Mini-Lectures of Biology

For school students

By
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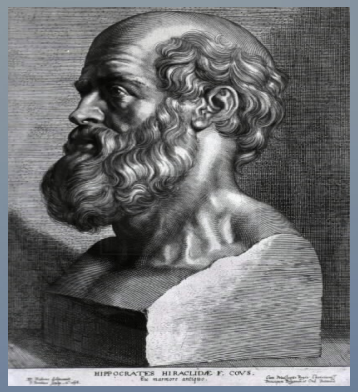
Why to study biology?

- How a single tiny cell becomes a tree or a dog
- To understand ourselves (How the human minds works)
- To provide confortable living
- To fulfil our needs
- Eradication of disease and medicine
- Conservation of natural resources
- Interrelationships of plants, animals & environment (Biology tells you about different plants and their mechanism of converting CO_2 to O_2)

Discoveries in field of biology

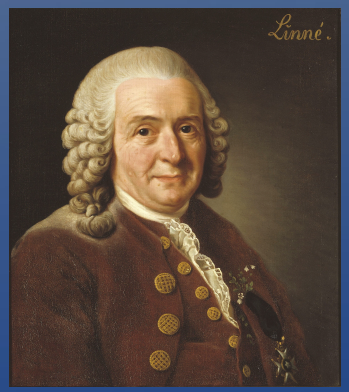


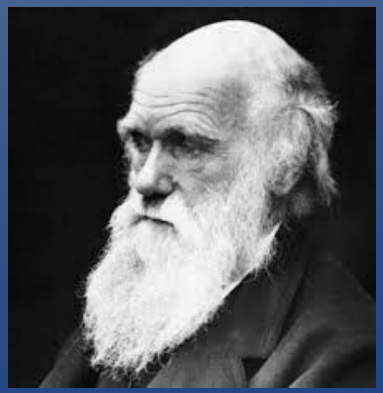
Hippocrates (460-370 BC)
Father of medicine

Theophrastus (370-287 BC)
Father of Botany

Aristotle (382-322 BC)
Father of Biology

G. J. Mendel
(1822-1884)
Father of genetics





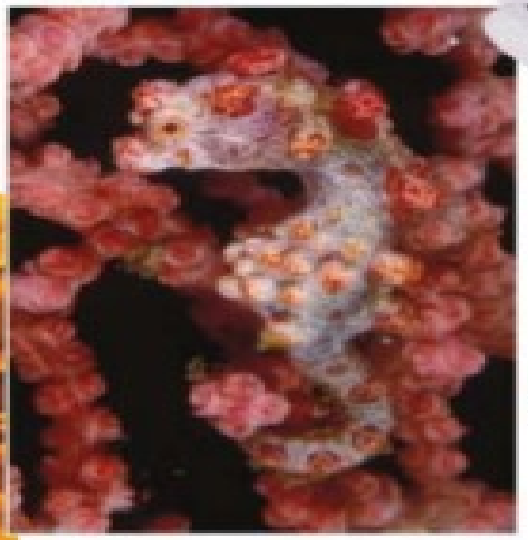
Charles Darwin (1809-1882)
“Survival of the fittest”

Carolus Linnaeus (1753)
Father of Plant Taxonomy

Antony van Leeuwenhock (1632-1723) Father of Microscopy

Life

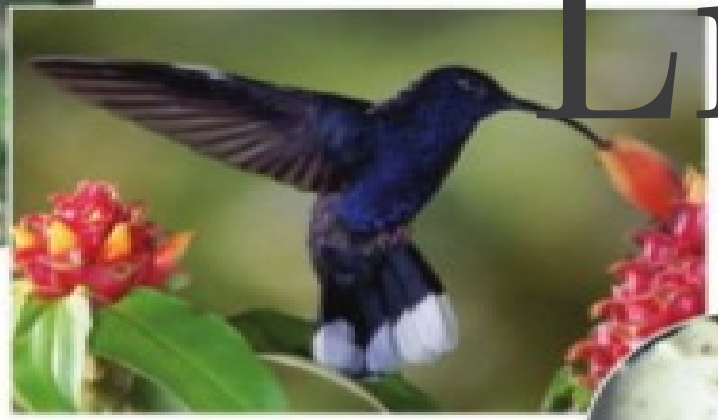
▼ **Order.** This close-up of a sunflower illustrates the highly ordered structure that characterizes life.



▲ **Evolutionary adaptation.** The appearance of this pygmy sea horse camouflages the animal in its environment. Such adaptations evolve over many generations by the reproductive success of those individuals with heritable traits that are best suited to their environments.

▲ **Response to the environment.** This Venus flytrap closed its trap rapidly in response to the environmental stimulus of a damselfly landing on the open trap.

▲ **Regulation.** The regulation of blood flow through the blood vessels of this jackrabbit's ears helps maintain a constant body temperature by adjusting heat exchange with the surrounding air.



▲ **Energy processing.** This hummingbird obtains fuel in the form of nectar from flowers. The hummingbird will use chemical energy stored in its food to power flight and other work.

▼ **Growth and development.** Inherited information carried by genes controls the pattern of growth and development of organisms, such as this Nile crocodile.

▲ **Reproduction.** Organisms (living things) reproduce their own kind. Here an emperor penguin protects its baby.

Branches of Biology

- Chemistry of life
- The cell
- Genetics
- Mechanism of evolution
- Evolutionary trees
- Plant form & function
- Animal form & function
- Ecology
- Biochemistry
- Molecular Biology
- Biotechnology
- Neuroscience
- Immunology
- Developmental Biology
- Microbiology
- Medicine

Concepts of Biology

a) Evolution, the Overarching Theme of Biology

Age of universe	13.8 billion years
Age of earth	4.54 billion years
First simple cells	3.6 billion years
First complex cells	2.0 billion years
First multicellular	1.0 billion years
Simple animals	600 million years
First mammals	200 million years
First primates	60 million years
Modern humans	200,000 years

Concepts of Biology

a) Evolution, the Overarching Theme of Biology

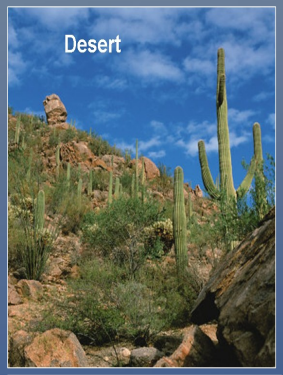
b) Emergent properties

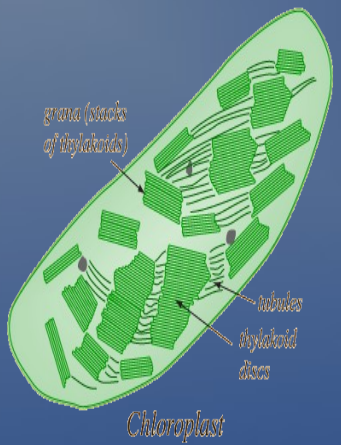
Levels of Biological Organizaiton

1 Biosphere

3 Communities

4 Populations





9 Organelles

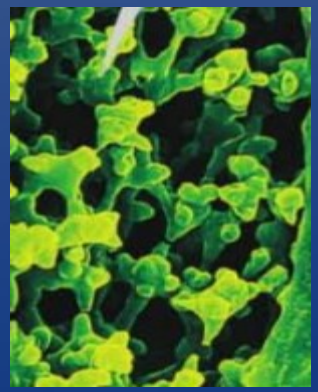
5 Organisms

6 Organs and Organ systems

8 Cells

2 Ecosystem

10 Molecules



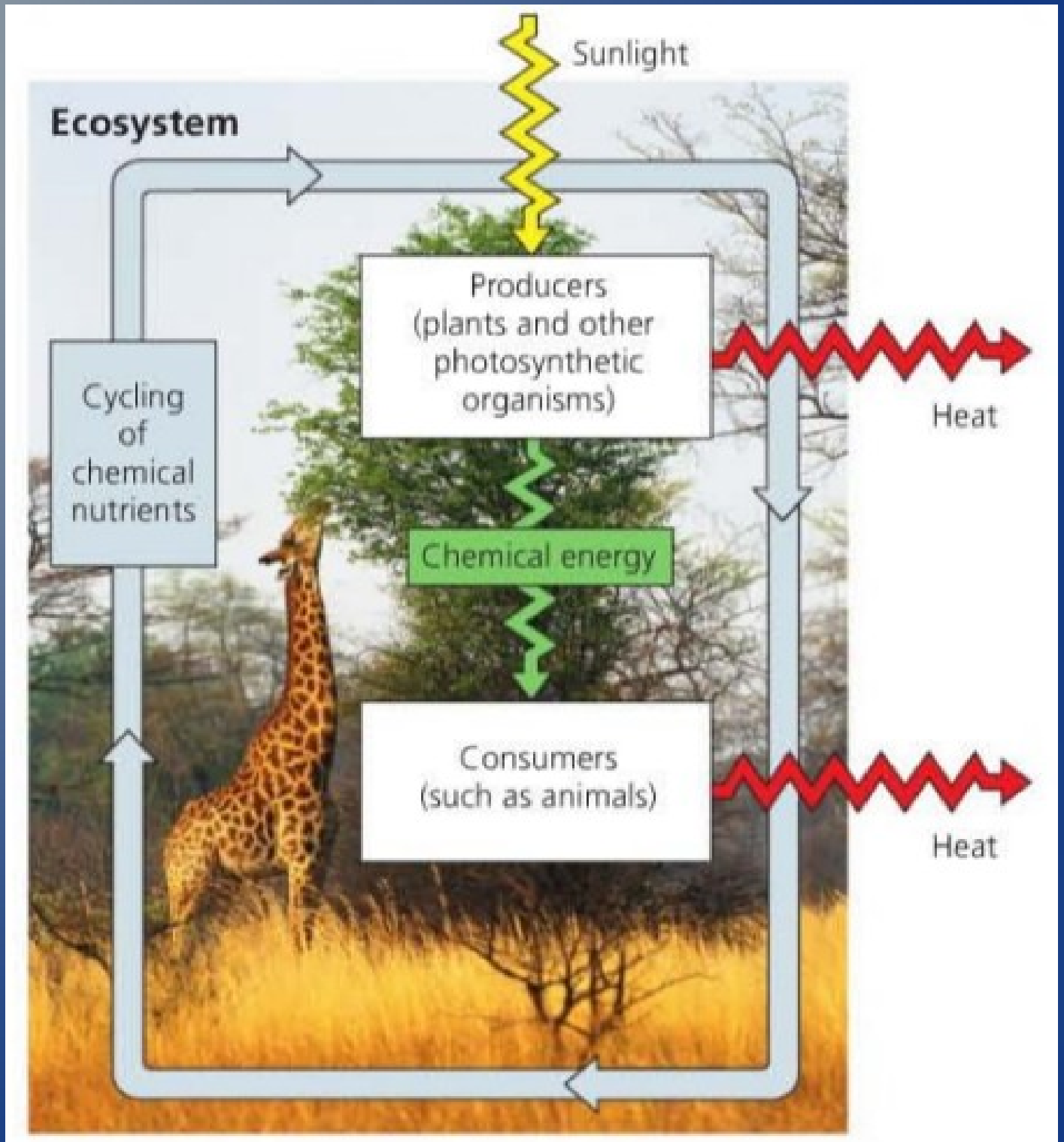
7 Tissues

Concepts of Biology

a) Evolution, the Overarching Theme of Biology

b) Emergent properties

c) Organism interact with their environments


Sunlight
Ecosystem
Producers
(plants and other
photosynthetic
organisms)
Heat
Cycling
of
chemical
nutrients
Chemical energy
Consumers
(such as animals)
Heat

Concepts of Biology

a) Evolution, the Overarching Theme of Biology

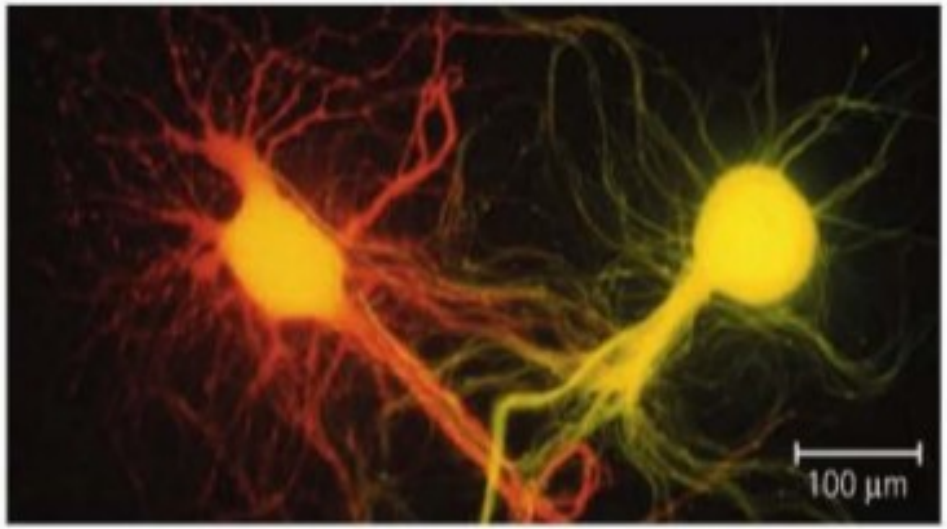
b) Emergent properties

c) Organism interact with their environments

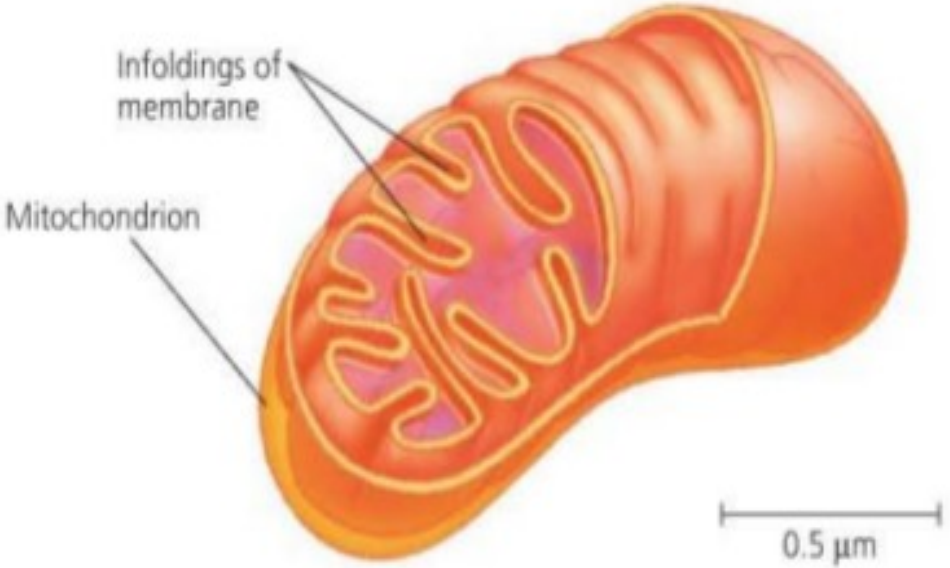
d) Structure and funcitons are correlated

(a) A bird's wings have an aerodynamically efficient shape.

(b) Wing bones have a honeycombed internal structure that is strong but lightweight.



(c) The flight muscles are controlled by neurons (nerve cells), which transmit signals. With long extensions, neurons are especially well structured for communication within the body.



(d) The flight muscles obtain energy in a usable form from organelles called mitochondria. A mitochondrion has an inner membrane with many infoldings. Molecules embedded in the inner membrane carry out many of the steps in energy production, and the infoldings pack a large amount of this membrane into a small container.

Concepts of Biology

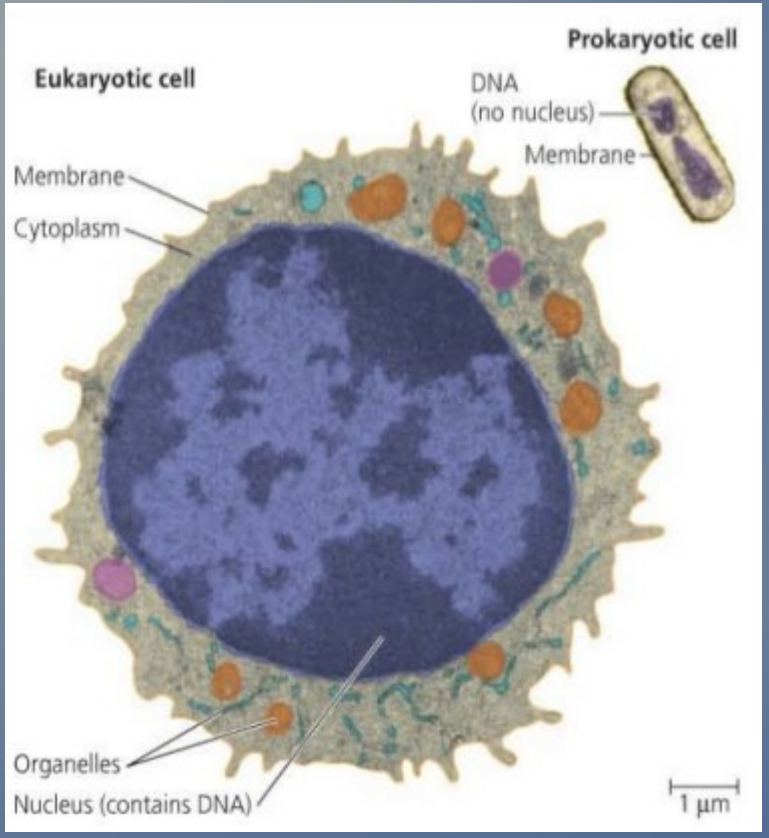
a) Evolution, the Overarching Theme of Biology

b) Emergenet properties

c) Organism interact with their environments

d) Structure and funcitons are correlated

e) Cells are an organisms's basic units


Prokaryotic cell
Eukaryotic cell
DNA
(no nucleus)
Membrane
Membrane
Cytoplasm
Organelles
Nucleus (contains DNA)
1 µm

Concepts of Biology

a) Evolution, the Overarching Theme of Biology

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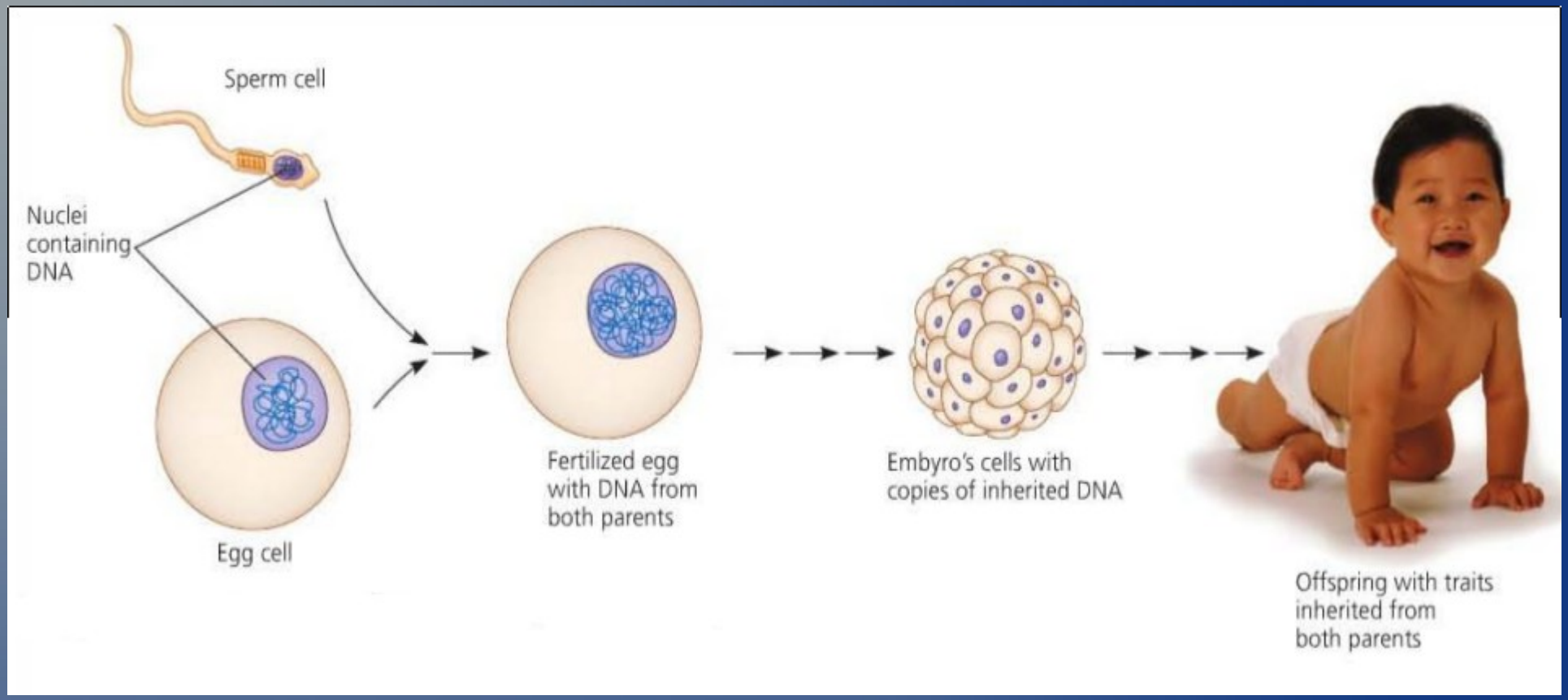
e) Cells are an organisms's basic units

f) Continuity of life is based on heritable information in the form of DNA


Sperm cell
Nuclei containing DNA
Egg cell
Fertilized egg with DNA from both parents
Embyro's cells with copies of inherited DNA
Offspring with traits inherited from both parents


thymine
deoxyribose
guanine
adenine

Concepts of Biology

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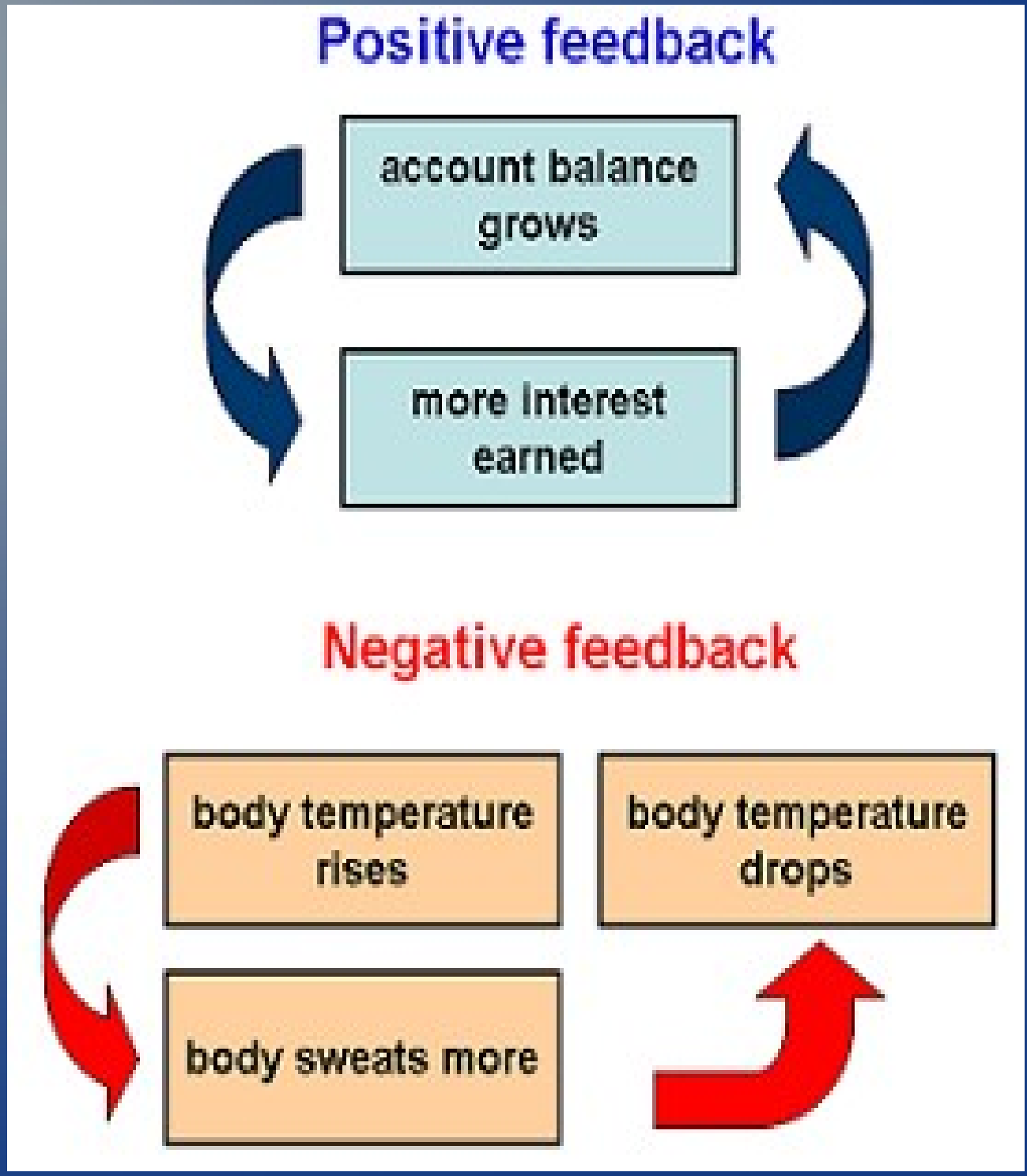
g) Feedback mechanisms regulate biological systems


Positive feedback
account balance grows
more interest earned
Negative feedback
body temperature rises
body temperature drops
body sweats more

THANK YOU FOR YOUR ATTENTION