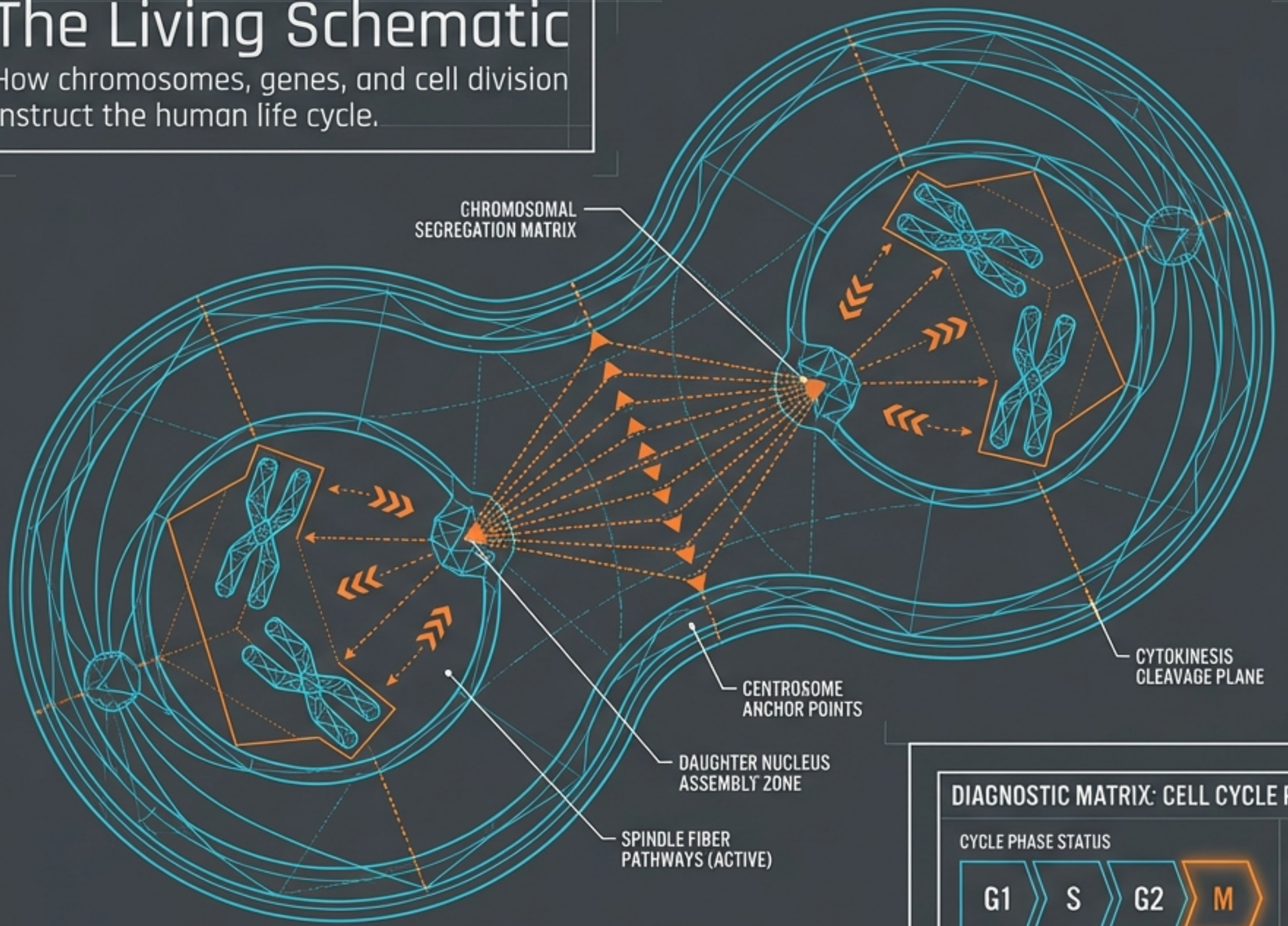
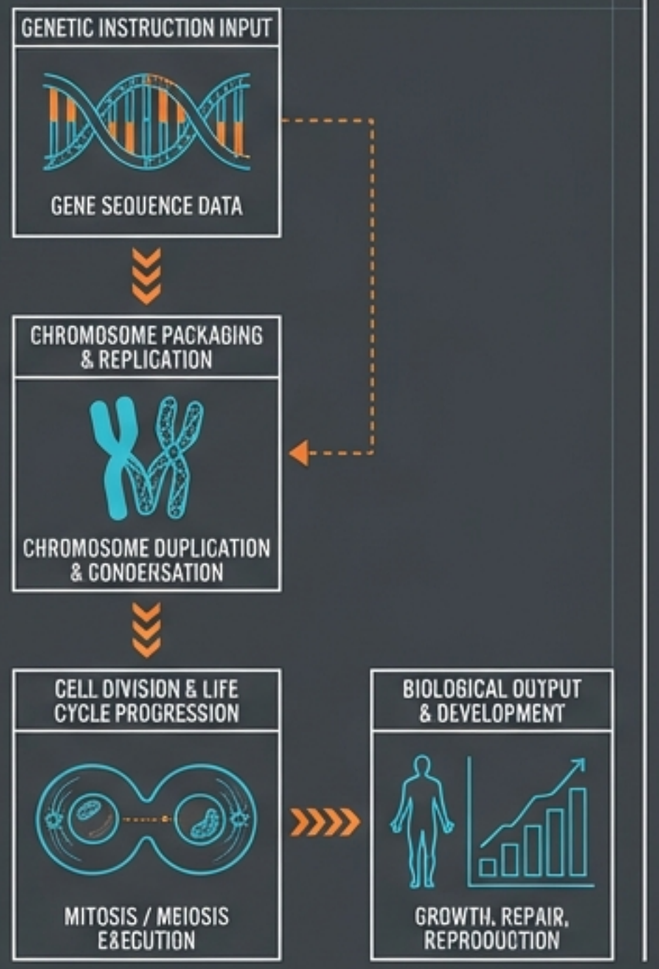
# The Living Schematic

How chromosomes, genes, and cell division instruct the human life cycle.




## DIAGNOSTIC MATRIX: CELL CYCLE REGULATION

**CYCLE PHASE STATUS**

G1 → S → G2 → M

ACTIVE PHASE: M-PHASE (DIVISION)

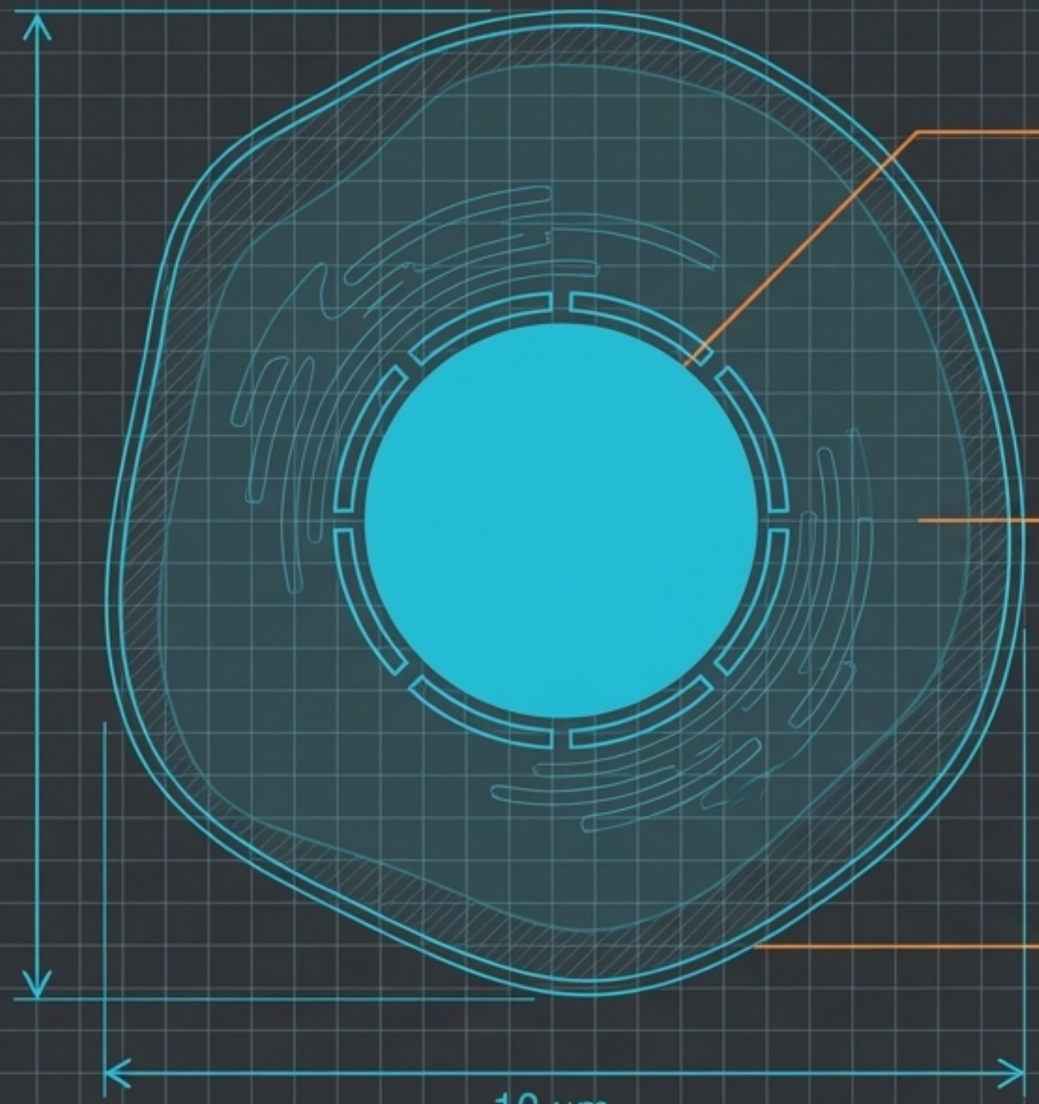
**CHECKPOINT INTEGRITY MONITOR**

- G1/S CHECKPOINT — PASSED
- G2/M CHECKPOINT — PASSED
- M CHECKPOINT — PASSED

**GENETIC STABILITY INDEX**

STABLE: 98.8% INTEGRITY

MUTATION RISK: LOW




## THE BLUEPRINT ARCHIVE

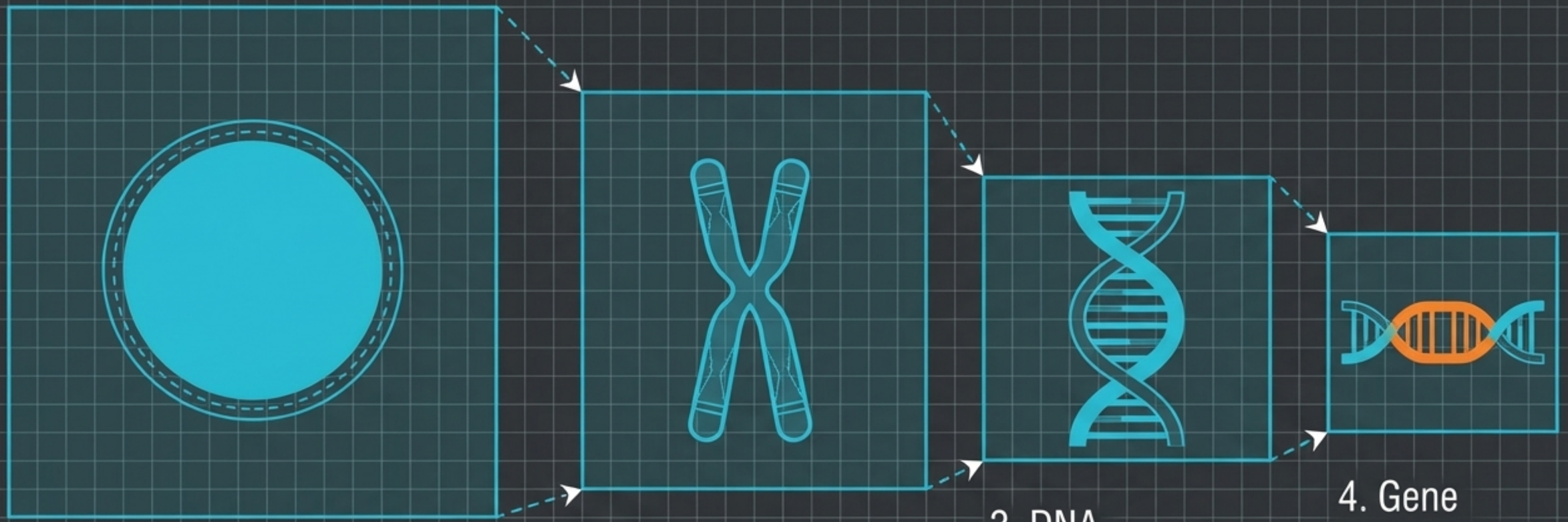
The nucleus is the largest organelle. It controls the activities of the cell by determining which proteins the cell can make.

## THE FACTORY FLOOR

The cytoplasm is the living material that makes up the cell, possessing a texture between a solid and a liquid. This is where complex structures assemble the nucleus's instructions.

## THE PERIMETER

The cell membrane forms a boundary. It is partially permeable, actively controlling the movement of substances in and out of the cell system.



## 1. Nucleus

The central archive of the cell.

## 2. Chromosomes

Thread-like structures carrying genetic material. Human cells contain exactly 46.

## 3. DNA

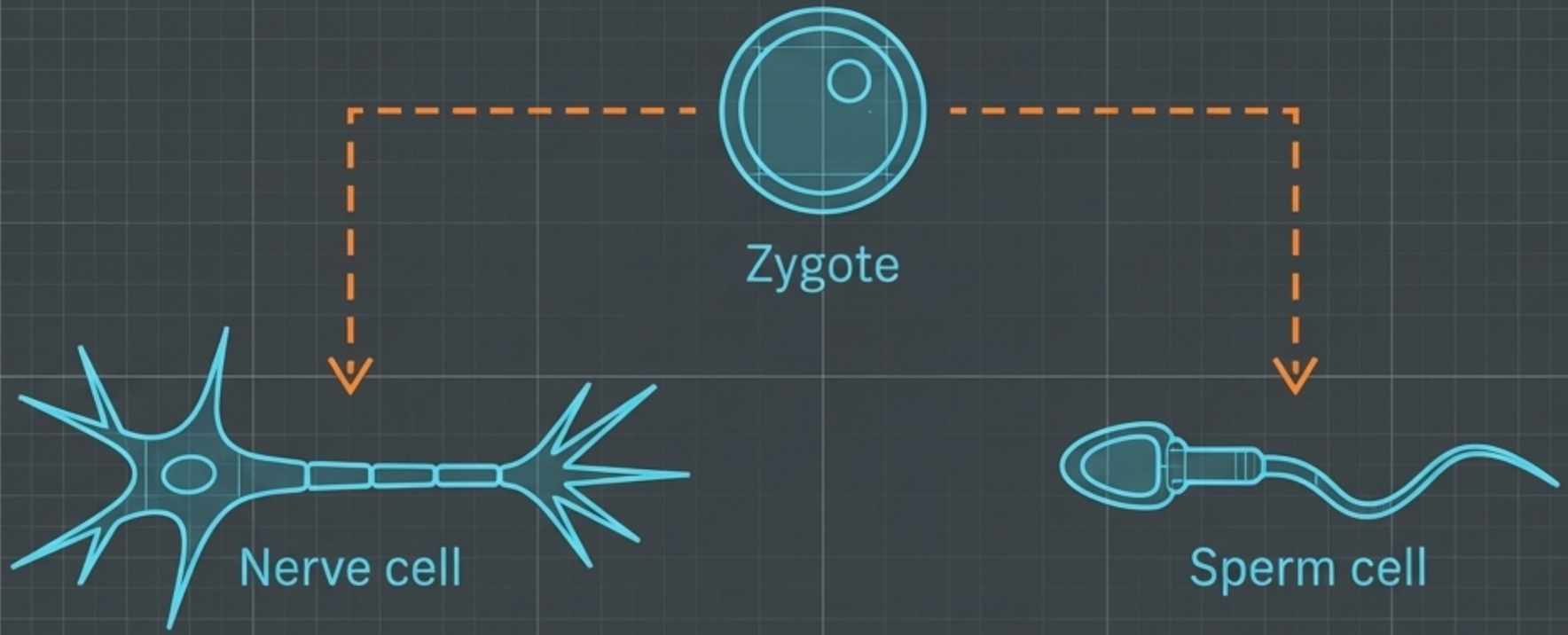
The continuous molecule that makes up the chromosome.

## 4. Gene

A specific section of DNA that acts as a discrete instruction.

A gene is a section of DNA that determines a particular characteristic by dictating protein production.

# One blueprint, infinite variations.




## The Rule of Identical Code

Through cell division, all cells of the body inherit the exact same genes.

## Differentiation

If the code is identical, how do cells function differently? Specific genes are ‘switched off’ to produce different cells. The active genes dictate a cell’s specialized form and function.

## Step 1: Archive

Location: Nucleus

The DNA blueprint remains safely inside the nucleus. It never leaves.

## Step 2: Transit

Instructions for making proteins are copied and carried out of the nucleus and into the cytoplasm.

## Step 3: Assembly

Location: Cytoplasm

Tiny structures called ribosomes read the instructions and assemble the physical proteins.

**Key Insight:** Genes do not do the work themselves; they provide the schematic for the proteins that build and operate the cell.

# GENES › PROTEINS (ENZYMES) › CATALYSE REACTIONS

Lock and Key Model

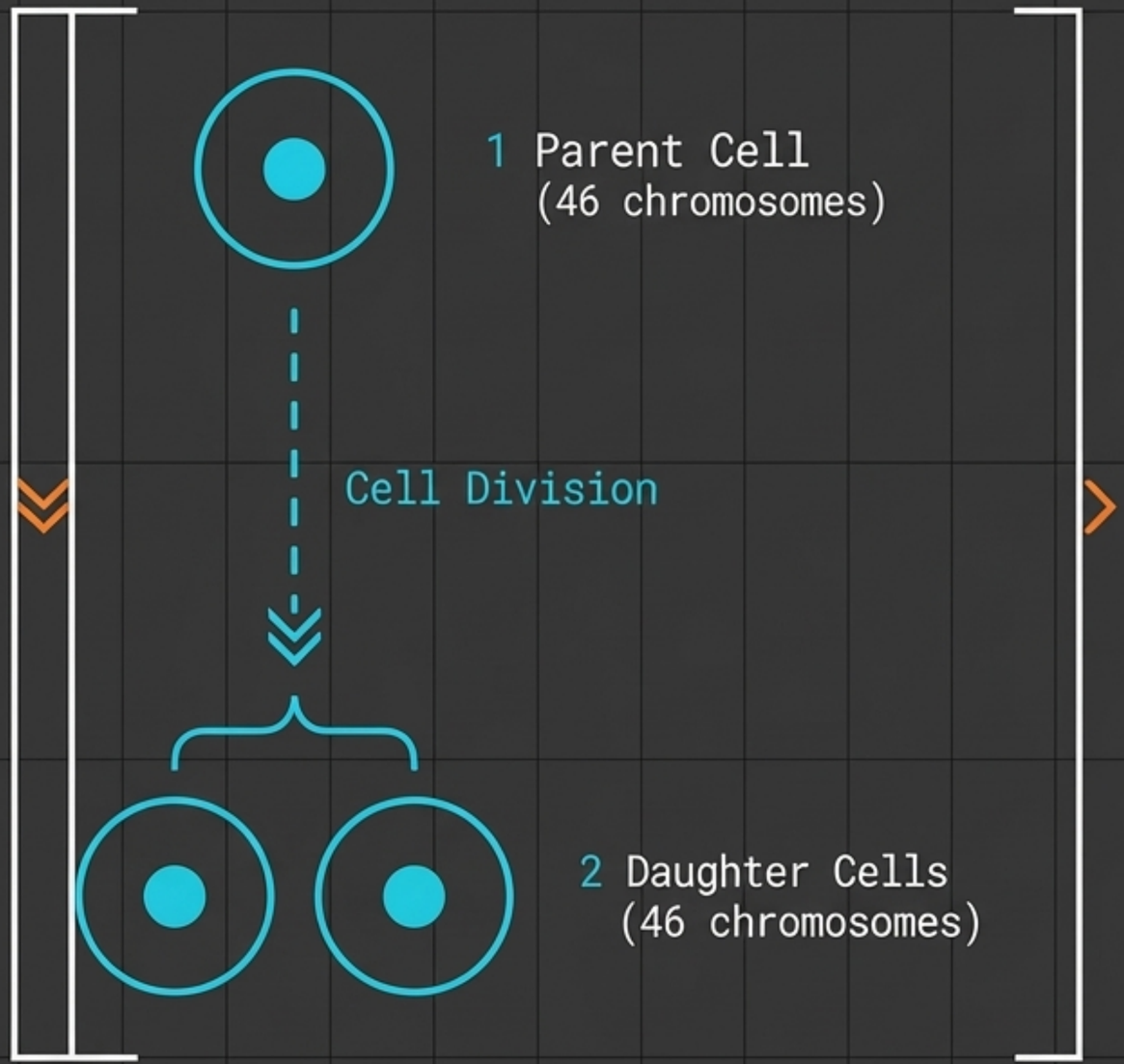

## BIOLOGICAL CATALYSTS

Enzymes are proteins that speed up reactions without being used up.

## METABOLISM CONTROL

Every chemical reaction in a cell is controlled by specific enzymes. Which enzymes a cell can make depends entirely on which genes in its nucleus are currently working.

# Mitosis: Scaling the system through exact replication.




| | |
|---|---|
| Input | 1 Diploid Cell (46 chromosomes). |
| Process | The cell divides, ensuring genetic information is shared equally. |
| Output | 2 “Daughter” Cells. |
| Outcome | Exact genetic copies. Used for growth, replacing dead cells, and repairing tissues. |

# The Generational Math Problem

46 (Sperm) + 46 (Egg) = ~~92 (Zygote)~~ → SYSTEM FAILURE

If sexual reproduction relied on standard cell division, the number of chromosomes would double every generation. To maintain the human constant of 46 chromosomes, the system requires a specialized division process to split the blueprint in half.

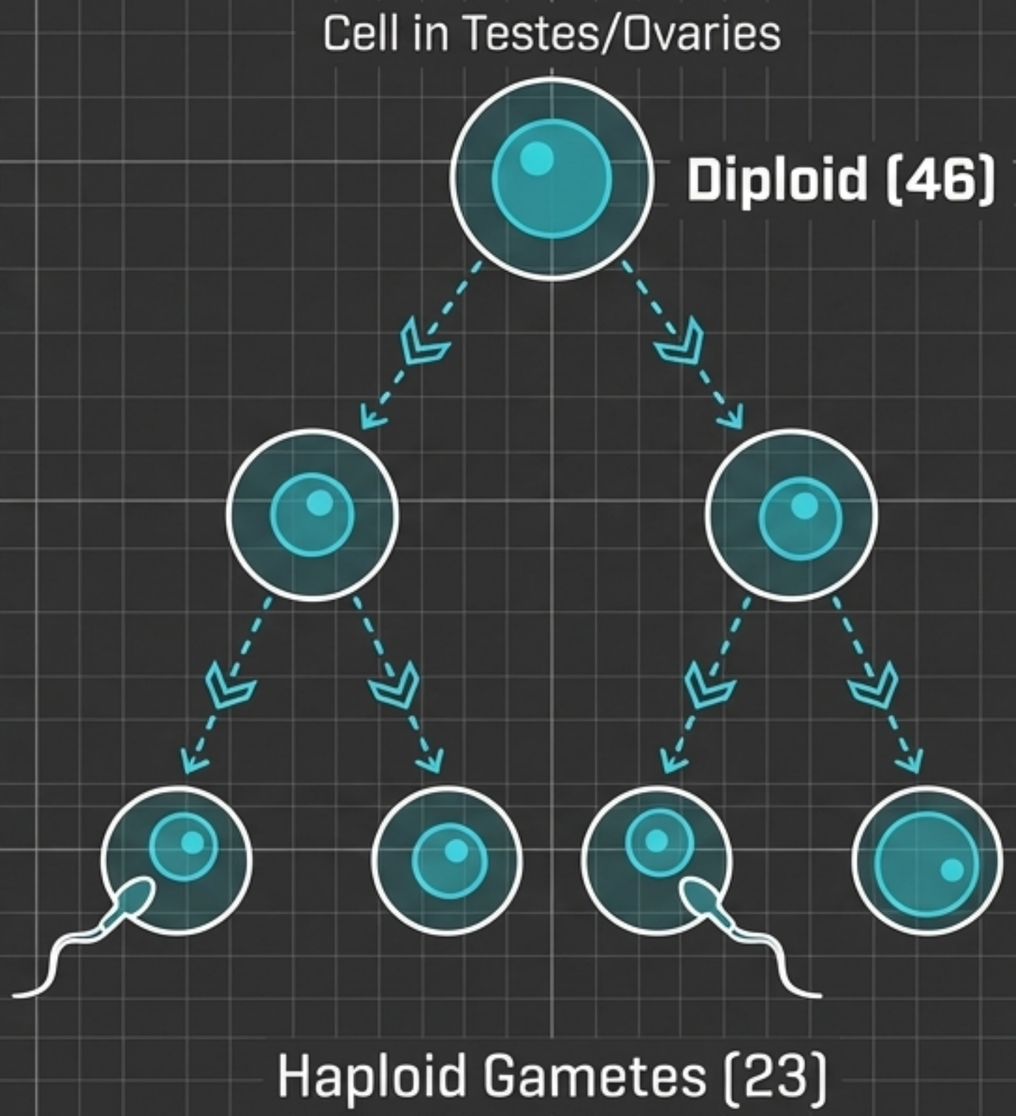
# **Meiosis:** Halving the code for sexual reproduction.

### Diploid

Cells with the full number of chromosomes (46).

### Haploid

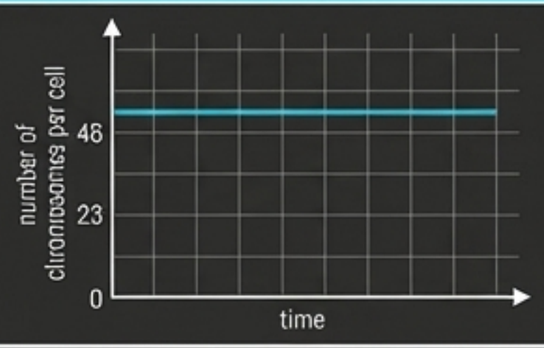
Specialized cells with exactly half the normal number of chromosomes (23). These are the gametes (sperm and egg).




### The Variation Factor

Unlike mitosis, meiosis ensures that all produced cells are genetically different, providing the foundation for variation in offspring.

# Diagnostic Matrix: Cell Division Modalities

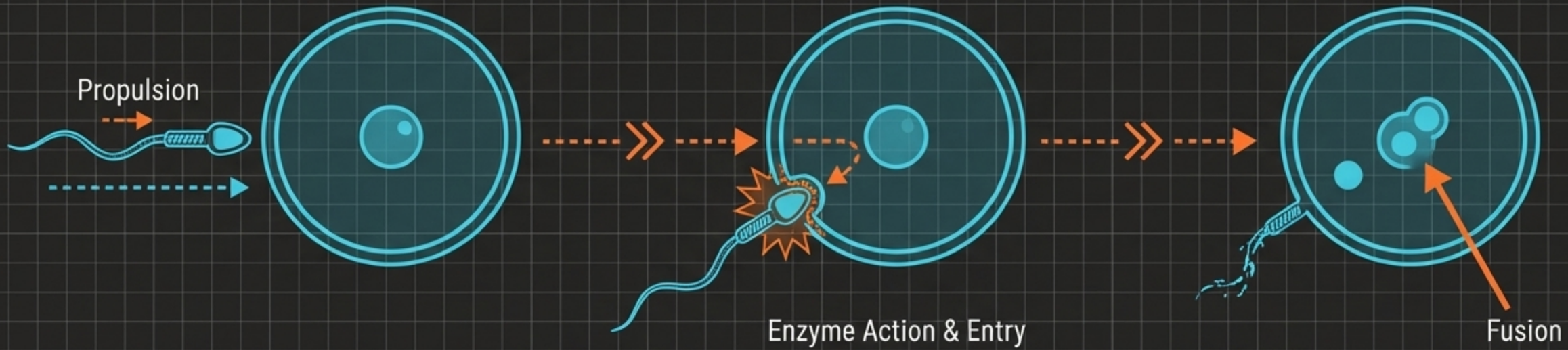
| Mitosis | Meiosis |
| --- | --- |
|  |  |
| Growth, repair, cell replacement | Production of gametes for sexual reproduction |
| Diploid / 46 | Haploid / 23 |
| Exact, identical copies | Genetically varied combinations |
| Throughout the body | Specifically in the testes and ovaries |

# **Fertilisation:** Restoring the Sequence

Phase 1
Sperm approach

Phase 2
Penetration

Phase 3
Nuclei fusion




## 1

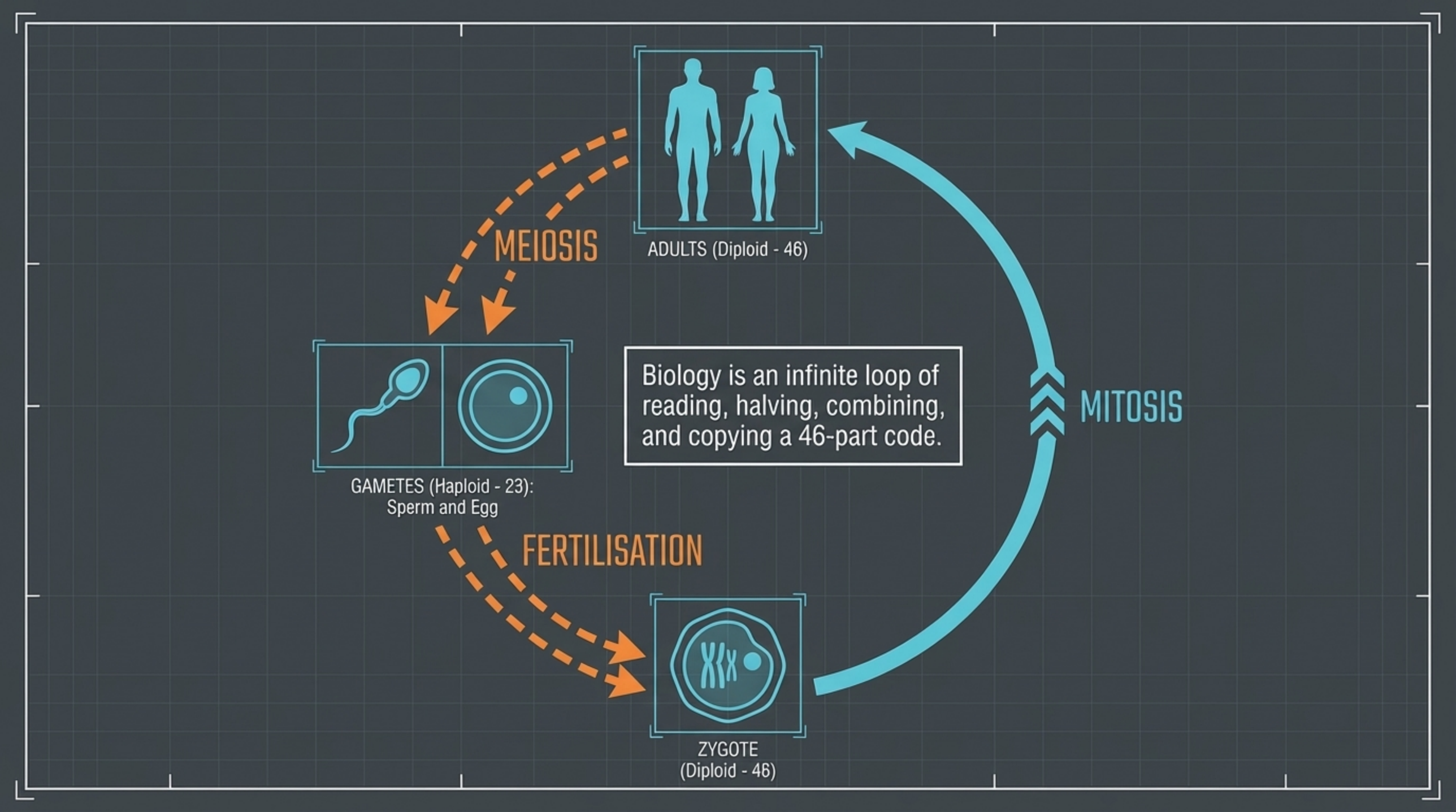
The sperm cell uses a tail (flagellum) for propulsion to reach the egg.

## 2

Once reached, the sperm nucleus (23 chromosomes) enters the egg and fuses with the egg nucleus (23 chromosomes).

## 3

This internal fertilisation produces a zygote with 46 chromosomes, restoring the diploid number and bringing together a totally unique combination of genes.


ADULTS (Diploid - 46)
MEIOSIS
GAMETES (Haploid - 23):
Sperm and Egg
Biology is an infinite loop of reading, halving, combining, and copying a 46-part code.
FERTILISATION
ZYGOTE
(Diploid - 46)
MITOSIS