

What is Biology?

Unit Notebook

JONNY'S
NOTES



Science — What is Bio Lesson 1

Diagrams

2 TYPES OF SCIENCE

EMPIRICAL

* HIGH CONFIDENCE



HISTORICAL

* LOW CONFIDENCE

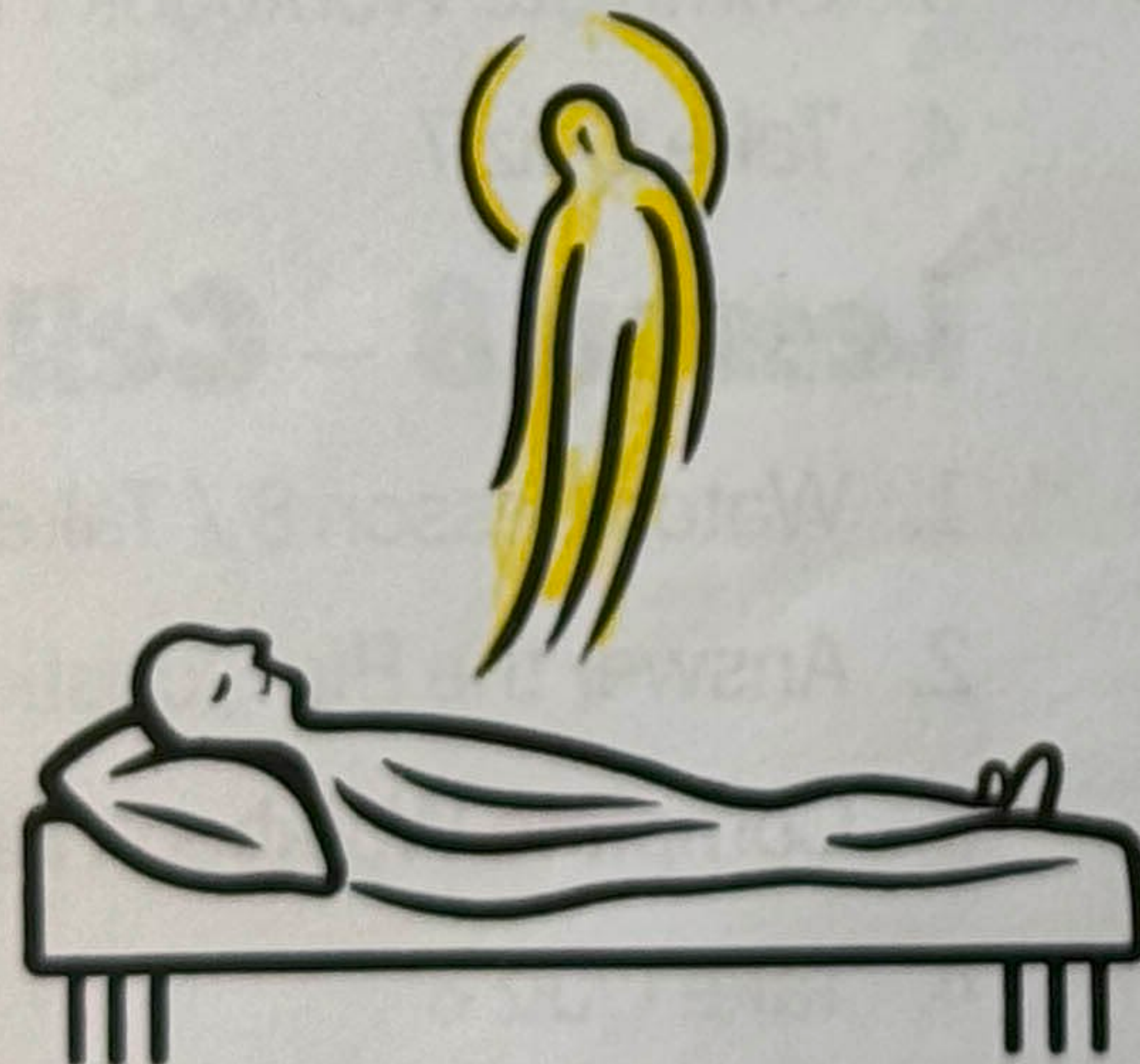


MATERIALIST

Science is Everything



DUALISM



FRANCIS BACON



A little philosophy inclines man's mind to atheism, but depth in philosophy brings men's minds about to religion.

1561 - 1626

Experiment

A chicken is left at room temperature, another is stuffed with ice and left in the snow. Over the course of a week changes in appearance, smell, and texture will be recorded.

WHAT YOU DO
Manipulated Variable

TEMP.

WHAT YOU MEASURE
Responding Variable

ROTTING

Notes

Big Question

Science

- 1 SCIENCE : A way to know things about the natural world through observation, experimentation, analysis, and inference.
- 2 EMPIRICAL SCI. : Science based on observation and experimentation.
- 3 HISTORICAL SCI. : Science based on analysis and inference rather than experimentation. (started with Lyell and Darwin)
- 4 FRANCIS BACON : The 'Father of Empirical Science'.
EDUCATED GUESS

Materialism vs Dualism

- 5 MATERIALISM : The worldview that the only physical things are real, and everything else can be explained by those things.
- 6 DUALISM : The worldview that in addition to the physical world, there is a spiritual or immaterial reality.

Experimentation

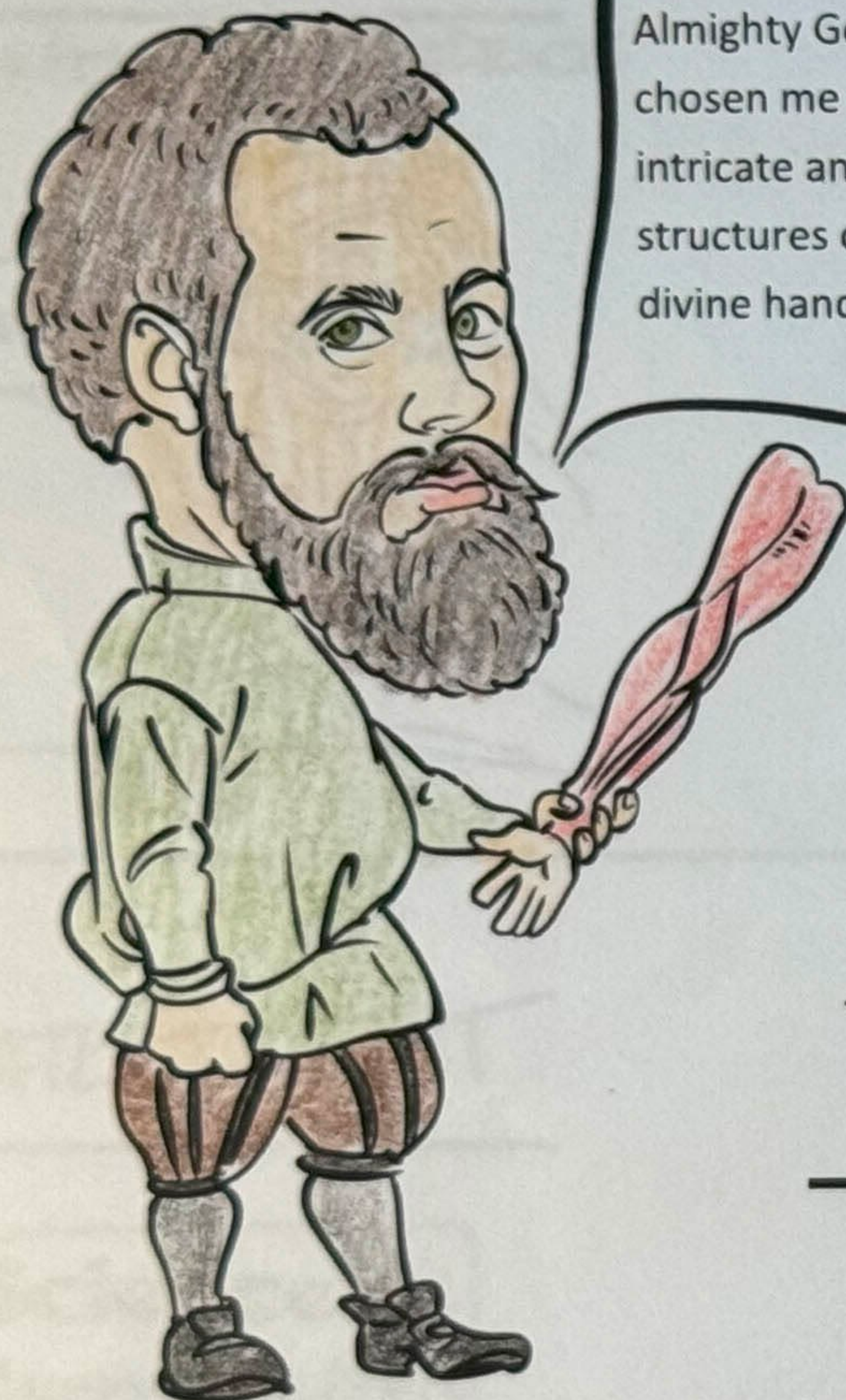
- 7 EXPERIMENT : Doing a controlled test and watching what happens.
- 8 OBSERVATION : A fancy name for 'watching what happens'.
- 9 VARIABLE : A thing that can change.
- 10 MANIPULATED V. : The one thing you change in your experiment to see how it effects the results.
- 11 RESPONDING V. : The thing that is potentially going to be changed by the manipulated variable.

How can studying Science help us grow in our love for God?

Medicine — What is Bio Lesson 2

Diagrams

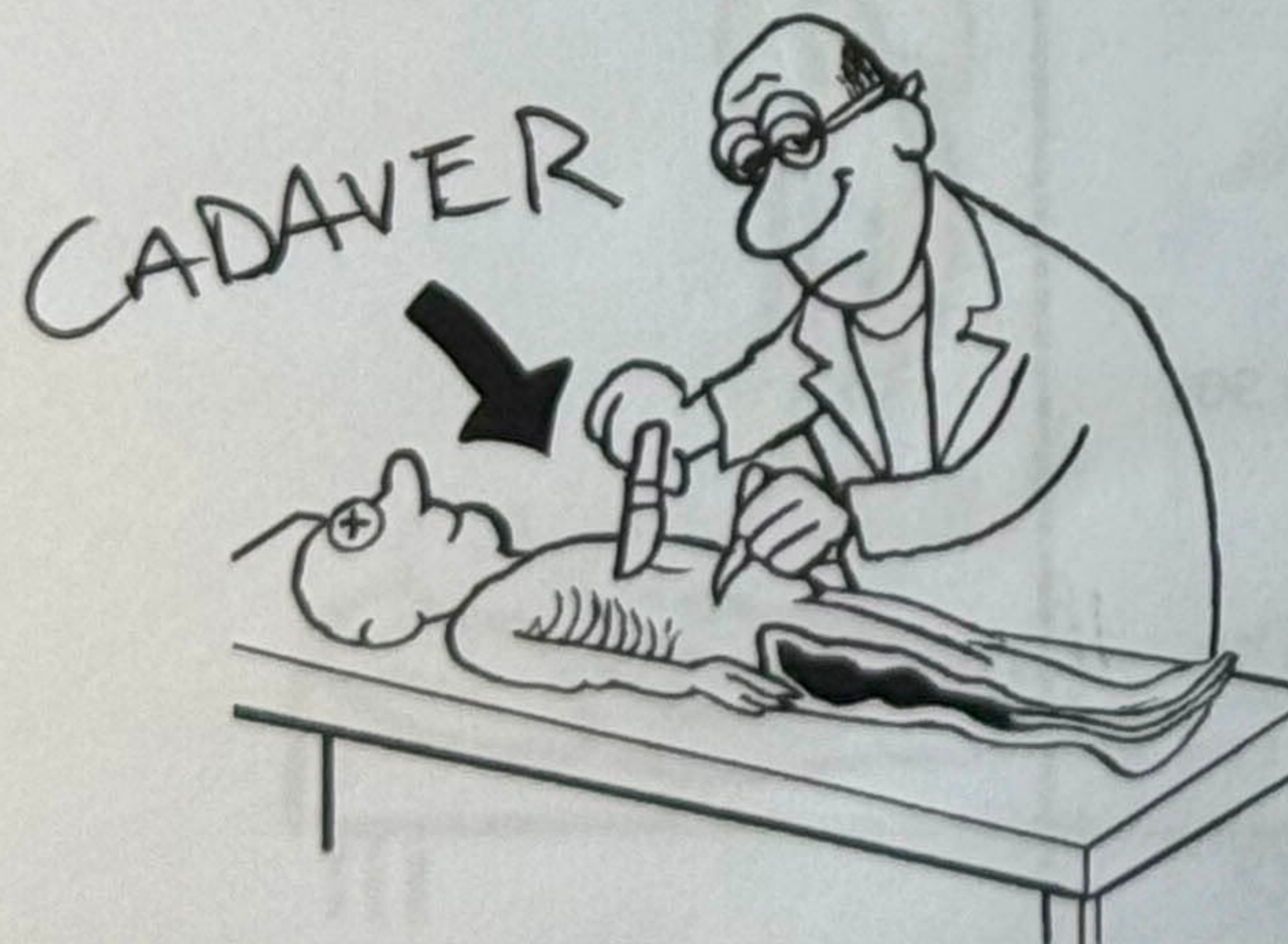
A. VESALIUS



1514 - 1564

I give endless thanks to Almighty God who has chosen me to reveal the intricate and marvelous structures of His most divine handiwork.

DISSECTION



CADAVER

W. HARVEY



1578 - 1657

Nature is a volume of which God is the author.

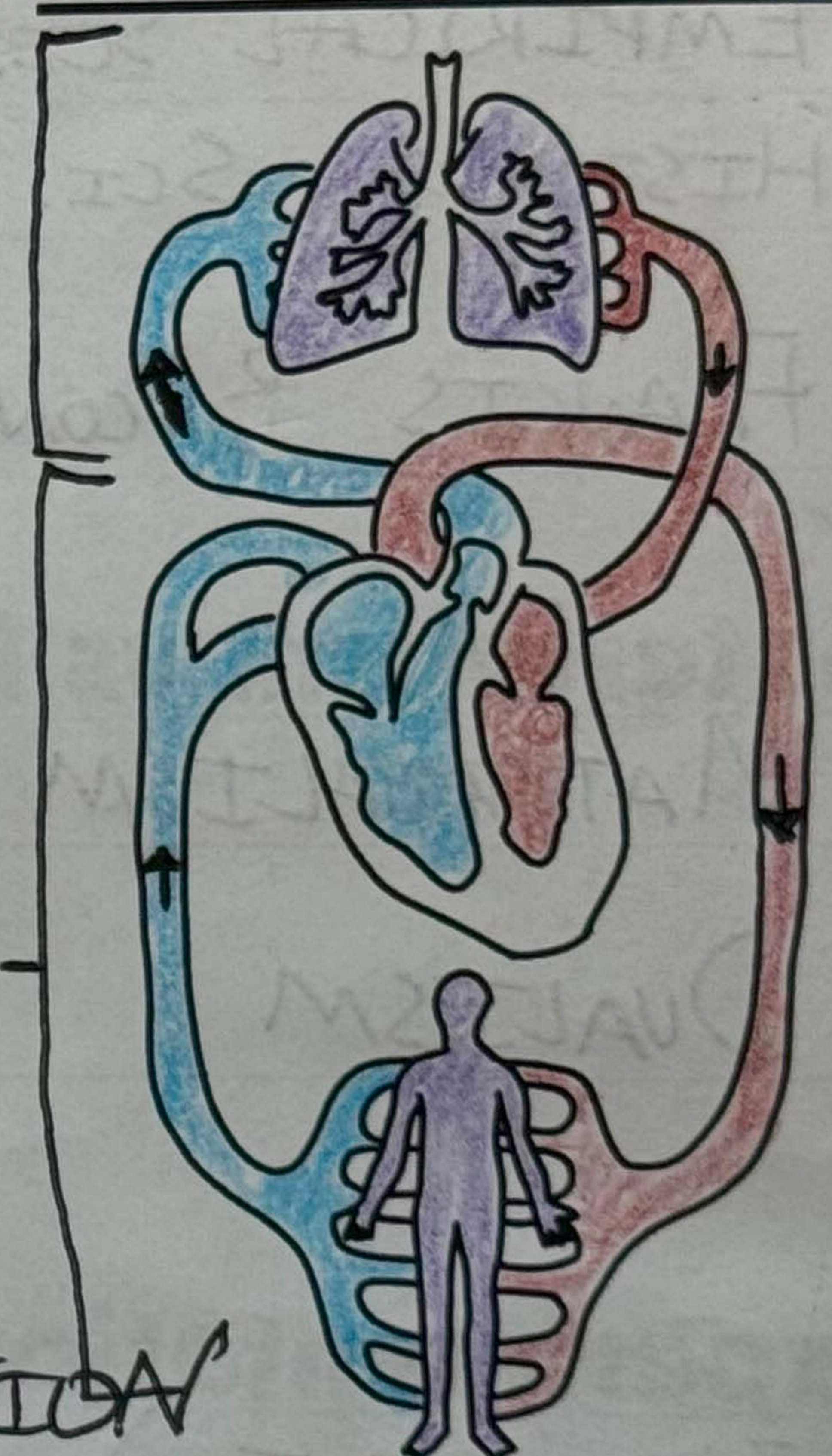
PULMONARY
CIRCUIT

SYSTEMIC
CIRCUIT

VIVISECTION



CIRCULATORY
SYSTEM



Notes

Medicine

- 1 BIOLOGY : The scientific study of life.
- 2 MEDICINE : The science of diagnosing, treating, and preventing diseases and injuries of the living body.

Vesalius

- 3 VESALIUS : The father of modern anatomy who corrected many wrong anatomical ideas with precise drawings from his own hands-on dissections of cadavers.
- 4 ANATOMY : The study of the structure and organization of the body.
- 5 DISSECTION : Vesalius emphasized the importance of this in anatomy.
- 6 CADAVER : A dead human body used for research and education.

Harvey

- 7 HARVEY : The father of modern physiology, who proved that the blood circulates, and killed the idea of the 4 humors.
- 8 VIVISECTION : Harvey emphasized the importance of this in studying physiology, which is live dissection of animals.
- 9 PHYSIOLOGY : The study of how living things work.

Circulatory System

- 10 HEART : The blood pumper.
- 11 SYSTEMIC CIRCUIT : The blood that goes to the whole body.
- 12 PULMONARY CIRCUIT : The blood that goes to the lungs.

Big Question

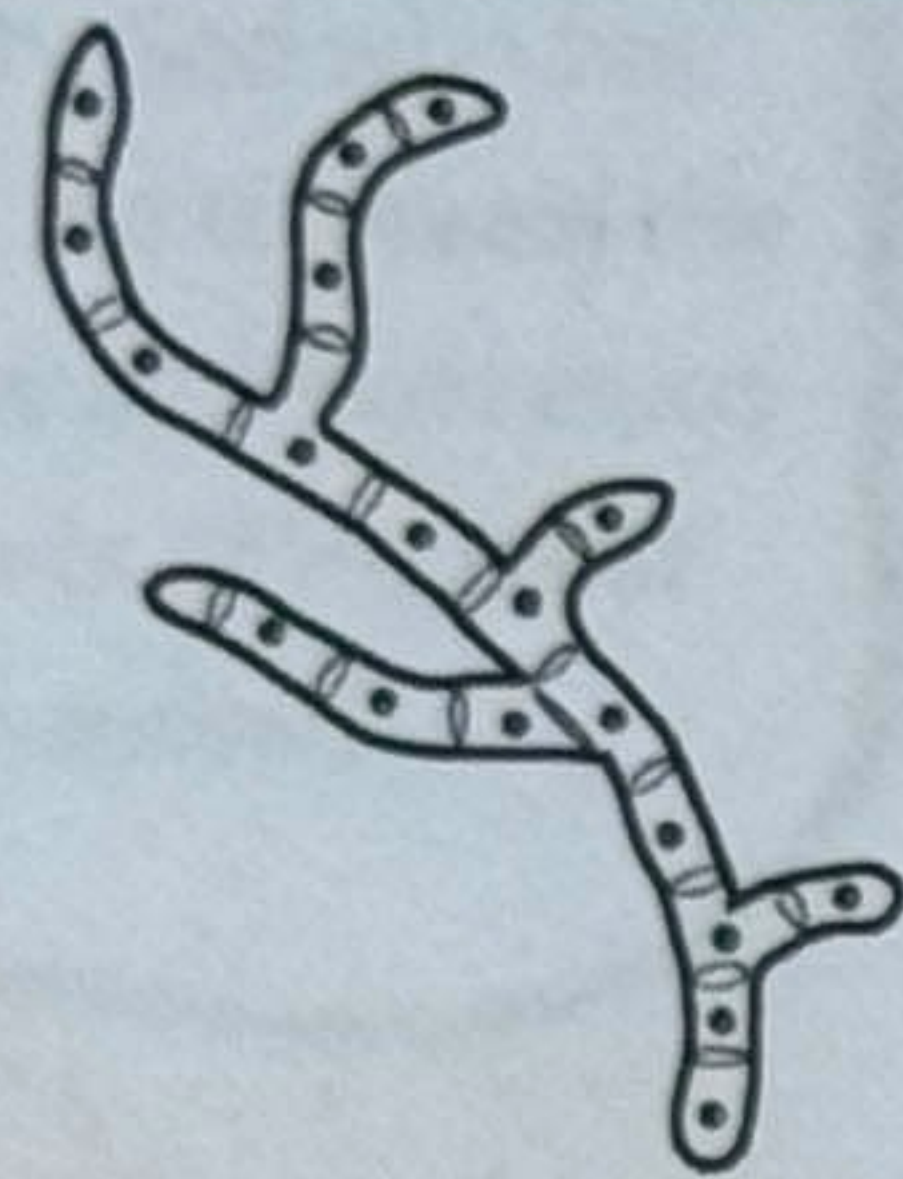
How did Vesalius and Harvey view science as a way to better know God?

Microbiology — What is Bio Lesson 3

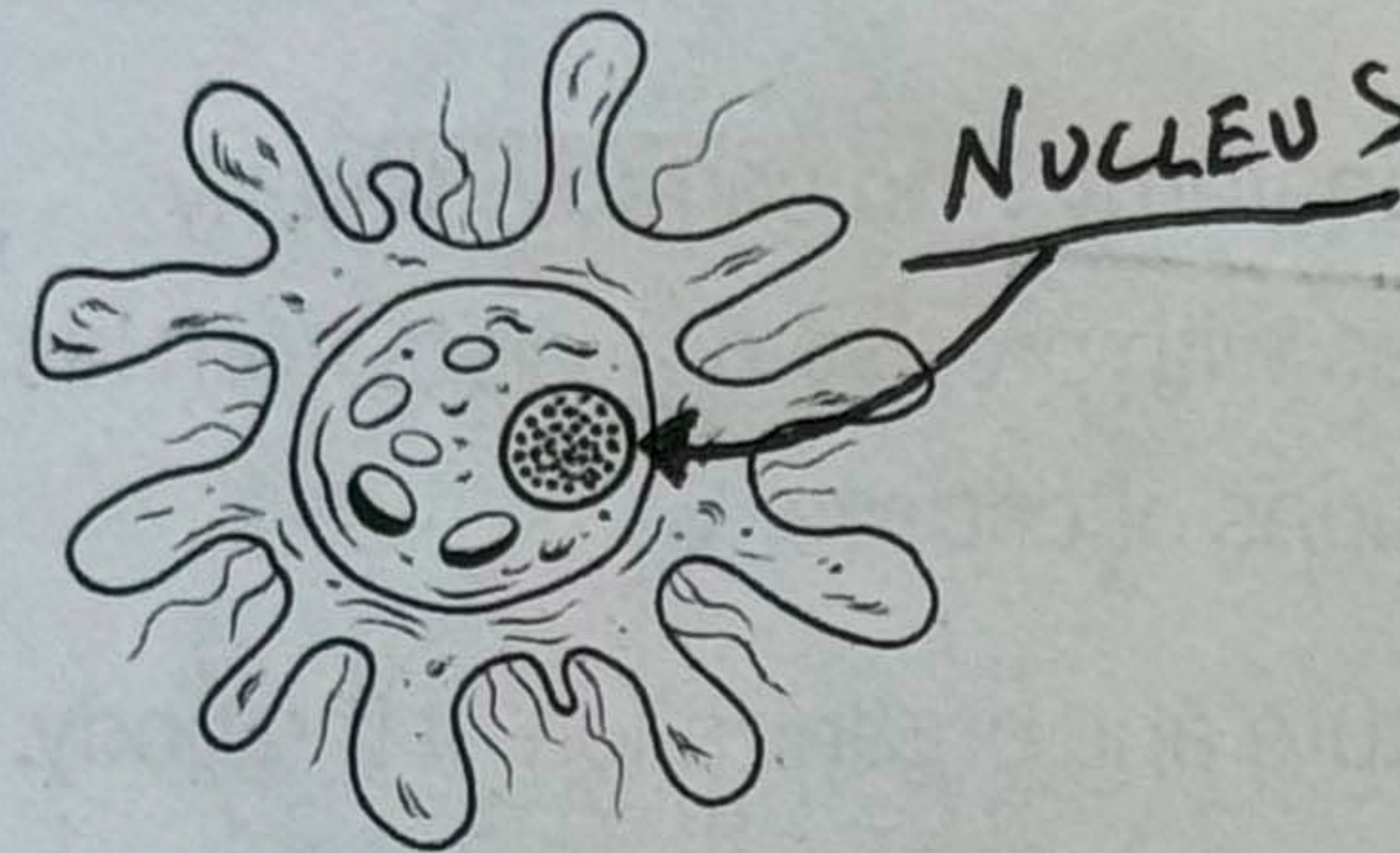
Diagrams

3 TYPES OF MICROBES

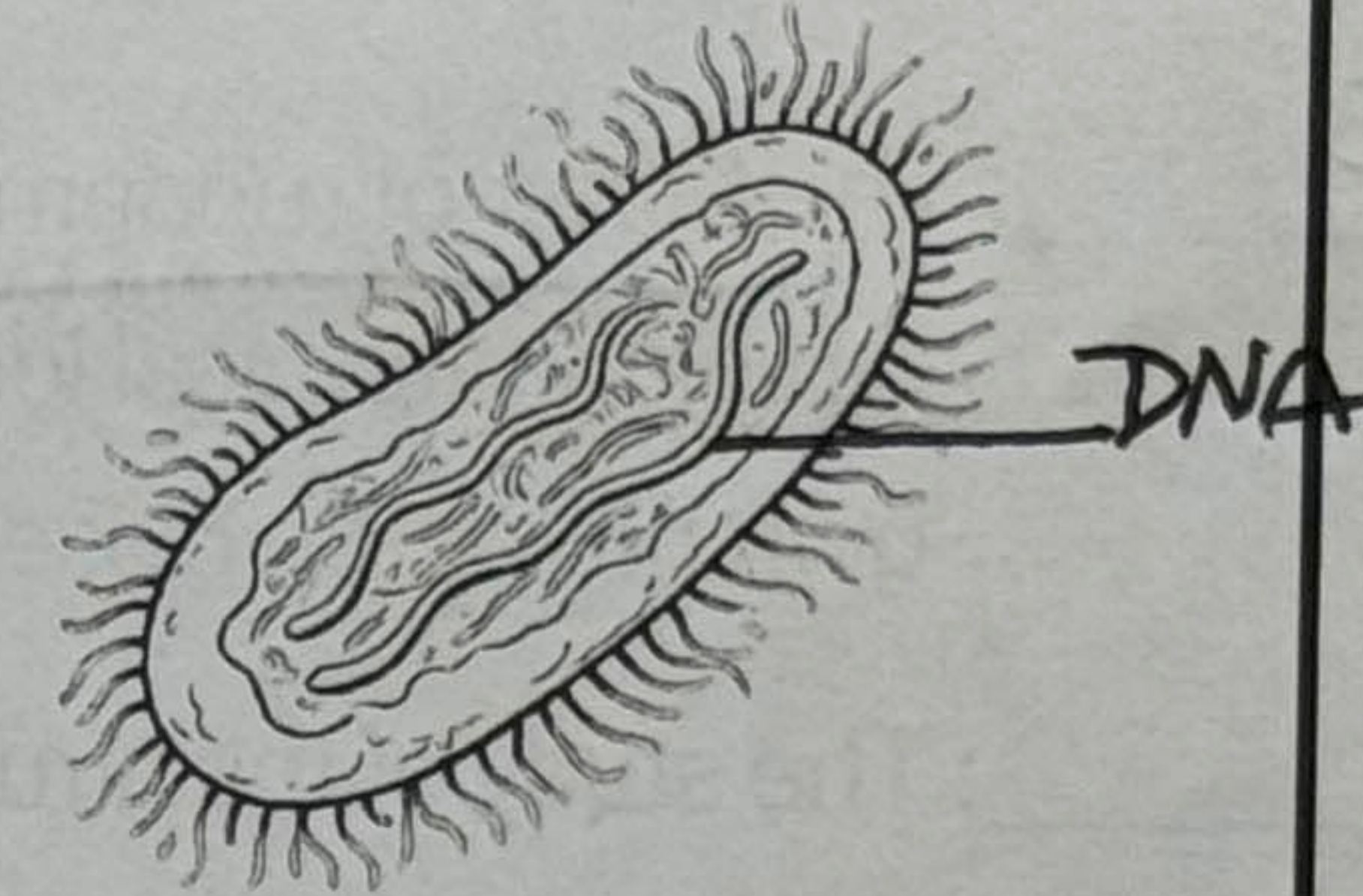
FUNGI



PROTISTS



BACTERIA



From all these observations we can conclude that God has created this world and everything in it with infinite wisdom and grandeur, and that it is impossible for man to comprehend the order and perfection of God's creation.



A. VAN LEEUWENHOEK

1632 - 1723

Experiment

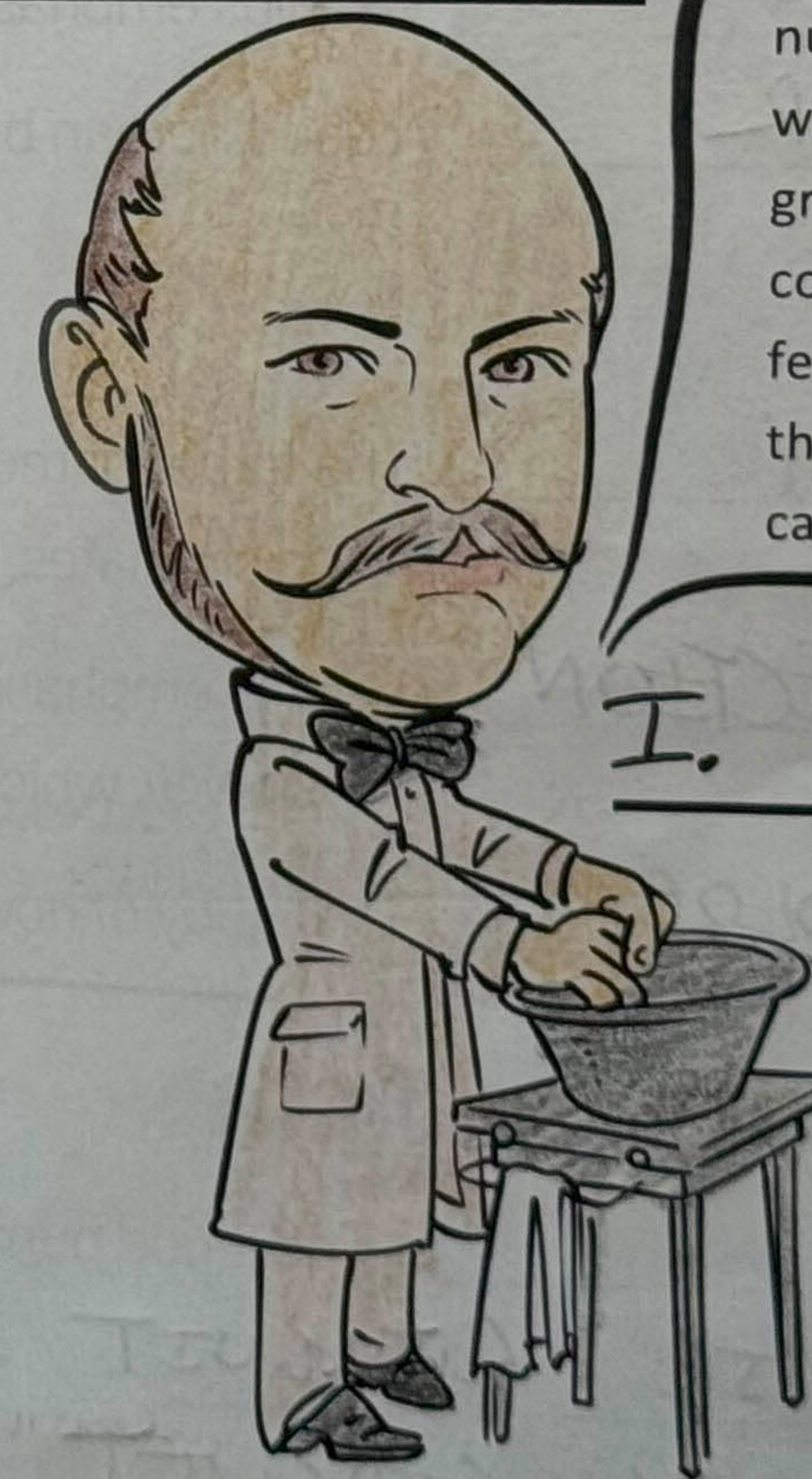
Dr. Semmelweis instituted a handwashing protocol in his hospital after noticing that medical students were treating mothers after working on cadavers. He also noticed midwives had much lower post birth death rates (2%) than medical students (18%).

**Manipulated
Variable**

HAND
WASHING

**Responding
Variable**

POST
BIRTH
DEATH
RATE



I. SEMMELWEIS

1818 - 1865

God only knows the number of patients who went to their graves needlessly in consequence of infection conveyed to them by their medical attendants.

Notes

Microbiology

- 1 MICROBIOLOGY: The scientific study of tiny life forms that are invisible to the naked eye, which include bacteria, fungi, and protists.
- 2 BACTERIA: Single cellular living things that lack a nucleus.
- 3 PROTISTS: Single cellular living things that have a nucleus.
- 4 FUNGI: Single cellular/multicellular living things that have a nucleus.

Van Leeuwenhoek

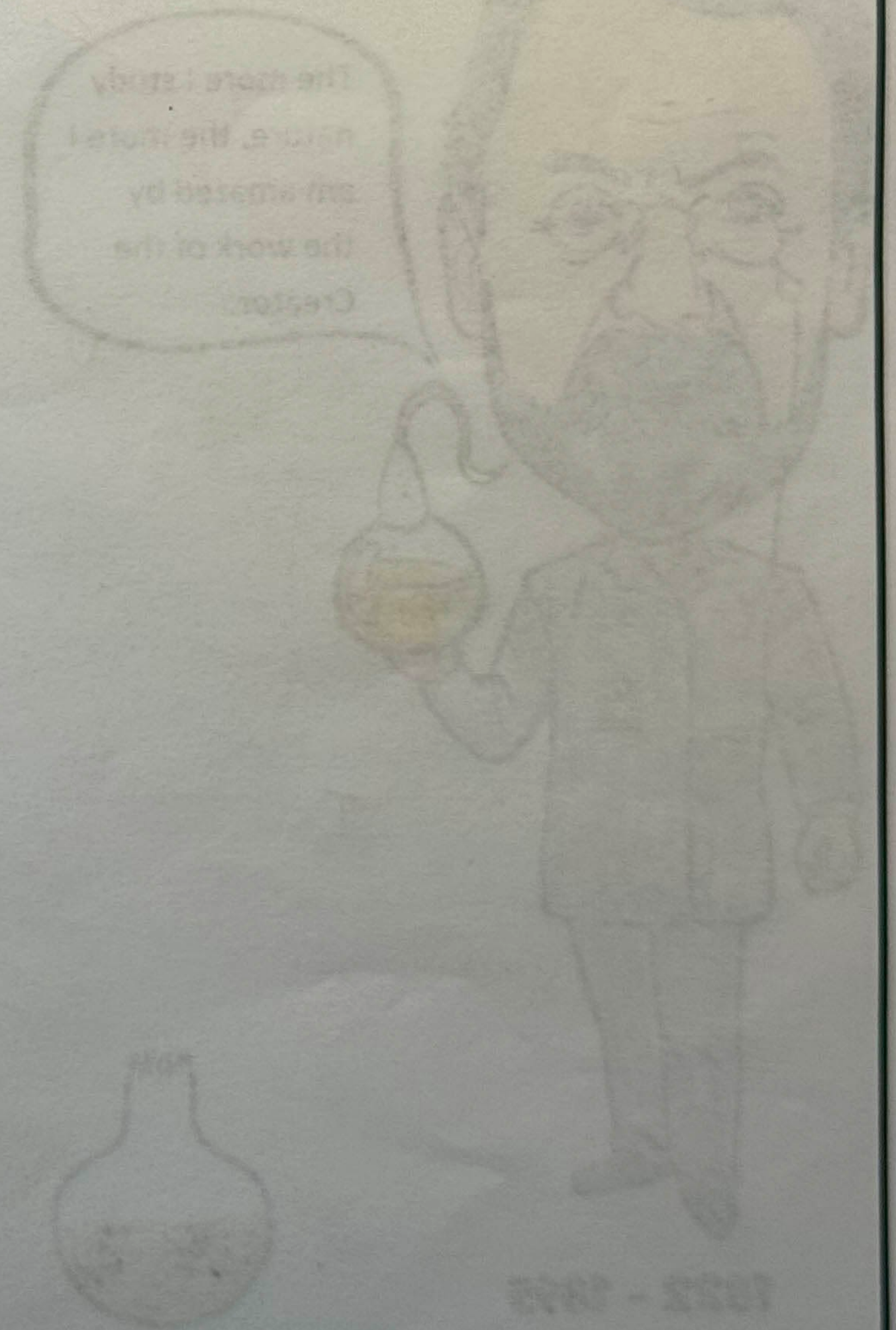
- 5 LEEUVENHOEK: The father of microbiology, who was the first to observe microorganisms, which he called, 'animalcules'.
- 6 MICRO-ORGANISMS
"MICROBES": Tiny living things too small to be seen with the naked eye, which include bacteria, fungi, protists, viruses, etc.
- 7 MICROSCOPE: Though not the original inventor of this key device of microbiology, he greatly improved its design.

Semmelweis

- 8 SEMMELEWEIS: The 'Savior of Mothers', who worked to drastically reduce the death rate of new mothers by using hand washing.
- 9 THE GERM THEORY OF DISEASE: Semmelweis's research laid the ground work for this idea that many diseases are caused by microorganisms that invade and multiply within a person/host.
- 10 SEMMELEWEIS REFLEX: The tendency of a community to reject new evidence or ideas because it contradicts established norms or beliefs.

Big Question

How did Leeuwenhoek and Semmelweis change our understanding of the unseen world?



Pathology — What is Bio Lesson 4

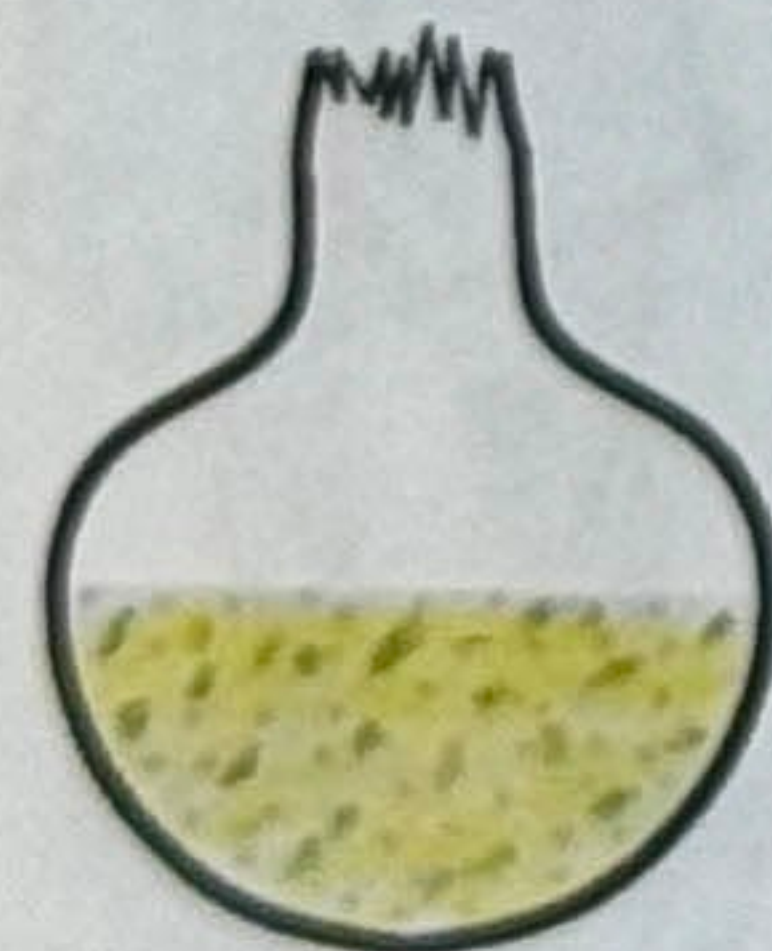
Diagrams

LOUIS PASTEUR

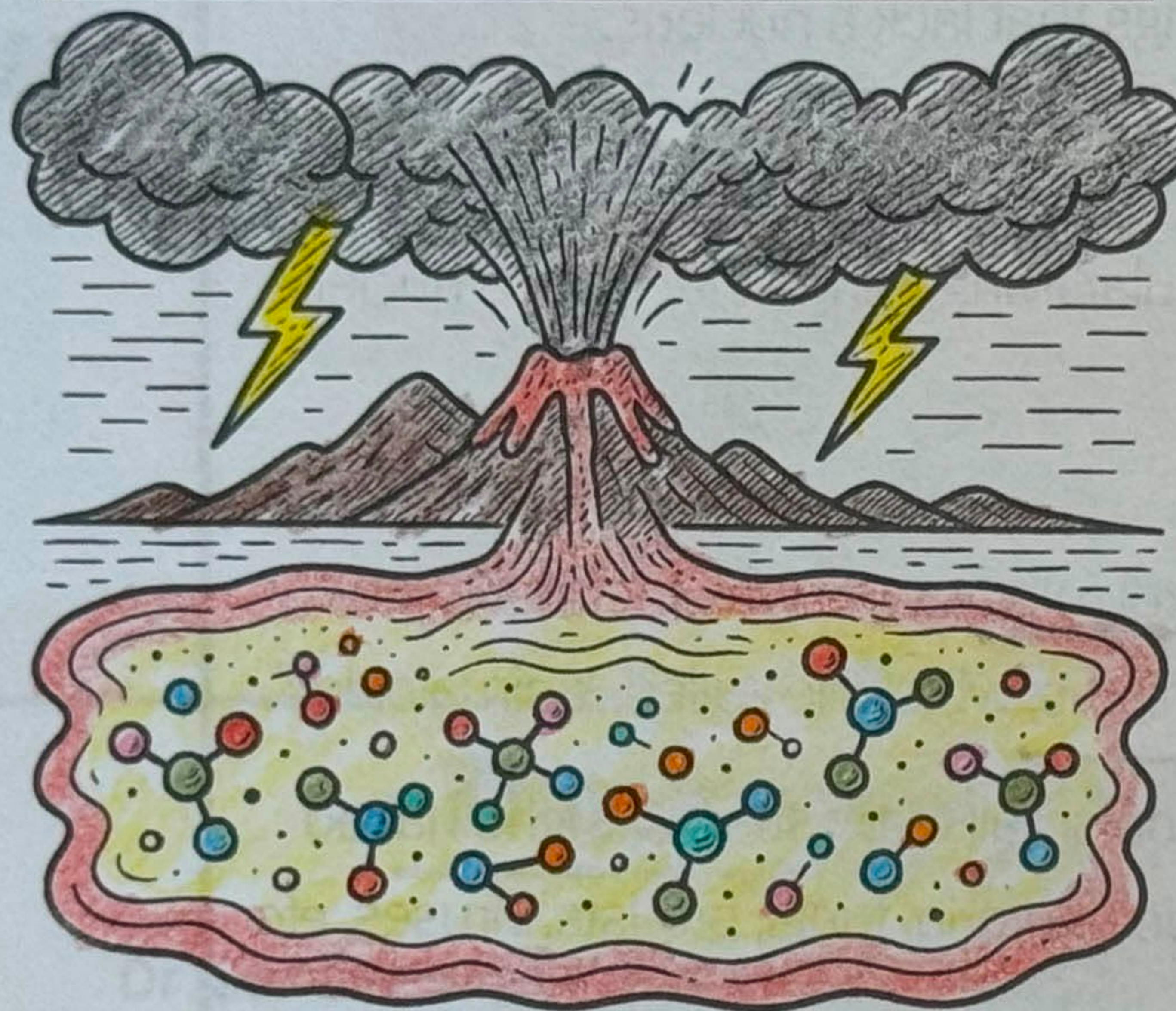


1822 - 1895

The more I study nature, the more I am amazed by the work of the Creator.



PRIMORDIAL SOUP



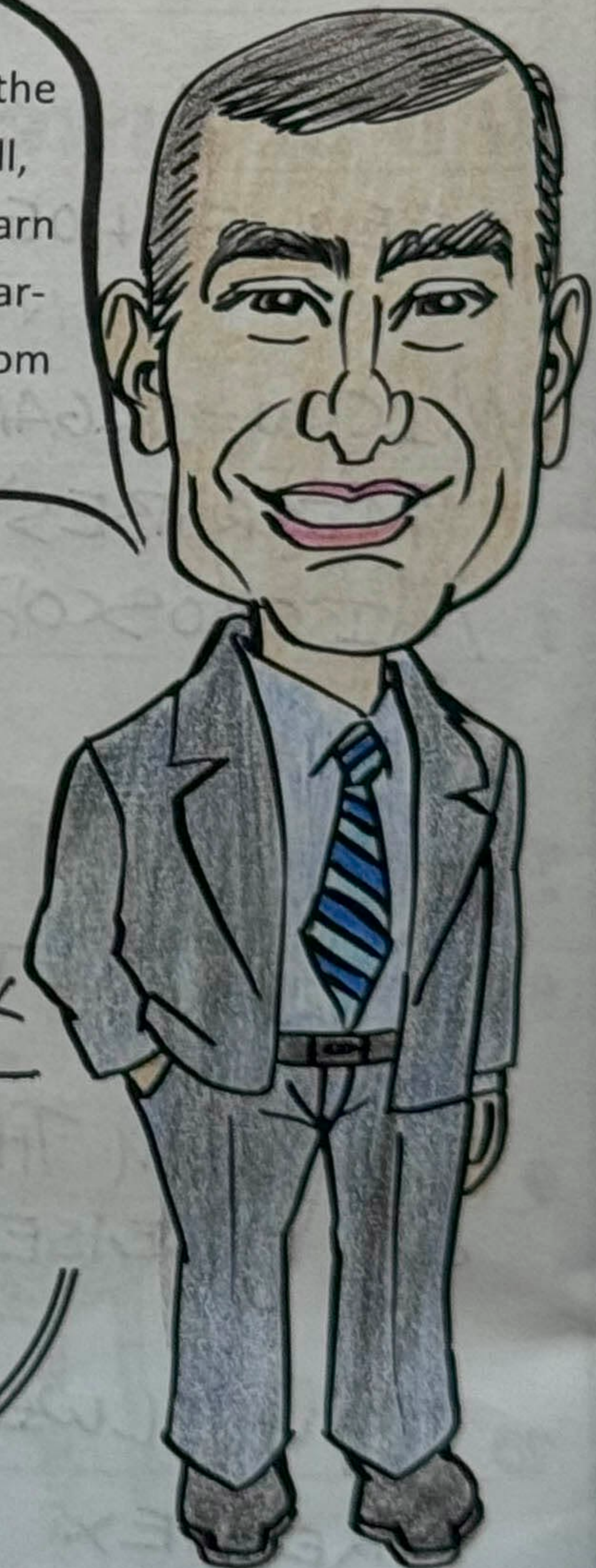
Experiment

Pasteur used swan-neck flasks containing nutrient broth. When the broth was boiled and the flasks were exposed to air through long, curved necks, no microbial growth occurred. When the necks were broken, microbial growth appeared.

Manipulated Variable	Responding Variable
EXPOSURE TO DUST (SPORES)	MICROBIAL GROWTH

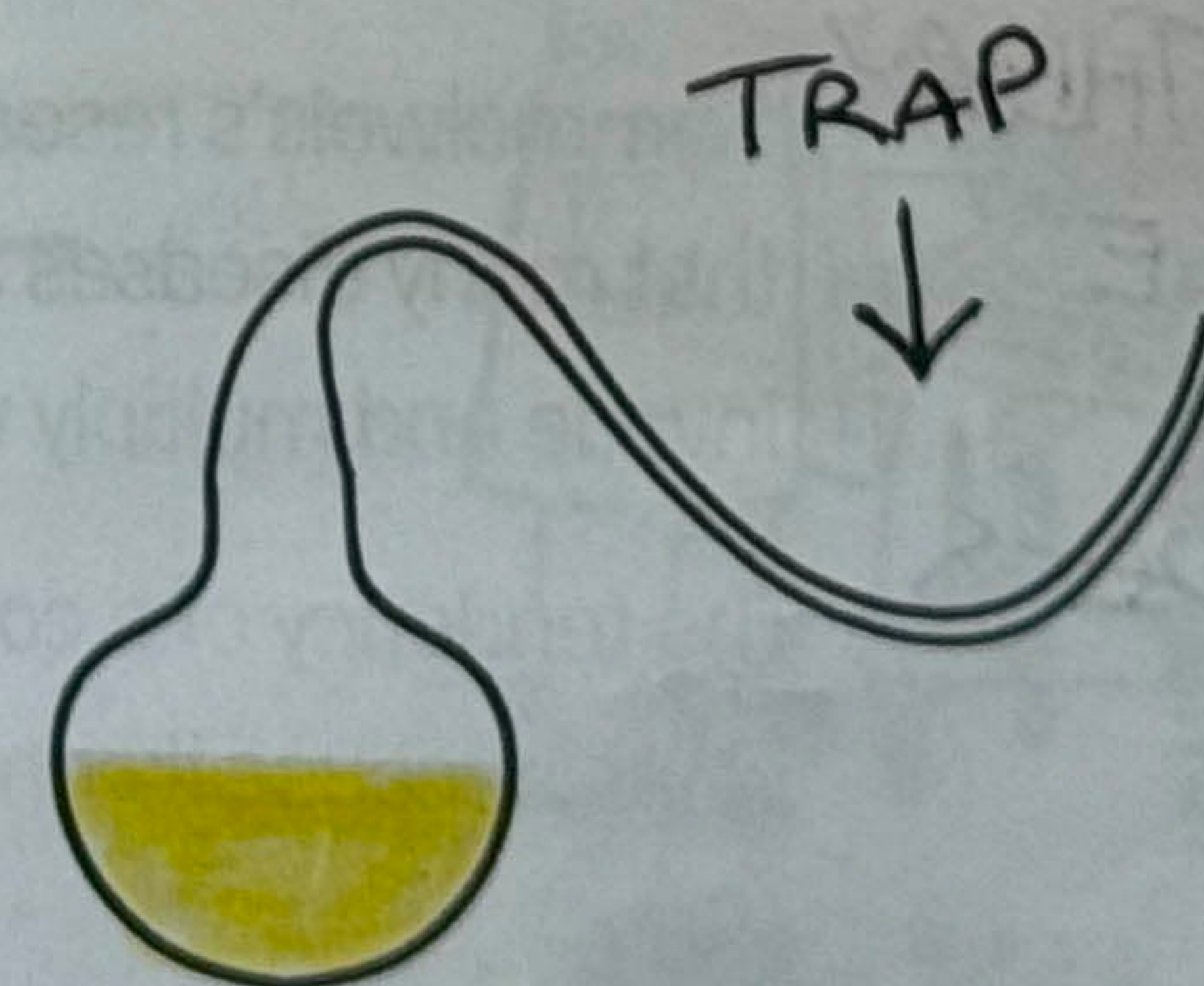
DR. JAMES TOUR

We are clueless on the origin of the first cell, and the more we learn about the cell, the farther away we get from finding an answer.



1959 -

SWAN NECK FLASK



Path

1 PAT

2 LOU

Spor

3 B

4

Past

5 Spo

6

Abi

7 AB

8 JA

9 LI

10

Notes

Pathology

- 1 PATHOLOGY: The branch of medicine that studies disease.
- 2 LOUIS PASTEUR: He conducted many experiments in pathology & is recognized as a founding father of the germ theory of disease.

Spore-Forming Bacteria Lifecycle

- 3 BACTERIA: Microscopic organisms that can eat leftover food.
- 4 SPORE: A mummified-like version of bacteria that can 'reanimate' when wet.

Pasteur's Swan Neck Flask Experiment

- 5 SPONTANEOUS GENERATION: The idea, that life can come from non-life, that Pasteur was disproving.
- 6 TRAP: The part of the swan neck flask that 'caught' stuff.

Abiogenesis / Spontaneous Generation

- 7 ABIOTENESIS: Today this is the name for the idea that a single cell came into existence by natural processes.
- 8 JAMES TOUR: This world renowned organic chemist, who is an outspoken Christian, has recently been very vocal about the lack of evidence for the idea of abiogenesis.
- 9 LIFE FRIENDLY: In Dr. Tour's words, chemistry does not naturally move in this direction.
- 10 CELLS: Cells are only known to come from this.

Big Question

How do the ideas of Pasteur and Tour demonstrate the need for a Creator?

Ecology — What is Bio Lesson 5

Diagrams

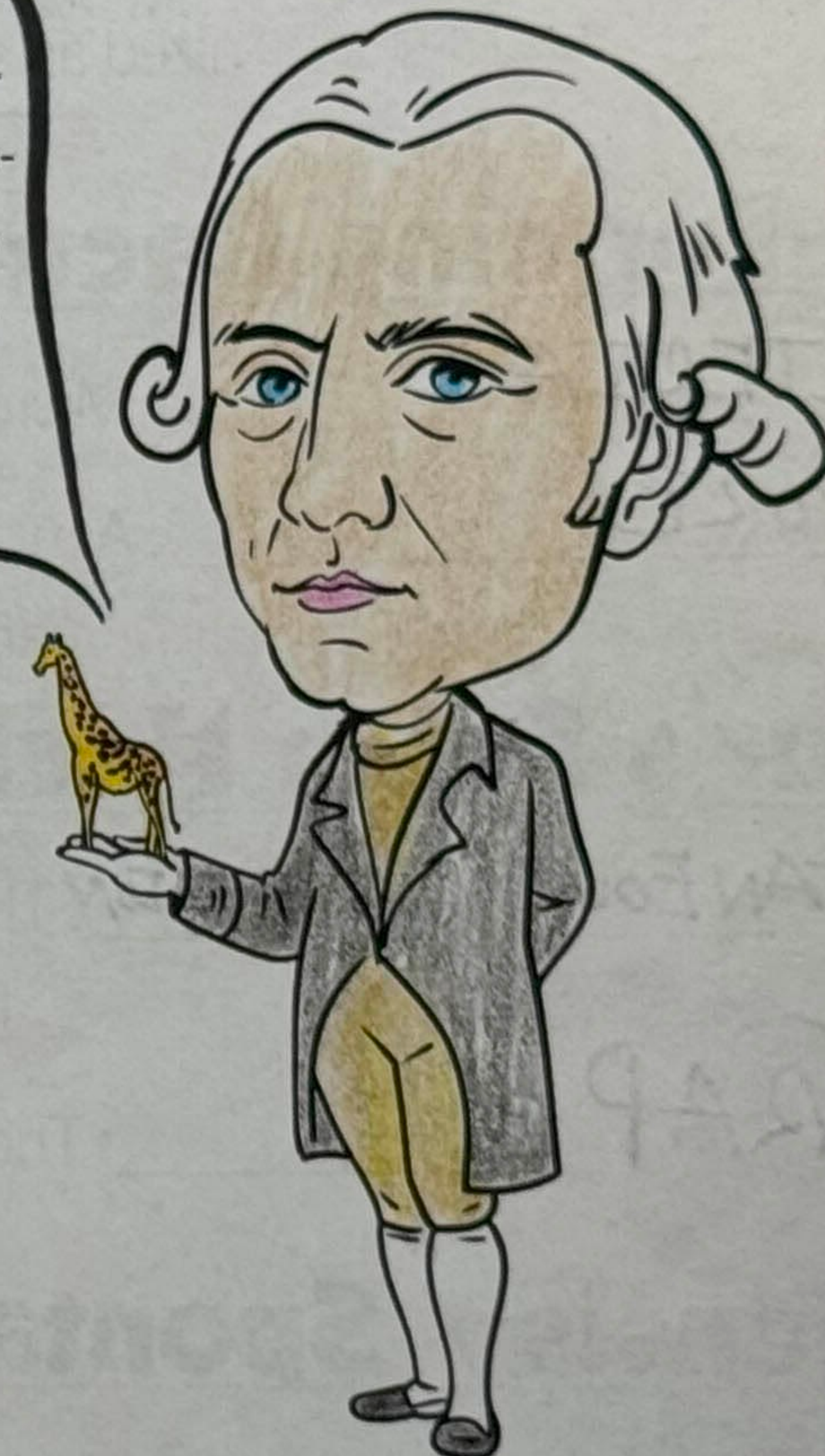
WILLIAM PALEY



1743 - 1805

The marks of design are too strong to be gotten over. Design must have had a designer. That designer must have been a person. That person is GOD.

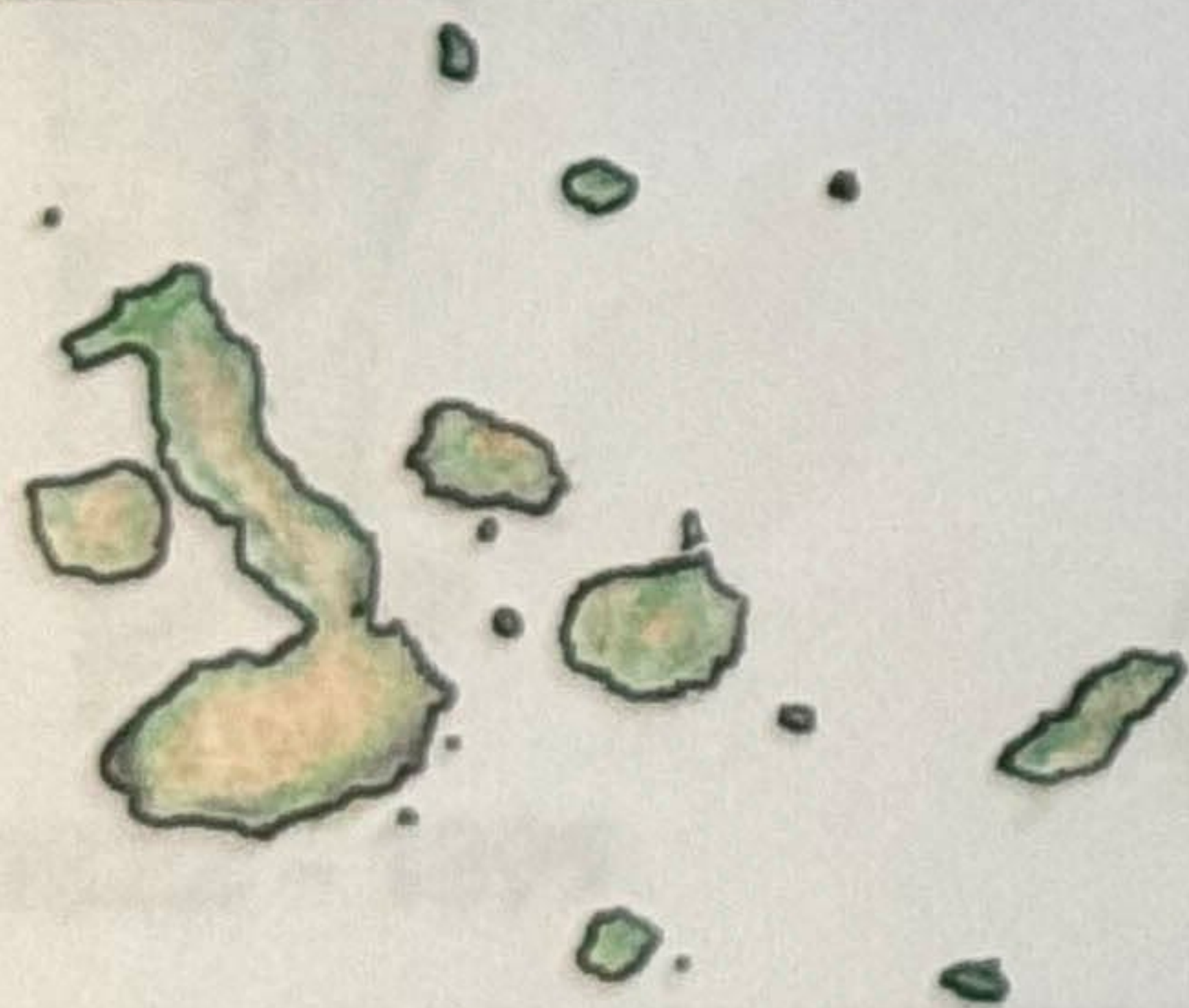
JEAN BAPTISTE LAMARCK



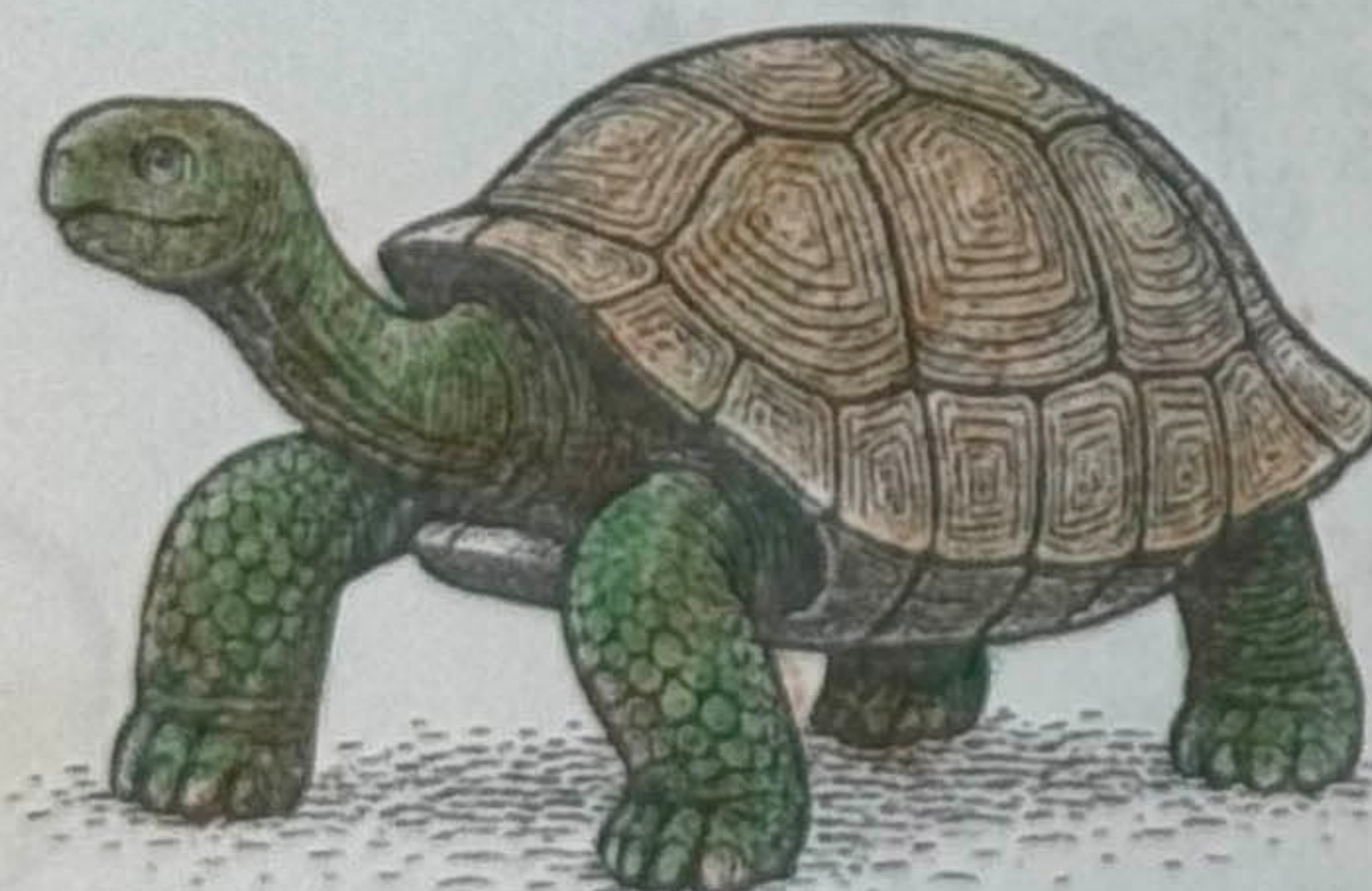
1744 - 1829

As new needs arise, new organs are developed; and with continued use, these organs become progressively adapted to perform their functions.

GALAPAGOS IS.



GIANT TORTOISES



MARINE IGUANA



SUCCESSION



Notes

Galapagos

- 1 GALAPAGOS ISLANDS: A set of 19 islands 1000 miles west of South America.
- 2 GALAPAGOS TORTOISE: The largest plant eating animal native to the islands.
- 3 MARINE IGUANA: The only lizard on earth that feeds in the ocean.

Ecology

- 4 ECOLOGY: The scientific study of interactions between organisms & their environment.
- 5 SUCCESSION: The gradual process of change in the species structure of an ecosystem over time following a disturbance or the creation of new habitat.

Paley

- 6 WILLIAM PALEY: An Anglican clergyman, philosopher and apologist for Christianity; most famous for the watchmaker argument.
- 7 WATCHMAKER ARGUMENT: The complexity of purposefulness of the natural world, like that of a watch, implies the existence of an intelligent designer, namely God.
- 8 FIXITY OF SPECIES: Paley's belief that species were created by God in their present form, and could not change.

Lamarck

- 9 LAMARCK: A French biologist who developed the first comprehensive theory of evolution.
- 10 USE OR DISUSE: The way Lamarck thought animals evolved.

Ex. Giraffe

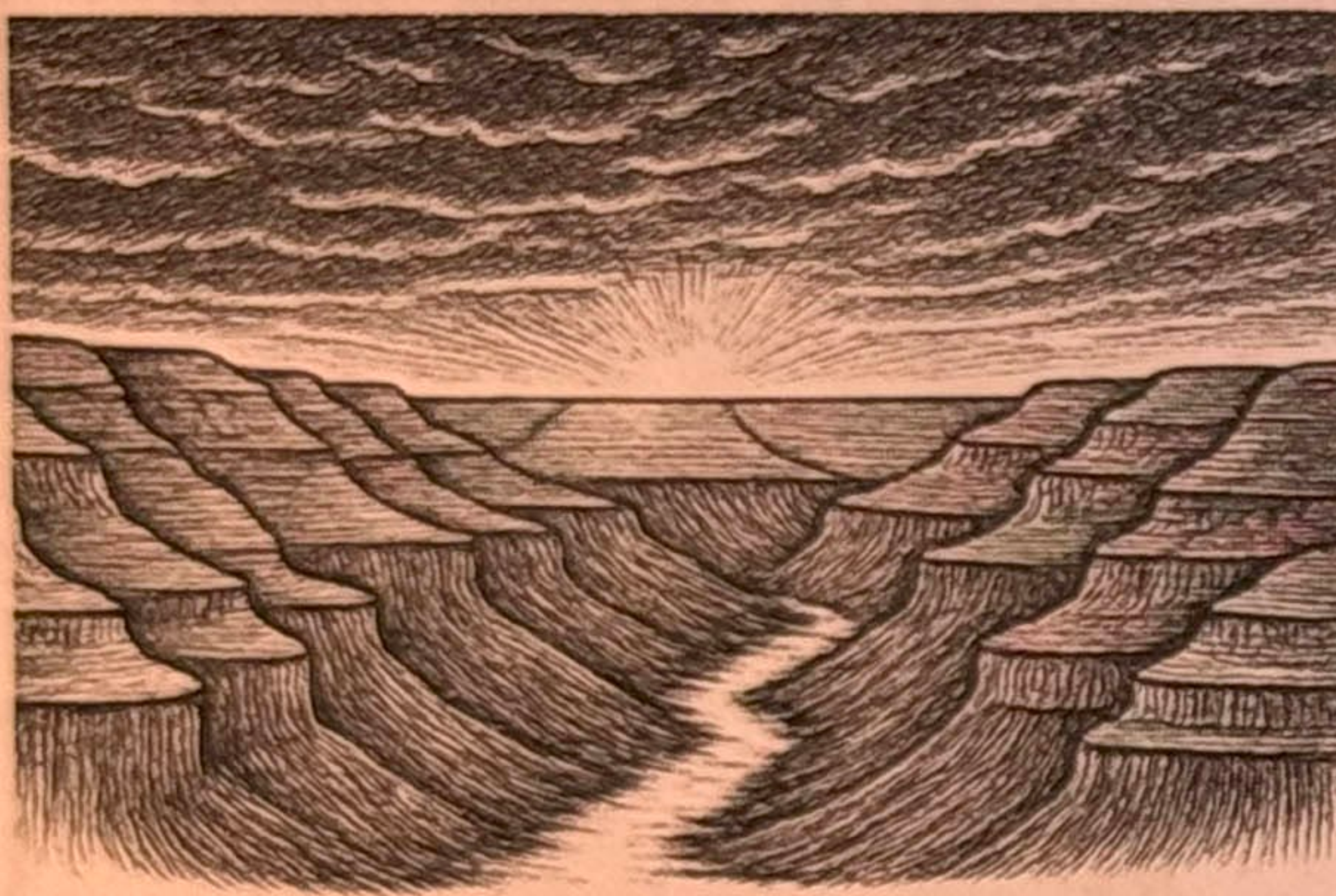
Big Question

How can we think carefully about ideas like Paley's and Lamarck's knowing that science about the past can change—but God's truth does not?

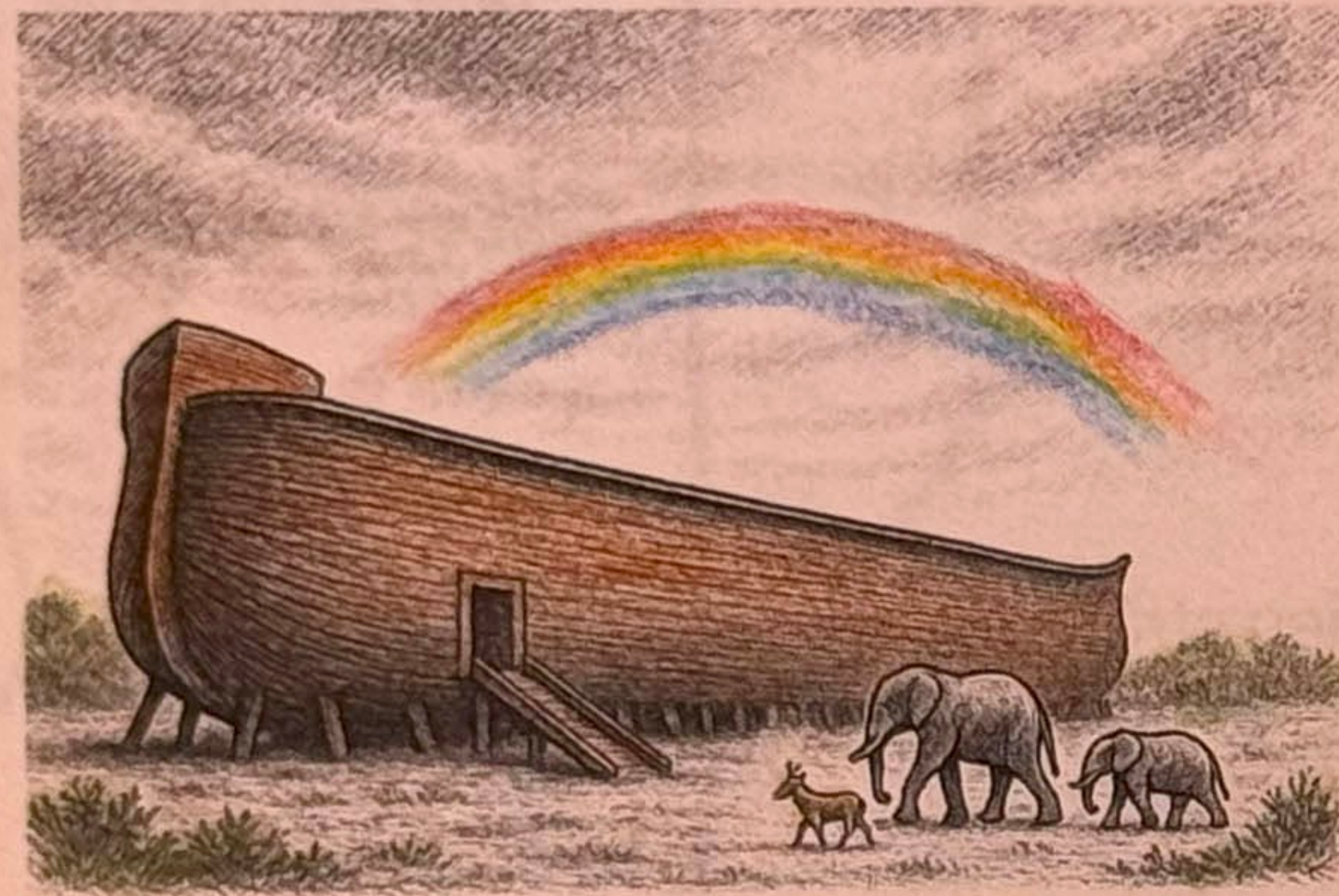
Evolution — What is Bio Lesson 6

Diagrams

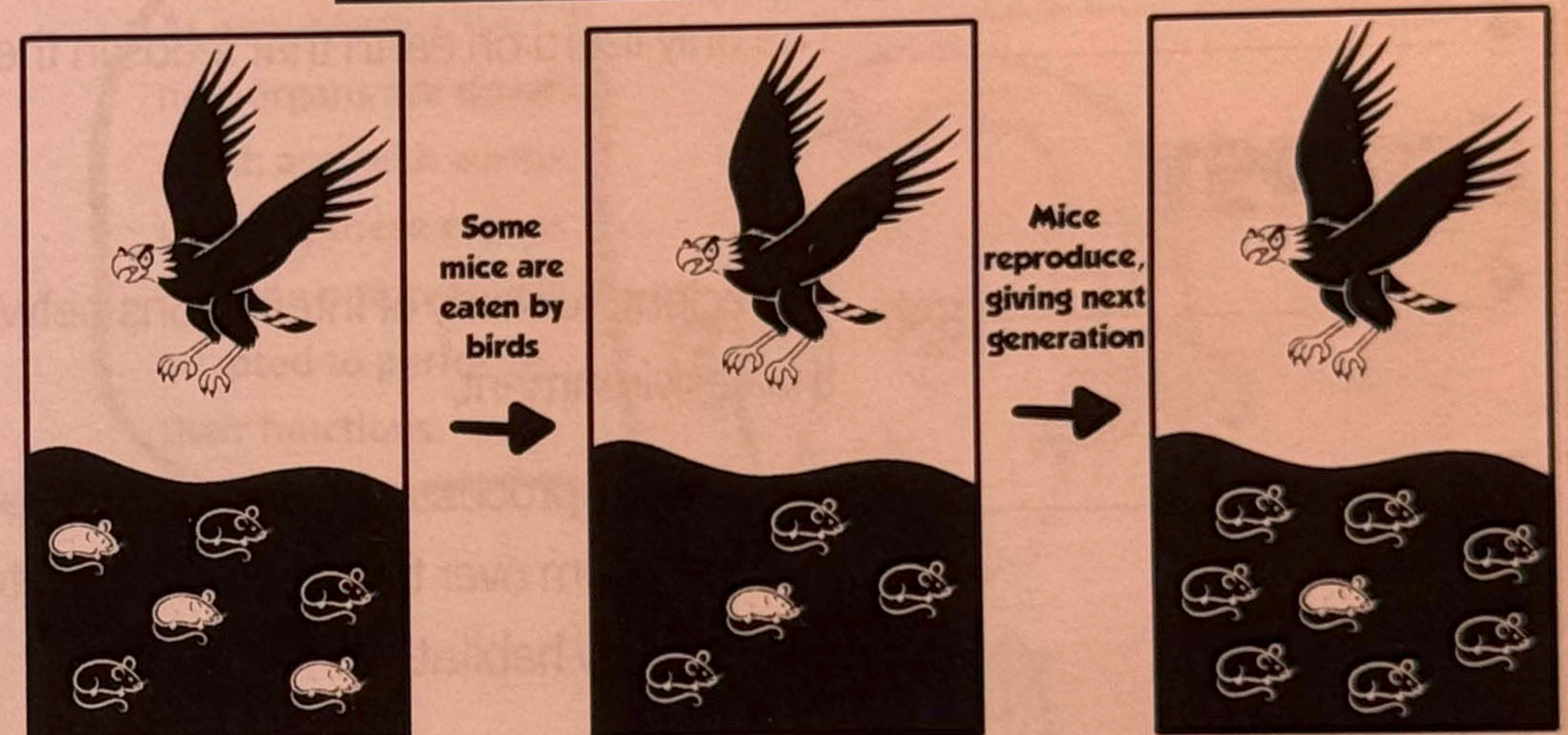
UNIFORMITARIANISM



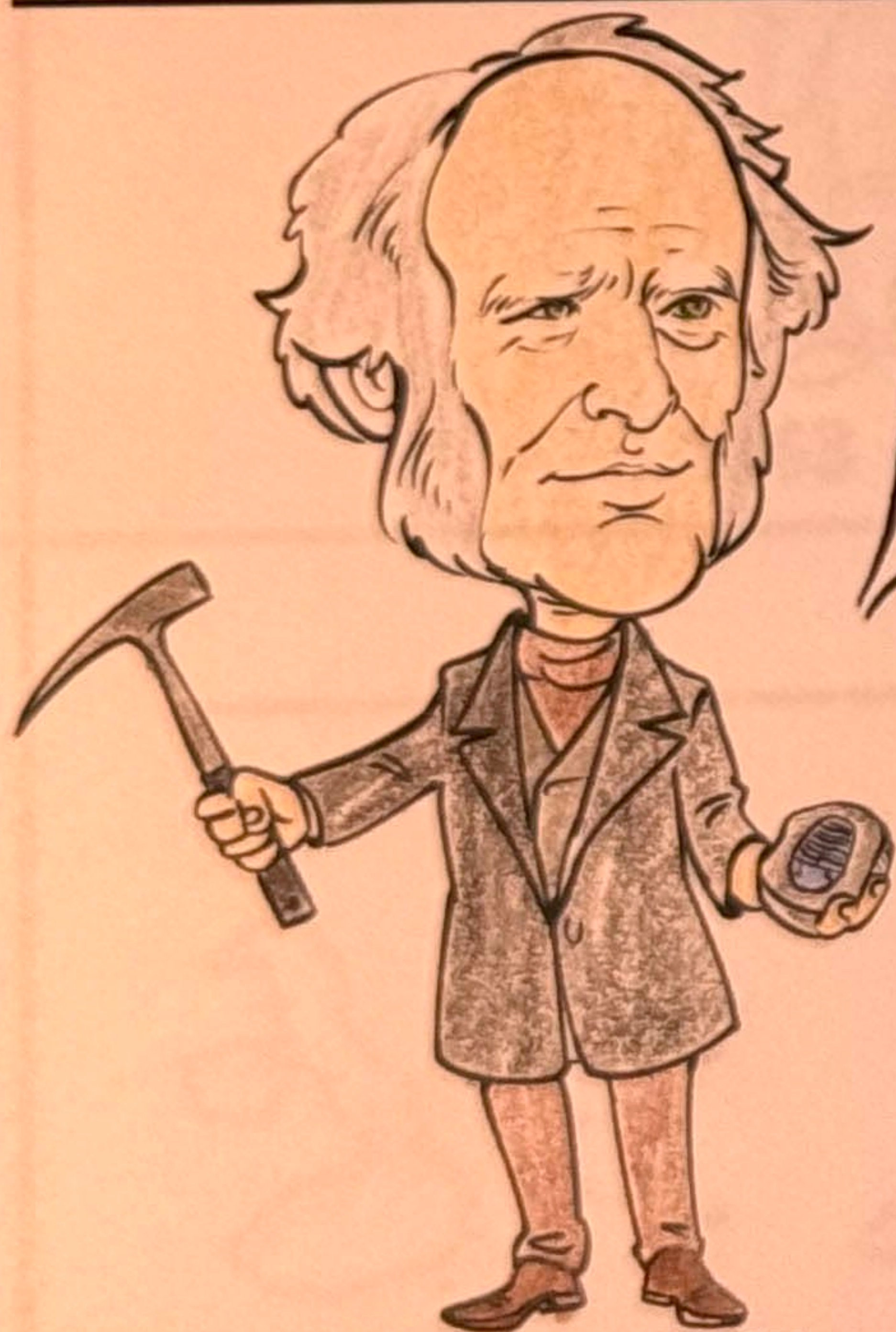
CATASTROPHISM



NATURAL SELECTION



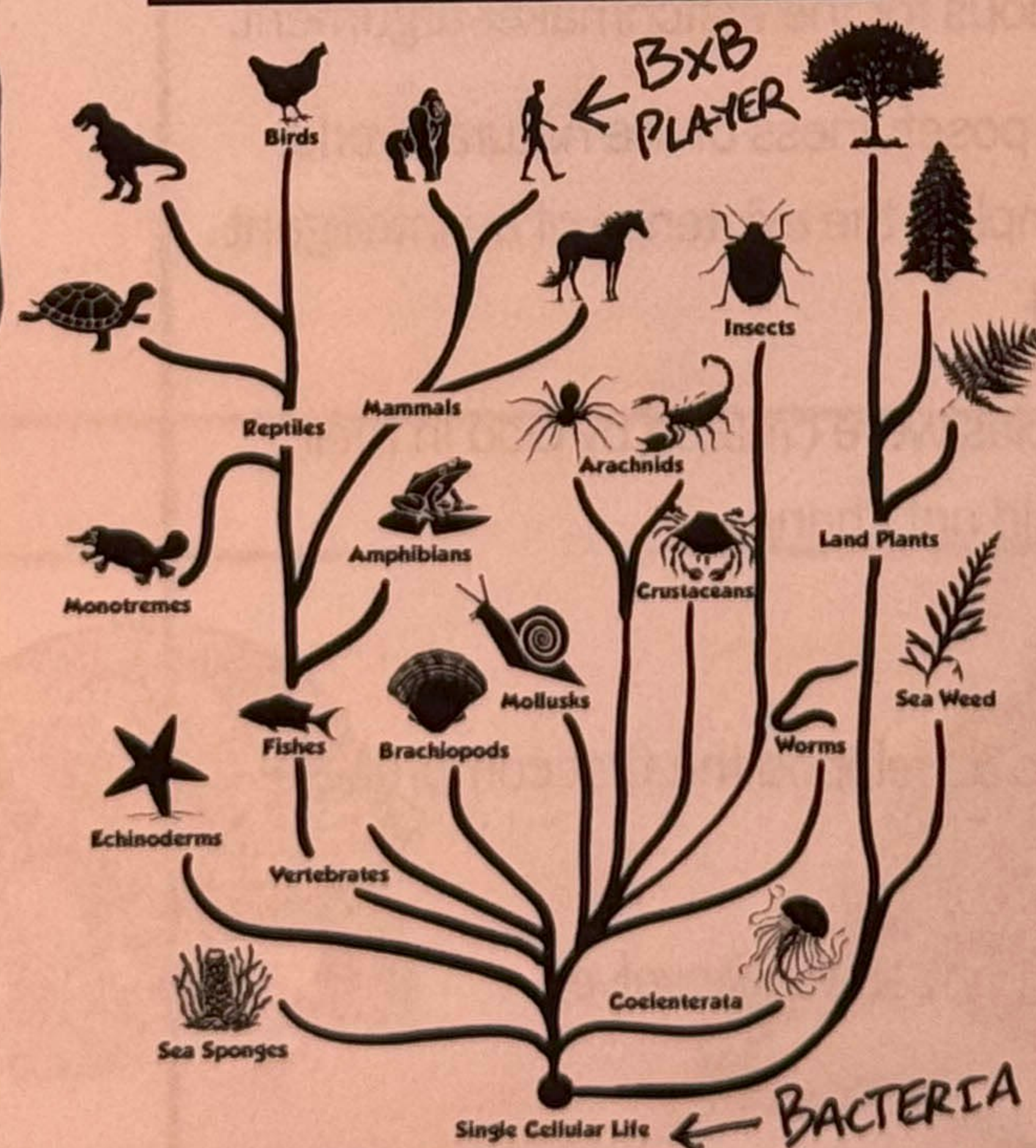
CHARLES LYELL



1797 - 1875

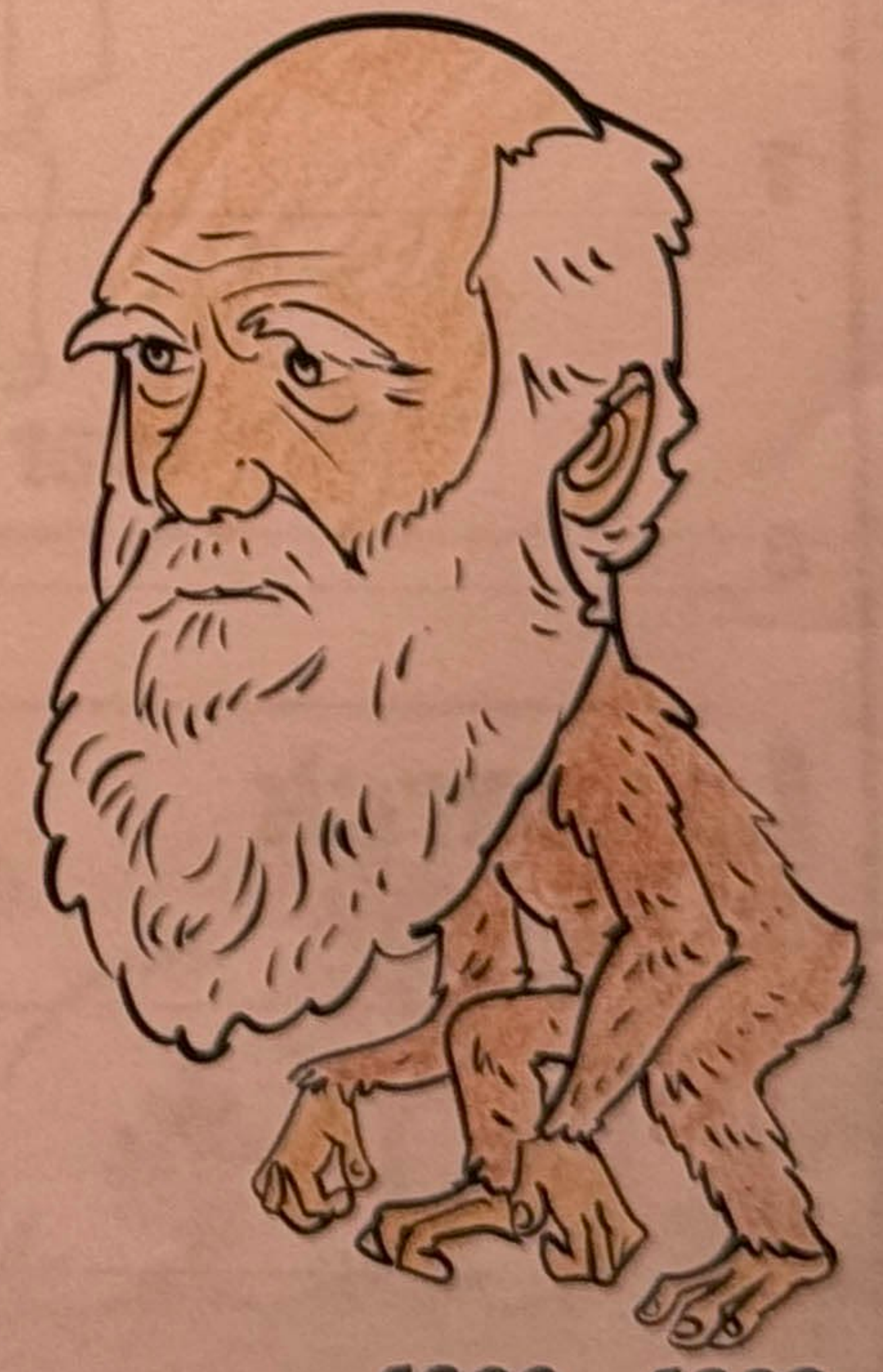
Geologists must therefore abandon the ancient doctrine that all the layers of the earth were formed by a single universal flood.

UNIVERSAL COMMON ANCESTRY



I gradually came to disbelieve in Christianity as a divine revelation.

CHARLES DARWIN



1809 - 1882

Notes

Charles Lyell

- 1 LYELL: He was a geologist who popularized uniformitarianism, which greatly influenced Darwin's thinking.
- 2 GEOLOGY: The study of Earth's composition. AKA Rocks. Fossils, etc...
- 3 UNIFORMITARIANISM: The geologic principle that the forces we observe today, have operated in the same manner, gradually shaping the planet's surface. (The present explains the past.)
- 4 CATASTROPHISM: The geologic principle that the planet's surface was shaped by sudden powerful events like floods & volcanic eruptions.

Charles Darwin

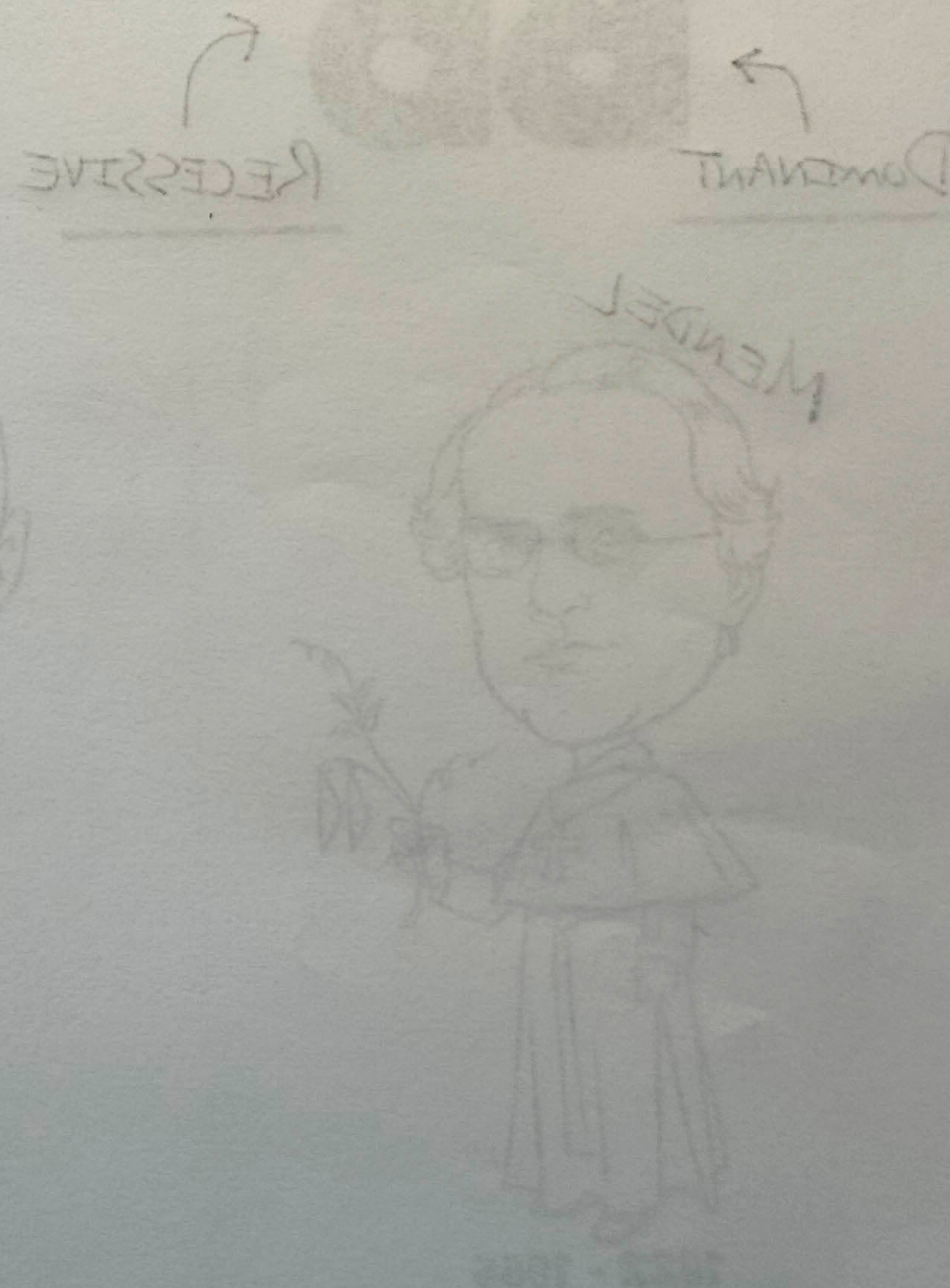
- 5 DARWIN: The father of the theory of evolution. When he was in his 20s he took a 5 year voyage on a ship called the 'Beagle' where he visited many places including the Galapagos.
- 6 ON THE ORIGIN OF SPECIES: After spending much of his life thinking about it, he finally published his ideas about evolution in this book.
- 7 HUMAN EVOLUTION: Later on he published a second more controversial book called the Descent of Man that proposed this idea.

Evolution

- 8 NATURAL SELECTION: Darwin didn't invent the idea of evolution. He is famous because he came up with this idea, the way evolution is thought to happen.
- 9 UNIVERSAL C.A. ^{BYA}: Darwin's other big idea, that all living things evolved from one single common ancestor.
- 10 3.5-4.0 ^{BYA}: The number of years ago when most scientists think microscopic life first appeared on earth.

Big Question

What can we learn from Darwin and Lyell about how easy it is to drift from God when we stop seeing Him as the foundation of truth?



Genetics — What is Bio Lesson 7

Diagrams

GENES

DOMINANT → **Bb** ← RECESSIVE

MENDEL



1822 - 1884

WATSON



1928 -

CRICK



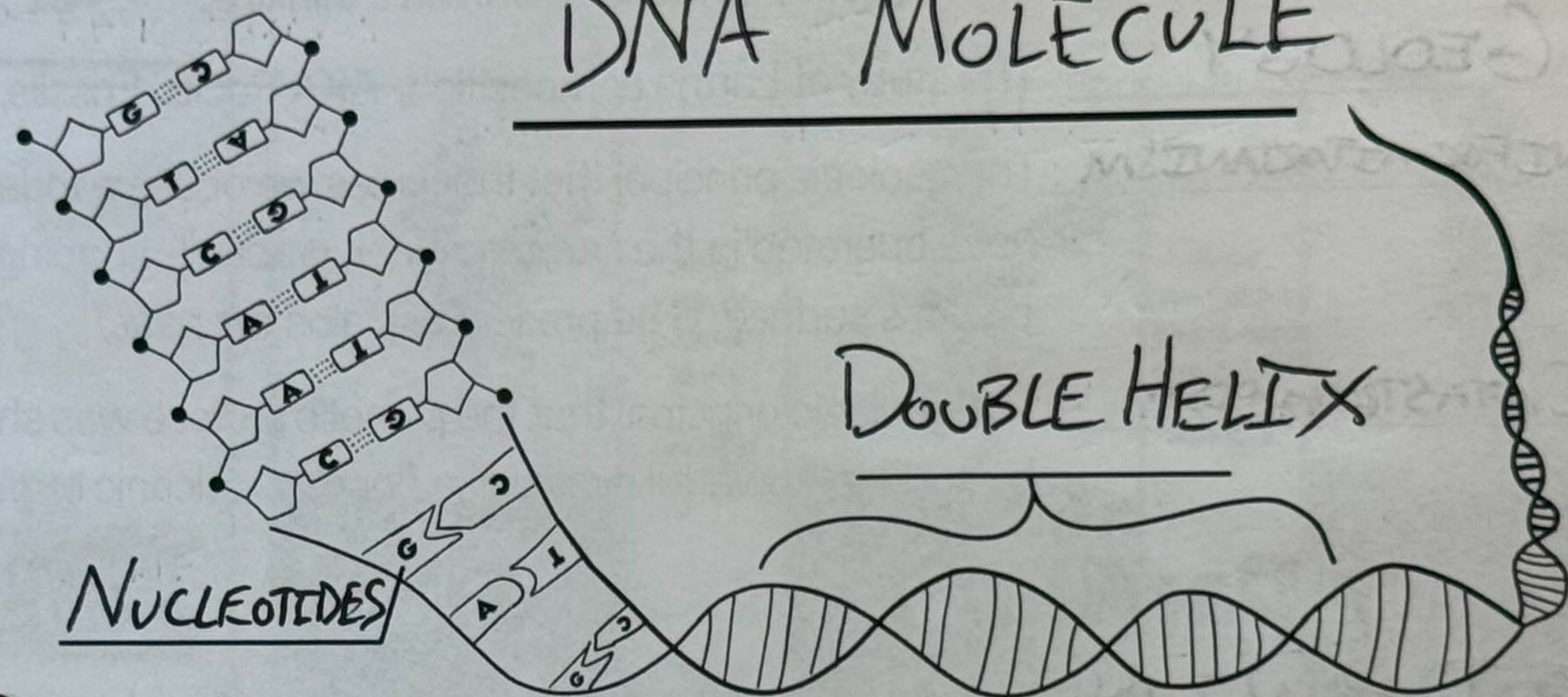
1916 - 2004



FRANKLIN

DOUBLE HELIX

DNA MOLECULE



MEYER



1958 -

Greg

1 M

2 Dom

3 RE

Wats

4 WAT

5 Nuc

Do

6

Step

7 M

8 SP

9

10

Notes

Gregor Mendel

- 1 MENDEL : He is known as the father of genetics, and was the one to figure out dominant and recessive by working on pea plants.
- 2 DOMINANT : The 'gene' that takes over when both are present.
- 3 RECESSIVE : The 'gene' that hides when both are present.

Watson and Crick

- 4 WATSON & CRICK : These two were the first to publish the correct structure for the DNA molecule, and later won a Nobel prize for the discovery.
- 5 NUCLEOTIDES : The Cs, Gs, As and Ts that make up the backbone of the DNA molecule.
- 6 DOUBLE HELIX : The shape of the DNA molecule.

Stephen Meyer

- 7 MEYER : A philosopher of science, author, and leader in the intelligent design movement.
- 8 SPECIFIED : Meyer argues that 'our repeated and uniform experience' is that this kind of information only comes from a mind.
- 9 DNA : Just like written language or computer code, this genetic information must have come from an intelligent designer.
- 10 GOD : As a Christian, this is who Meyer believes the intelligent agent or designer to be.

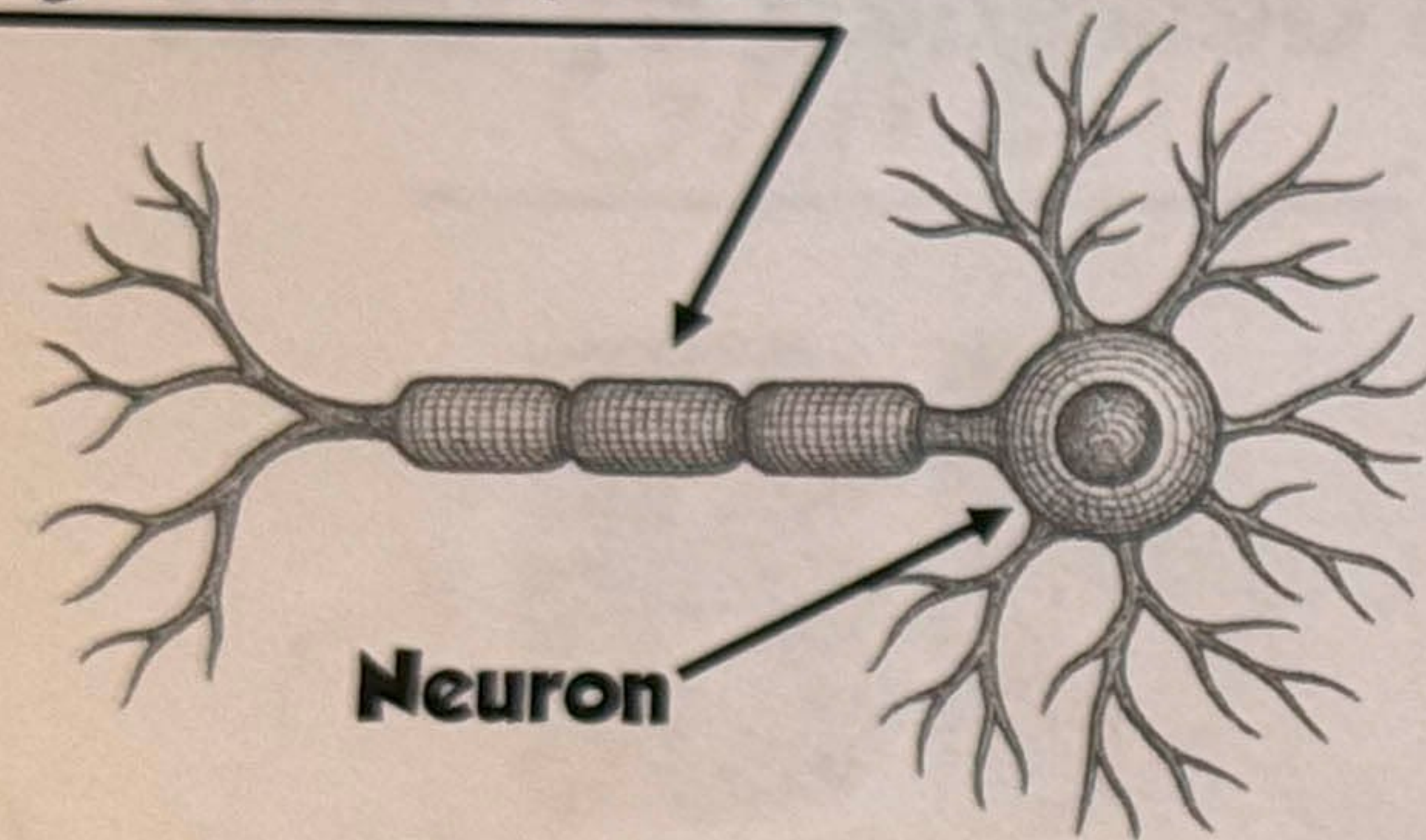
Big Question

How does the information in DNA support the idea that life was designed by God?

Cell Biology — What is Bio Lesson 8

Diagrams

SCHWANN CELL



Neuron

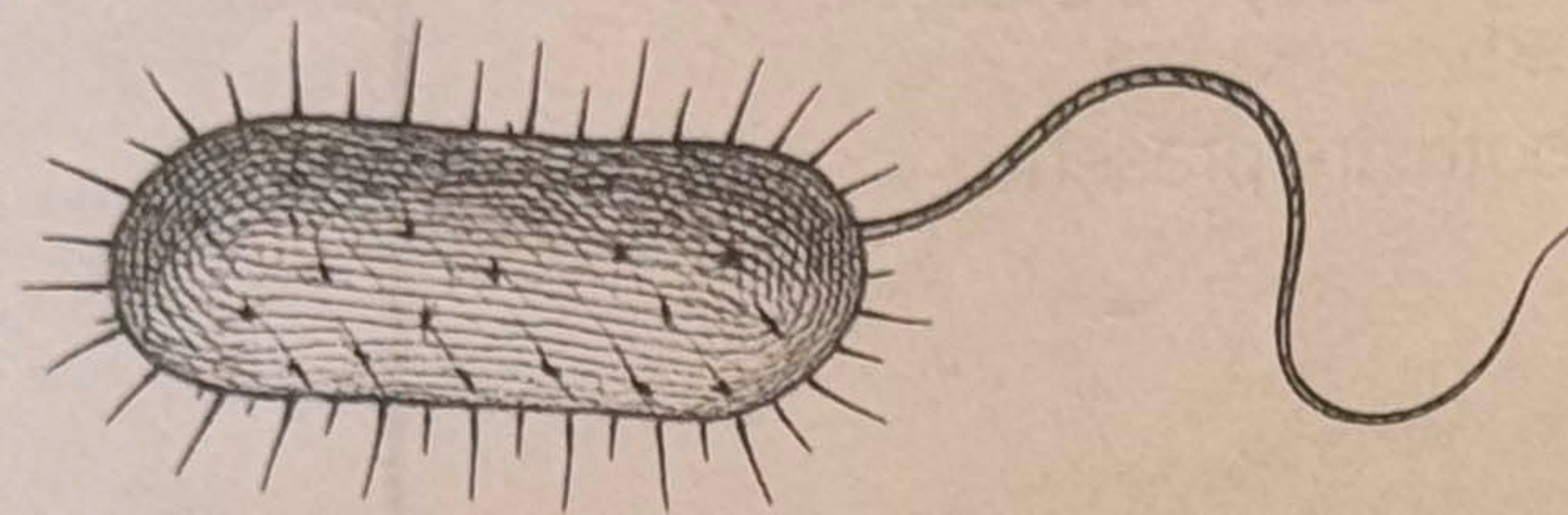
THEODORE SCHWANN



1810 - 1882

To study the laws of nature is to seek the will of God in creation.

BACTERIUM



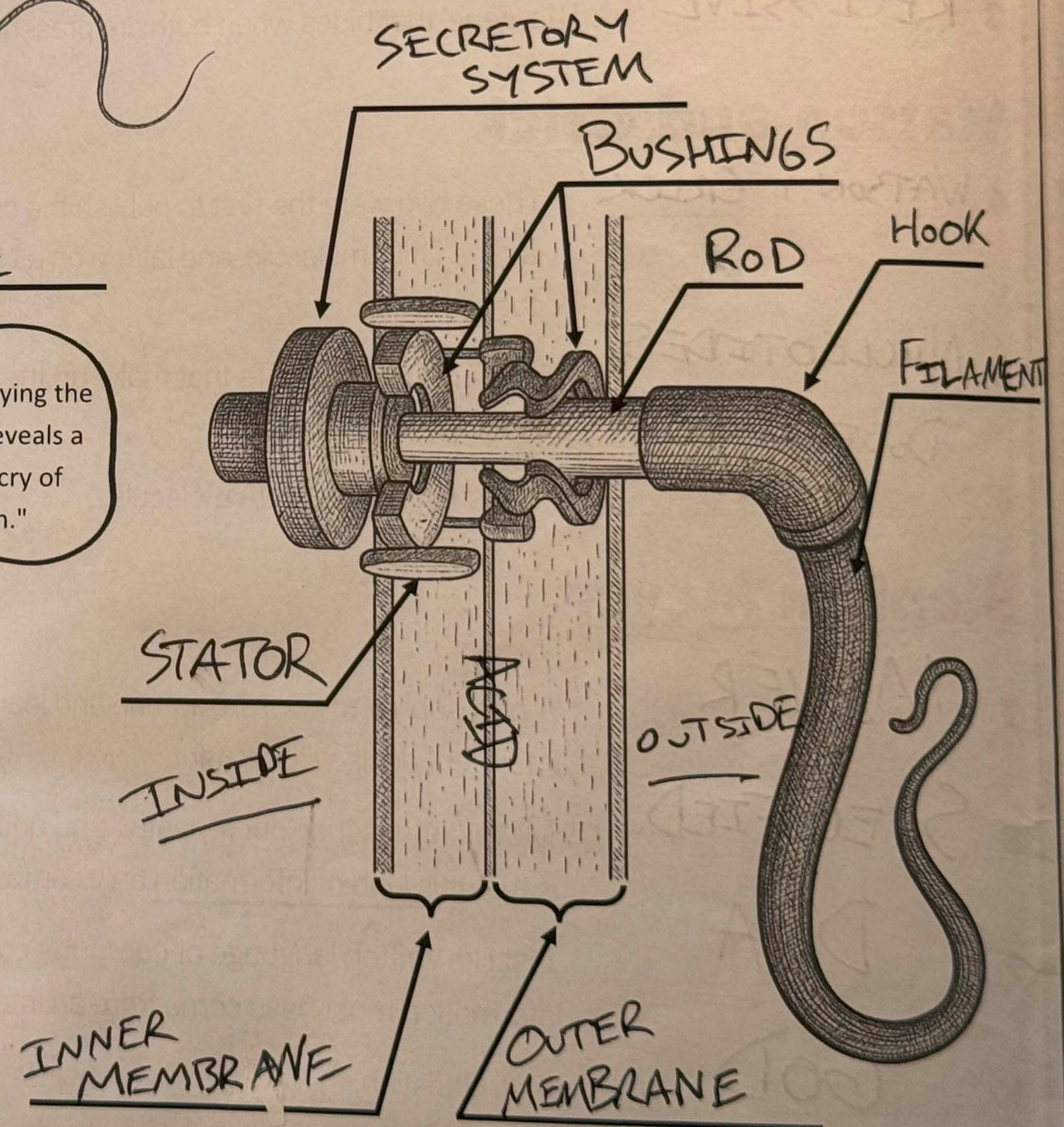
MICHAEL BEHE



1952 -

"Studying the cell reveals a clear cry of design."

FLAGELLUM



Notes

Theodore Schwann

- 1 SCHWANN : He was one of the founding fathers of cell biology and coined the term metabolism.
- 2 SCHWANN CELL : Schwann discovered this cell, that insulates neurons.
- 3 ANIMAL CELLS : In particular Schwann focused on this branch of cell biology, while Schleiden focused on plant cells.

Michael Behe

- 4 DR. BEHE : A biochemistry professor/researcher who was one of the pioneers of the Intelligent Design movement and coined the term 'irreducible complexity'.
- 5 IRREDUCIBLE COMPLEXITY : The idea that certain cellular machines cannot evolve step by step b/c all of their parts must be present and working together at the same time in order to function.
- 6 MOUSE TRAP : The object used as an ex. of irreducible complexity.
- 7 BACTERIAL FLAGELLUM : The micro-motor used as ex. of irreducible complexity.

Flagellum Structure

- 8 MEMBRANE : A layer around a cell.
- 9 STATOR : Stationary part of motor that allows acid through.
- 10 SECRETORY SYSTEM : Allows parts from inside out for assembly of flagellum.
- 11 BUSHINGS : Act as protective rings or bearings reducing friction.
- 12 ROD : Axle; transfers spinning motion to the hook and filament.
- 13 FLOW OF ACID : This is what powers the flagellum to spin.

Big Question

What does learning about tiny complex machines inside of cells tell us about God?