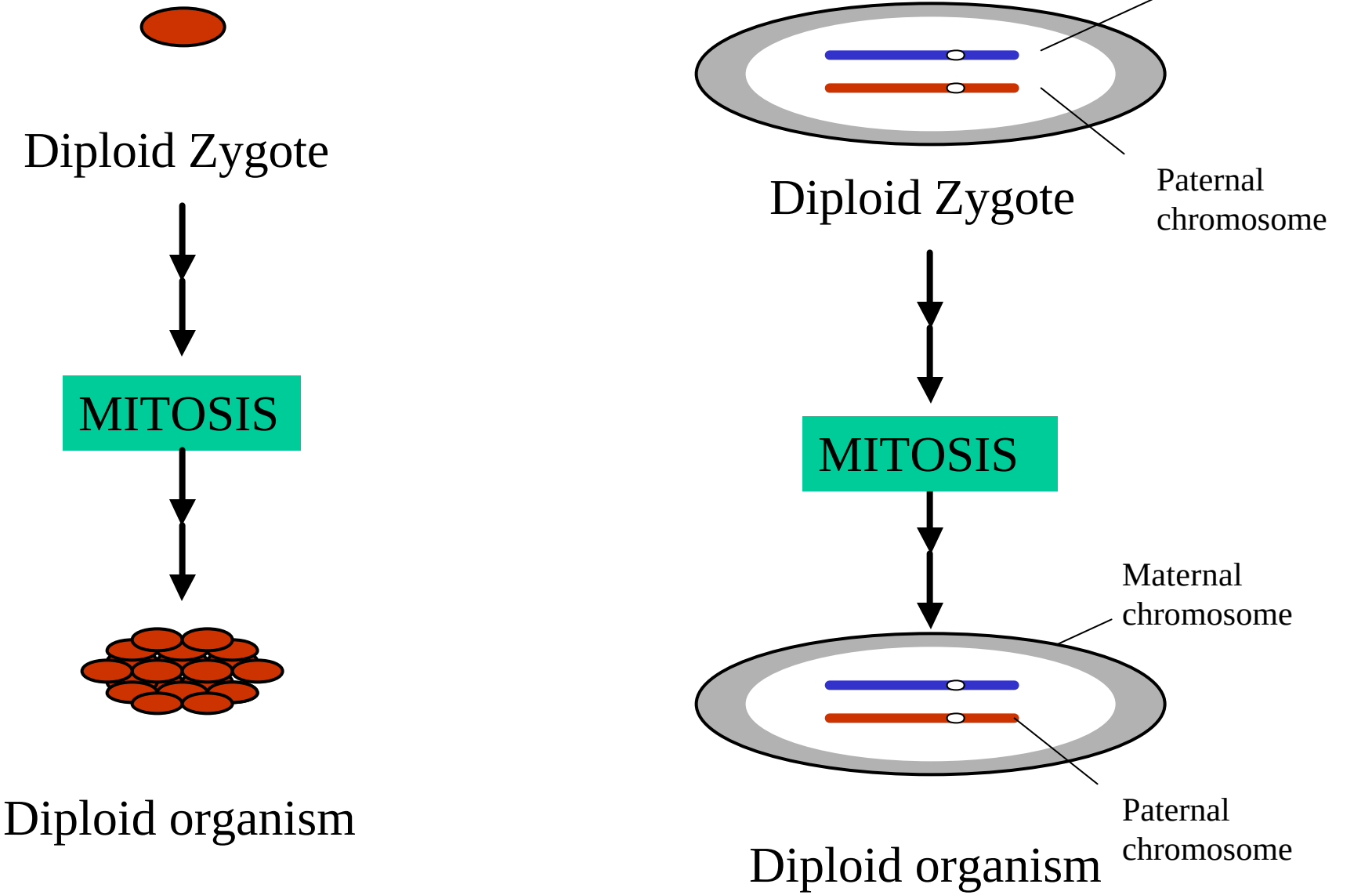

Meiosis
The Gametic Cell Cycle
Diploid Parents
Haploid Gametes
FERTILIZATION
Diploid Zygote
Mitosis
The Somatic Cell Cycle
Diploid organism

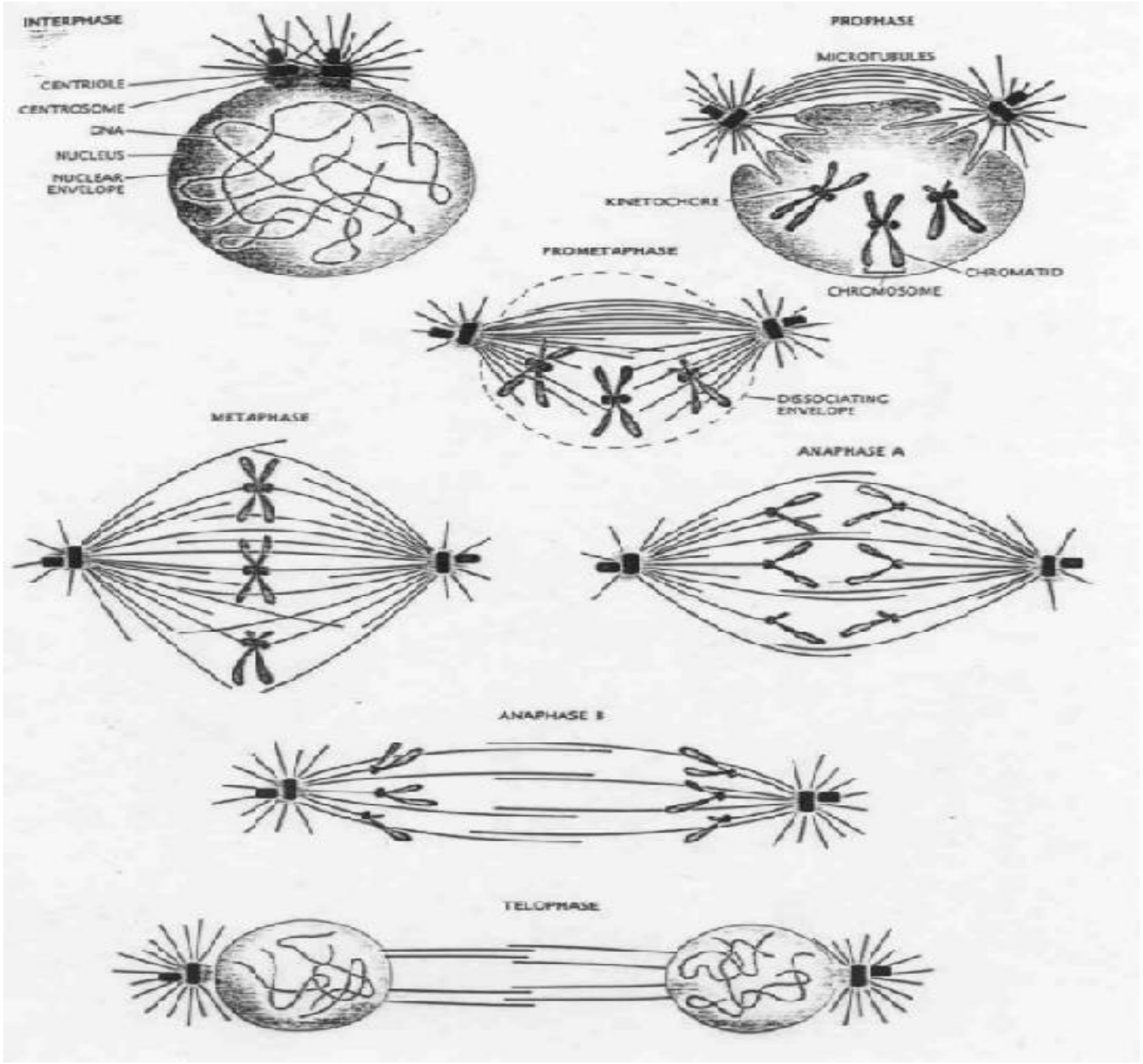
1860 - 1940

Chromosome theory of heredity

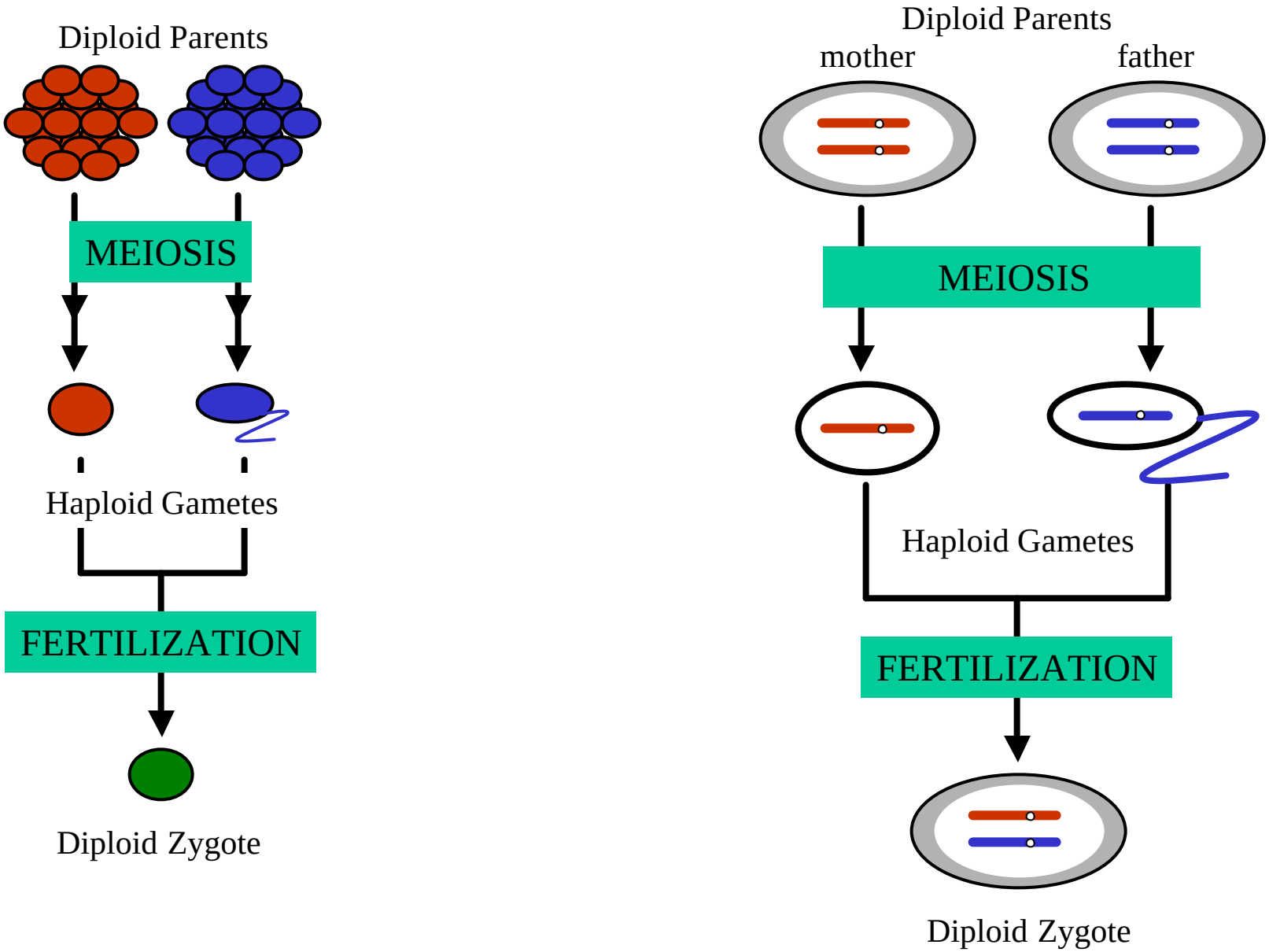
Heredity characters are carried & passed on to generations in discrete units (Correlation between Mendelian inheritance and chromosome behavior)

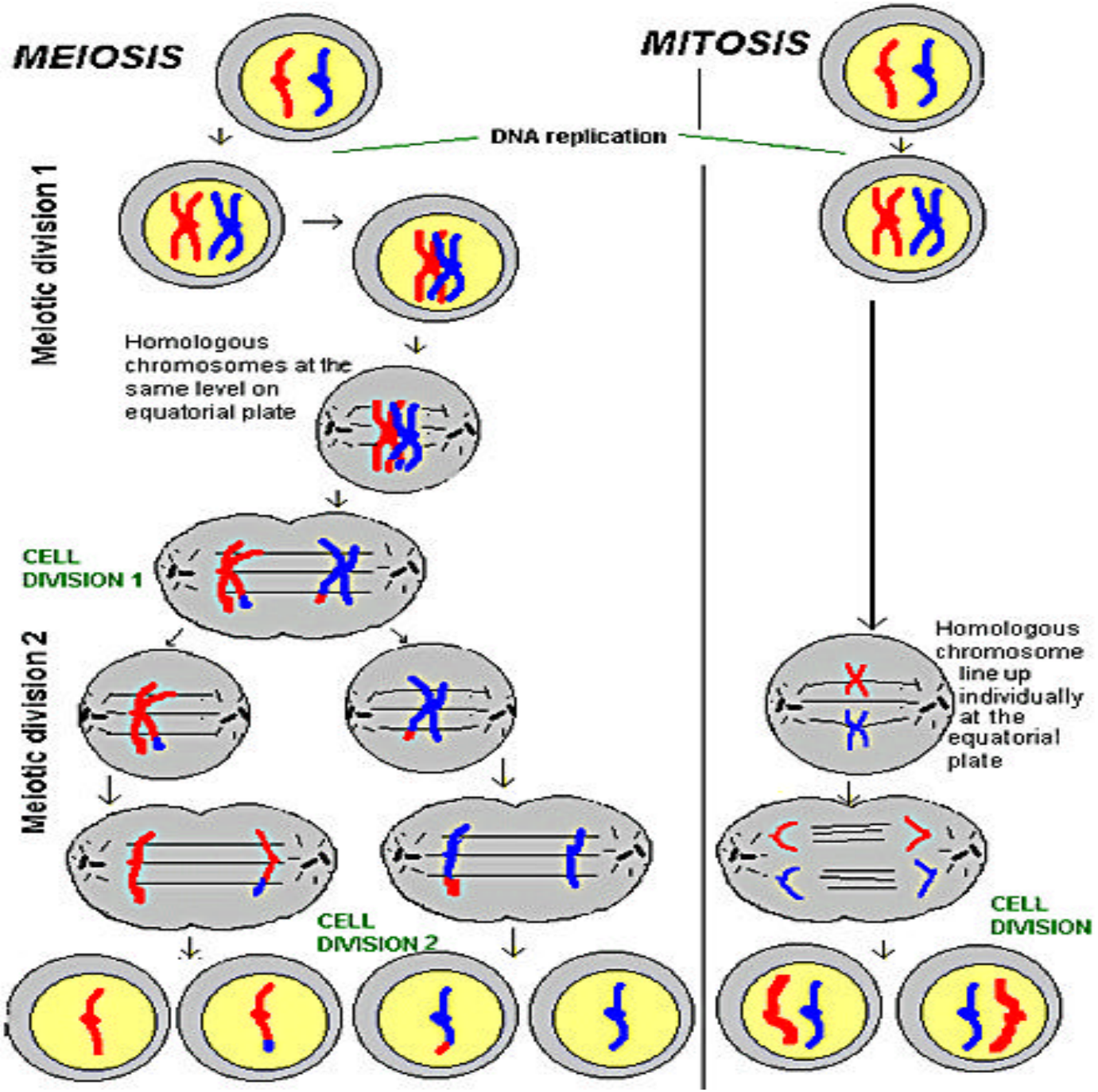
The Somatic Cell Cycle




INTERPHASE
CENTRIOLE
CENTROSOME
DNA
NUCLEUS
NUCLEAR ENVELOPE
PROPHASE
MICROTUBULES
KINETOCHORE
CHROMATID
CHROMOSOME
PROMETAPHASE
DISSOCIATING ENVELOPE
METAPHASE
ANAPHASE A
ANAPHASE B
TELOPHASE

The Gametic Cell Cycle




MEIOSIS
MITOSIS
DNA replication
Meiotic division 1
Homologous chromosomes at the same level on equatorial plate
CELL DIVISION 1
Meiotic division 2
Homologous chromosome line up individually at the equatorial plate
CELL DIVISION 2
CELL DIVISION

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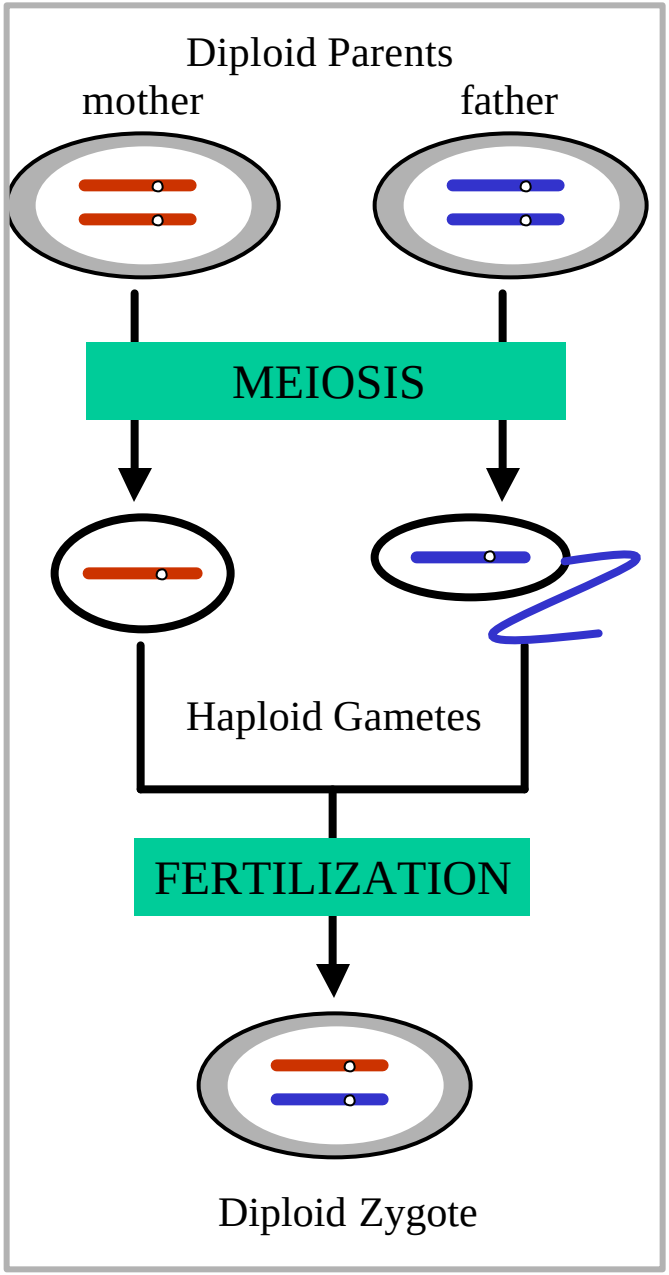

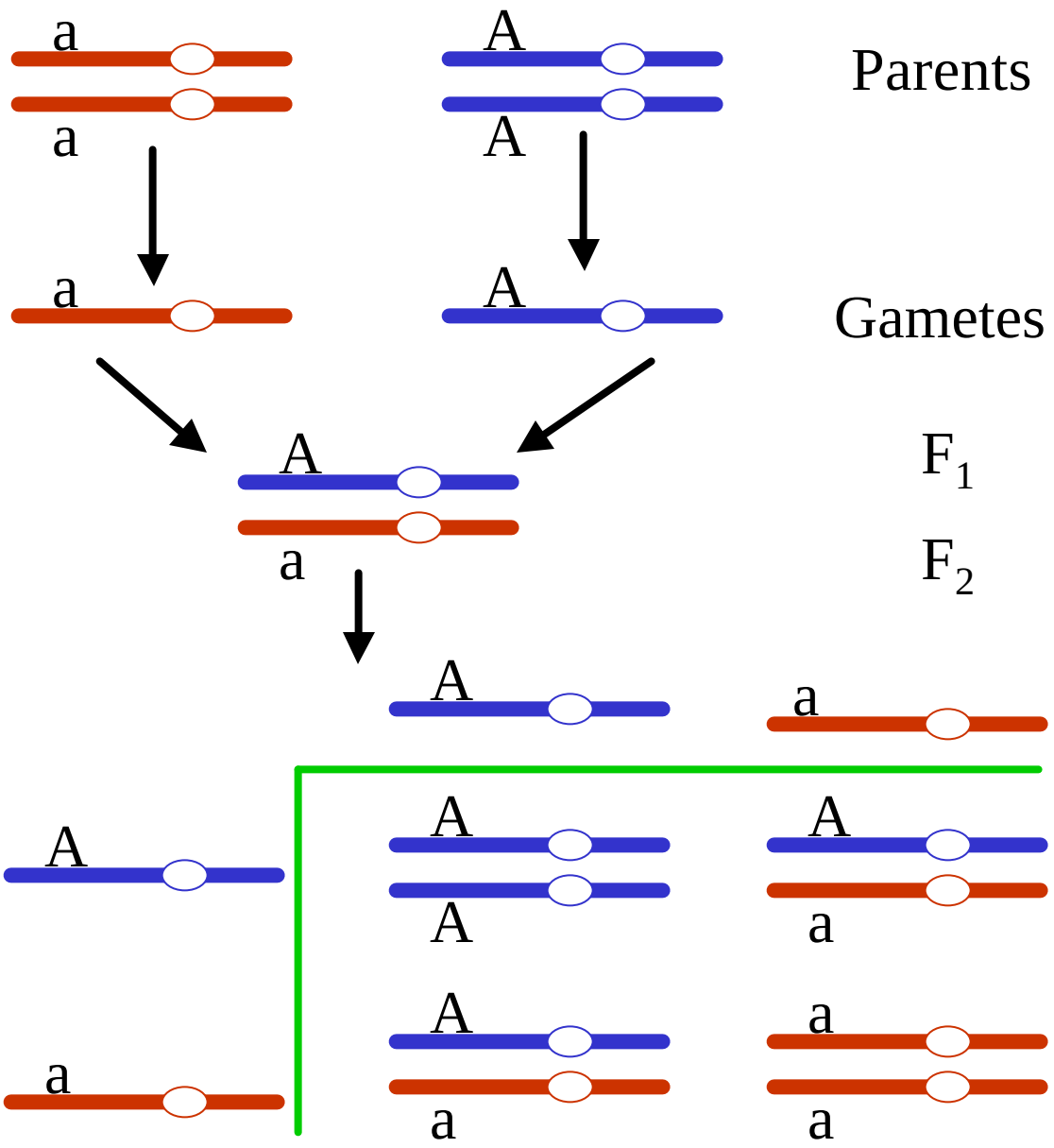

Glossary of terms

Mitosis = The cell division producing two daughter cells identical to the original cell.

Meiosis = A process in diploid eukaryotes that results in gametes or spores with only one member of each original homologous pair of chromosomes per nucleus.

Homologous chromosomes = Members of a pair of essentially identical chromosomes each coming from the parents that synapse during meiosis.

Centromere = Constrictions in eukaryotic chromosomes on which the kinetochore (site of spindle fiber attachement) lies.

Diploid = The state of having each chromosome in two copies per cell.

Haploid = The state of having one copy of each chromosome per cell.