Ollscoil na Gaillimhe
University of Galway

MICROBIOLOGY AT GALWAY

HOW MICROBES MAKE A LIVING

And will save the planet

University *of* Galway.ie

Dr Gavin Collins
School of Biological & Chemical Sciences

A **MICROBIOLOGY** lecture for **Orientation Week**, 2024

Microbiology at Galway

Dr Gavin Collins

TODAY'S SEMINAR

- 1st year Biology
- 2nd/3rd/4th year Microbiology

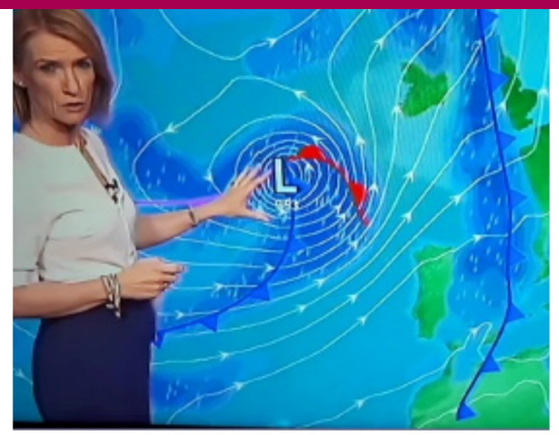
- Study Biology in 1st Year
- Follow the **Microbiology** pathway

Ollscoil na Gaillimhe
University of Galway

SCIENTISTS are required everywhere

CAREERS IN SCIENCE ARE AS VARIED AS THEY ARE MANY

What makes each of these people a scientist is their **CORE SKILLS**








Ollscoil na Gaillimhe
University of Galway

If you have an enquiring mind…

*… and would like to **develop the core skills of Science,** and access a **diverse range of fascinating careers…***

… then a B.Sc. may suit you

Ollscoil na Gaillimhe
University of Galway

33 ways to STUDY SCIENCE

Our main BSc

GY301

‘Science’ at University of Galway

A course with lots of choice, but which results in a specialist degree

20 pathways to specialism

- Botany and Plant Science
- Chemistry
- Computing
- Data Science
- Earth and Ocean Sciences
- Mathematics
- Mathematics and Applied Mathematics
- Mathematics and Computing
- Mathematical Studies and Computing
- Medicinal Chemistry *
- Microbiology
- Pharmacology*
- Physics and Applied Physics
- Physics and Climate Physics
- Physiology *
- Plant and Agri-Biosciences
- Zoology
- Anatomy*
- Applied Mathematics
- Biochemistry

* Limited Places

Our range of other BSc degrees

Decide at the beginning what your specialism will be

13 Specialist degrees

- Agricultural Science
- Biomedical Science
- Bio-pharmaceutical Chemistry
- Biotechnology
- Earth and Ocean Sciences
- Environmental Health and Safety
- Environmental Science
- Financial Maths & Economics
- Genetics & Genomics
- Marine Science
- Mathematical Science
- Physics with options (Applied, Astro, Biomedical, Theoretical, Climate)
- Computer Science & Information Technology

GY301, BSc Science:

Flexibility to specialise as you study

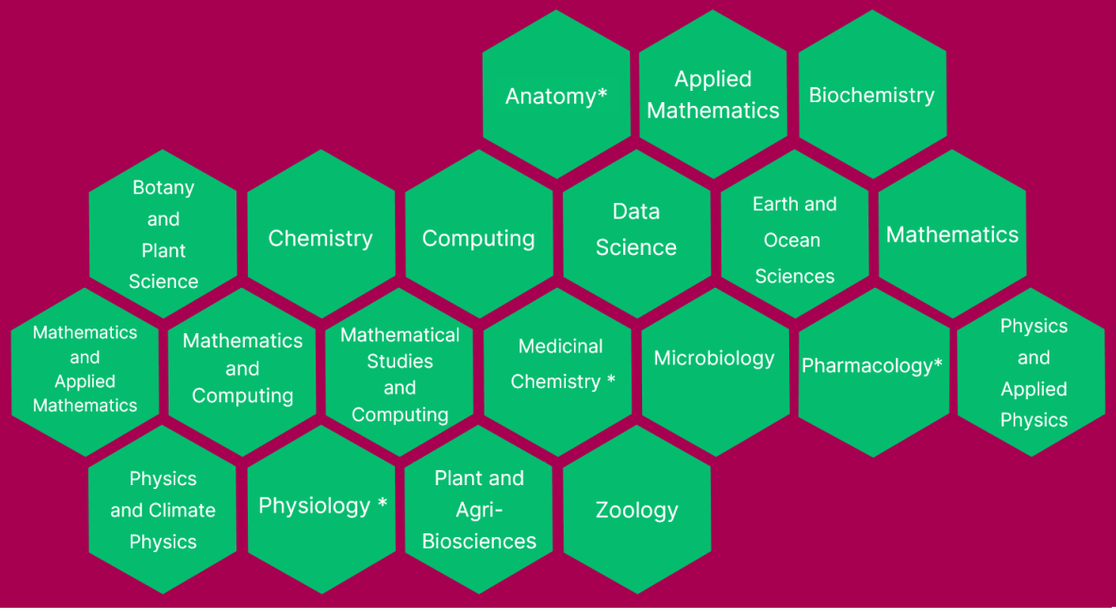
YEAR 1 — YEAR 2 — YEAR 3 — YEAR 4

Study 4 introductory subjects

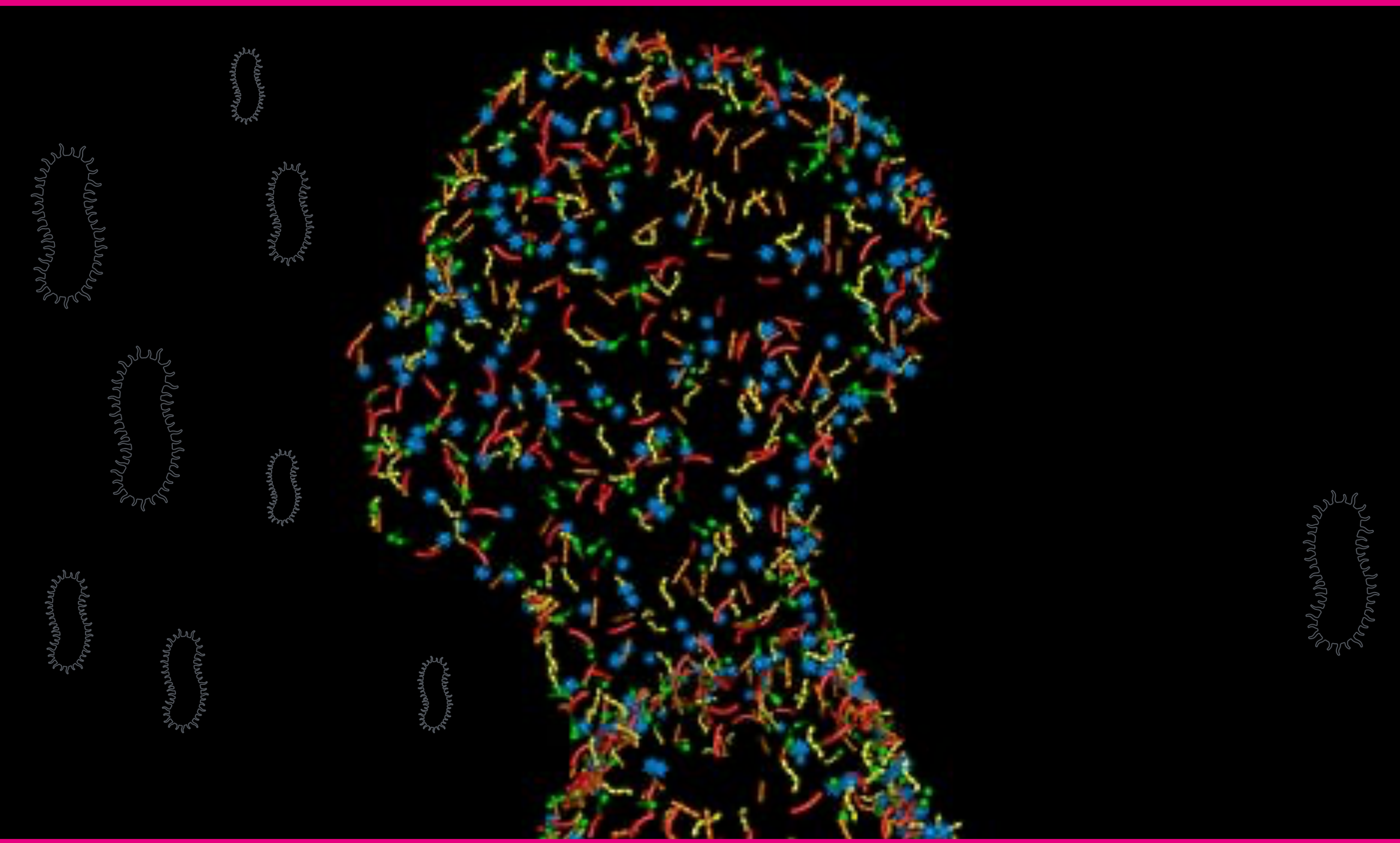
Choose 3 pathways (from 20)

Keep 2 of your pathways

1 major specialism: your degree

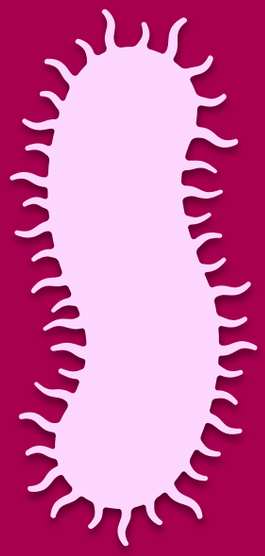


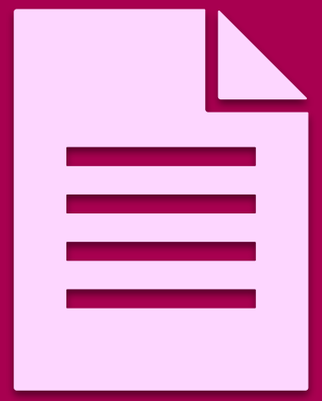
Microbes are *everywhere*



Microbes are *everywhere*

But, what do people *think about* microbes?





Microbes in the news

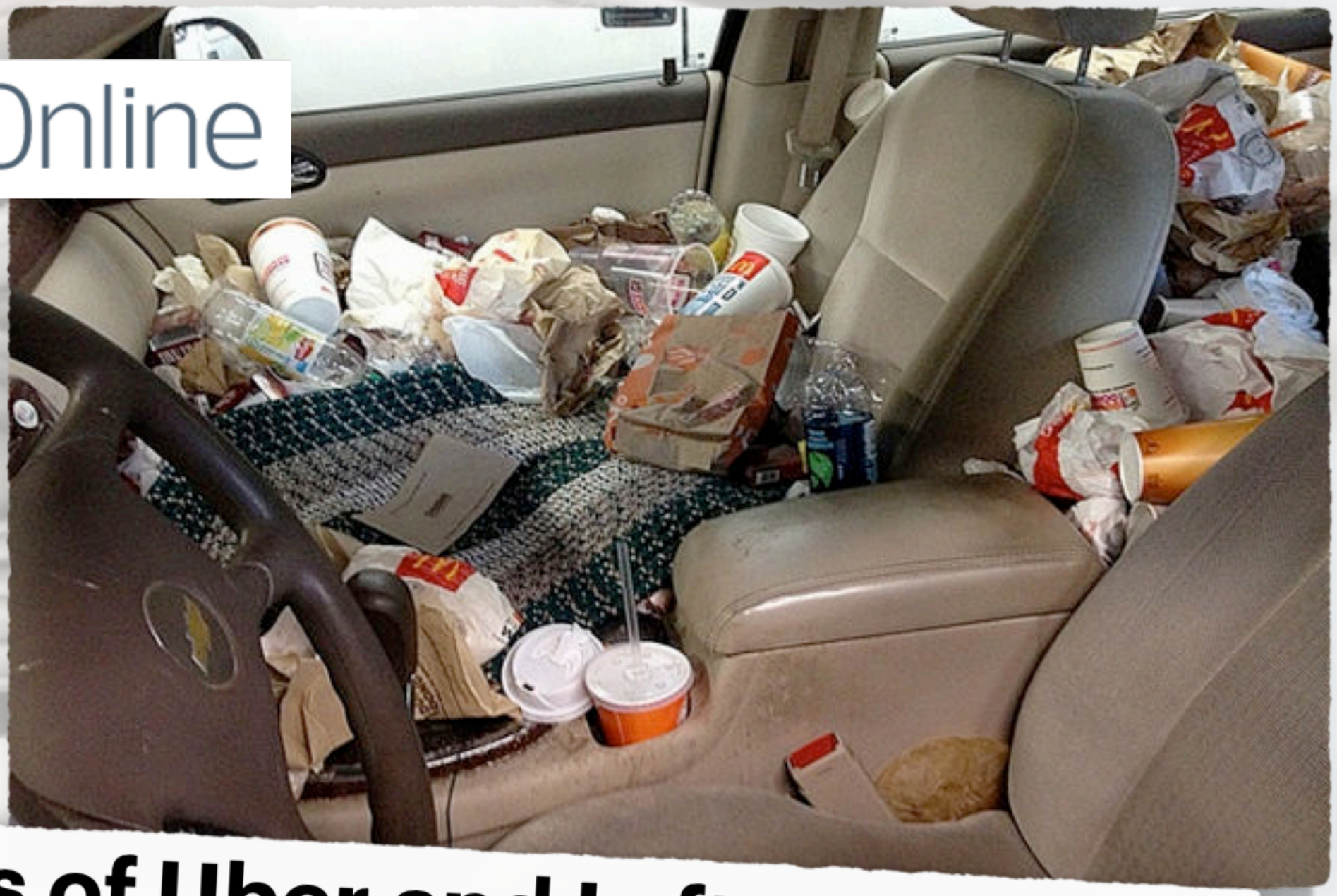
Mail Online

Mobile phones are seven times dirtier than TOILET SEATS, finds new study (and those with leather cases are even filthier!)

Mobile phones have 18 times more bacteria than toilet handle

By ANDREW LEVY FOR THE DAILY MAIL
UPDATED: 08:51, 30 July 2010

Mail Online



Backseats of Uber and Lyft cars 'have 35,000 times more germs than the average TOILET SEAT and 219 times as many as the average taxi'

Mail Online

Gloves contain five times as much bacteria as a toilet seat

Mail Online

How clean is your car? Steering wheels have nine times more germs than public toilet seat

By DAILY MAIL REPORTER
UPDATED: 20:00, 4 May 2011

Daily Mail

Sensational Toilets Issue

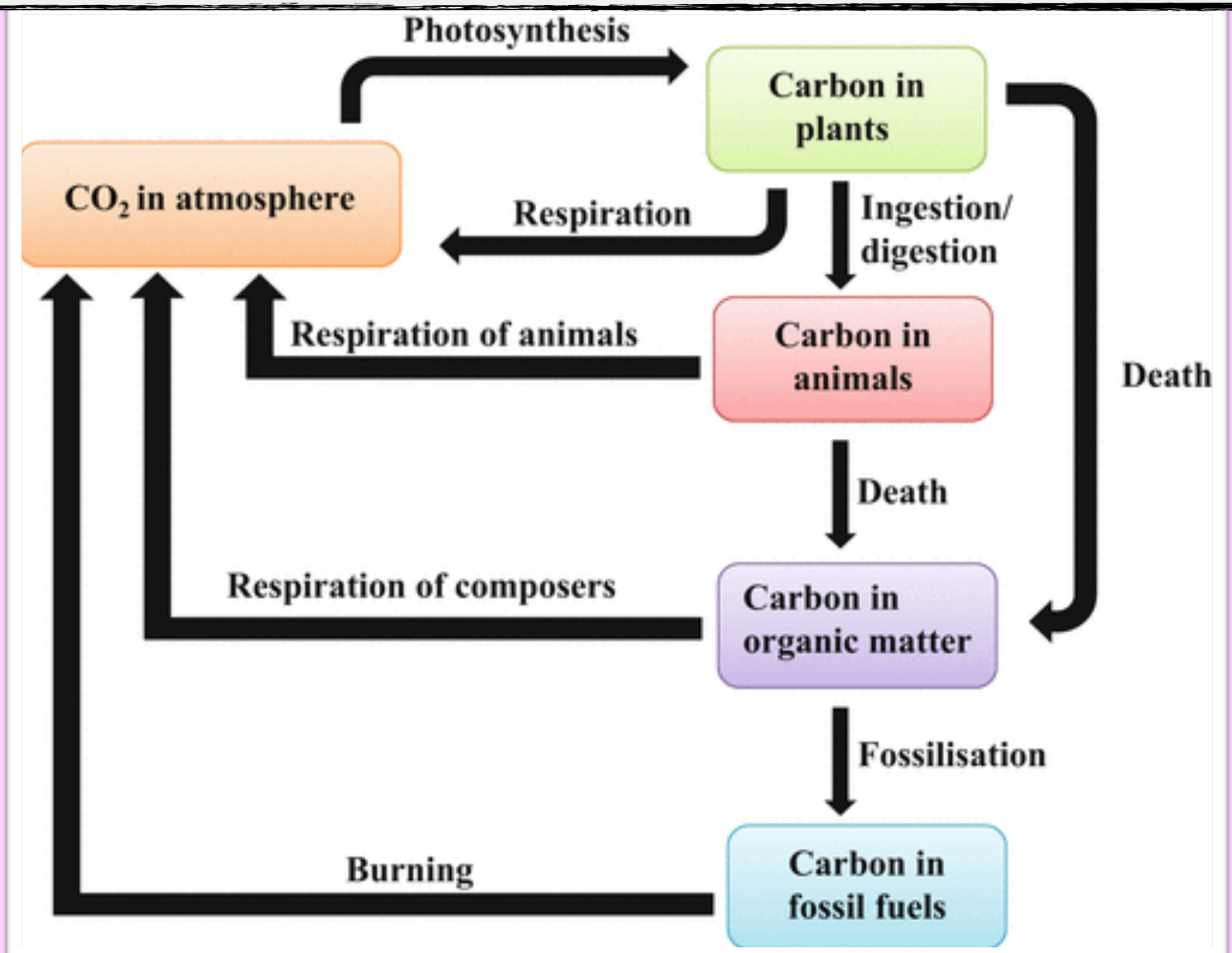
OH MY GOD!

None of that is surprising

- Toilets are cleaned more than watches, carpets, phones, make-up bags, sponges, gyms, desks, keyboards or Uber cars! Big deal!!
- **Bacteria are everywhere.** That's OK!
- **Most are not pathogenic.** Phew!
- **Microbes are mis-understood.**
- ***You*** should become experts and tell everyone about it

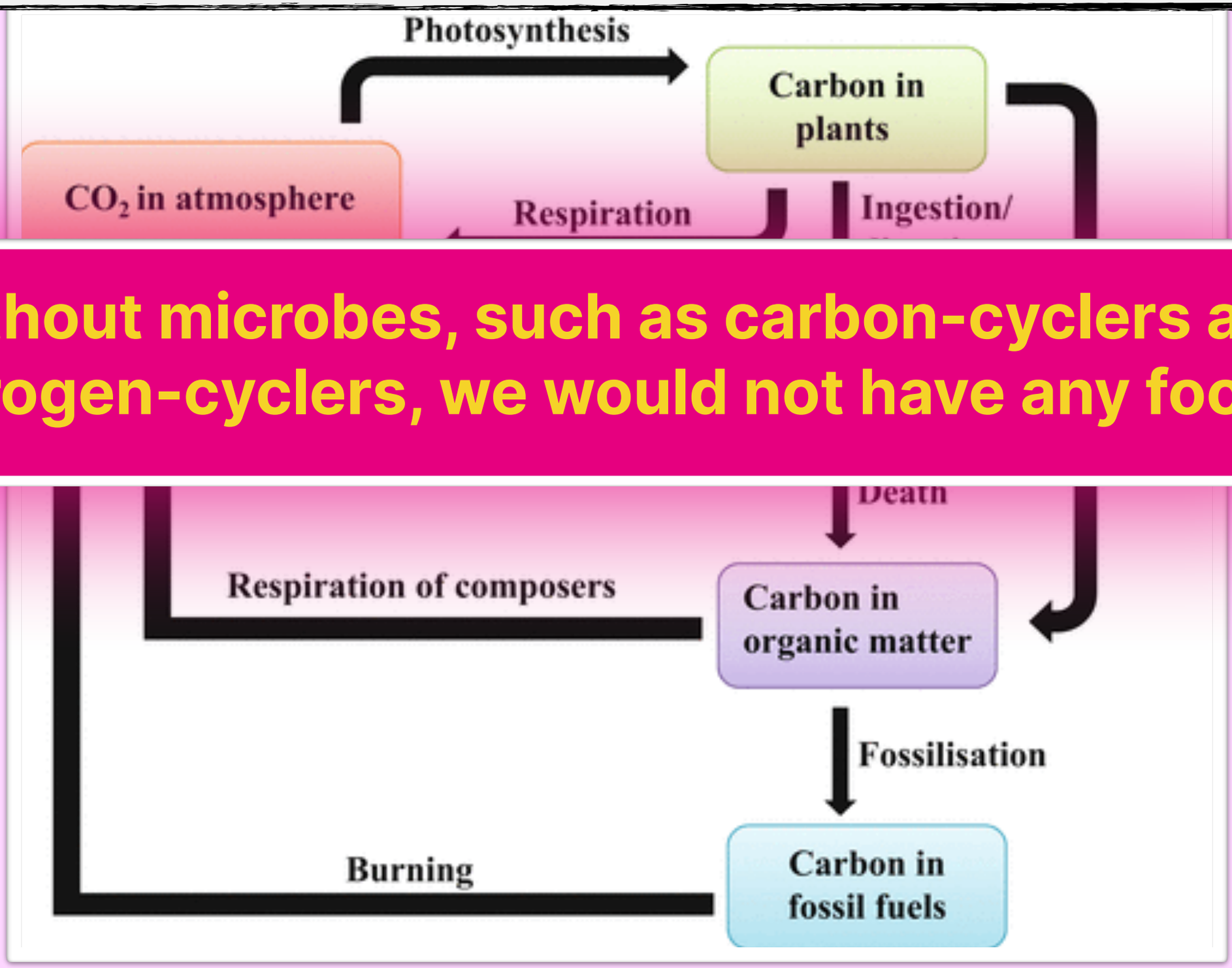
But, microbes are also useful!

THEY'RE ESSENTIAL FOR PRODUCTION & DECOMPOSITION



But, microbes are useful

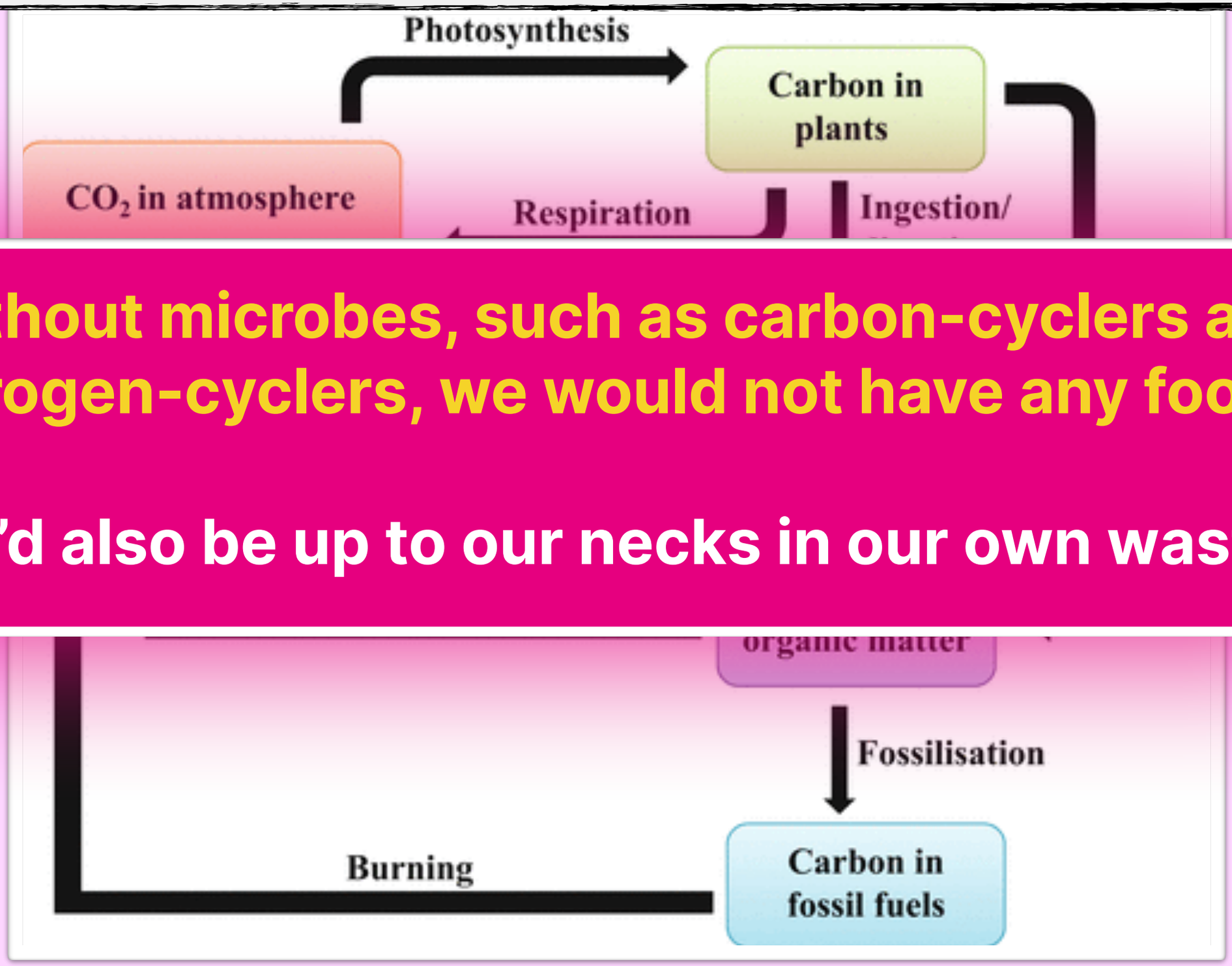
THEY'RE ESSENTIAL FOR PRODUCTION & DECOMPOSITION



Without microbes, such as carbon-cyclers and nitrogen-cyclers, we would not have any food.

But, microbes are useful

THEY'RE ESSENTIAL FOR PRODUCTION & DECOMPOSITION



Without microbes, such as carbon-cyclers and nitrogen-cyclers, we would not have any food.

We'd also be up to our necks in our own waste.

THERE ARE CHALLENGES, of course

e.g., ANTIMICROBIAL RESISTANCE…

….BUT, MOST ARE NOT PATHOGENS, AND ARE VERY USEFUL

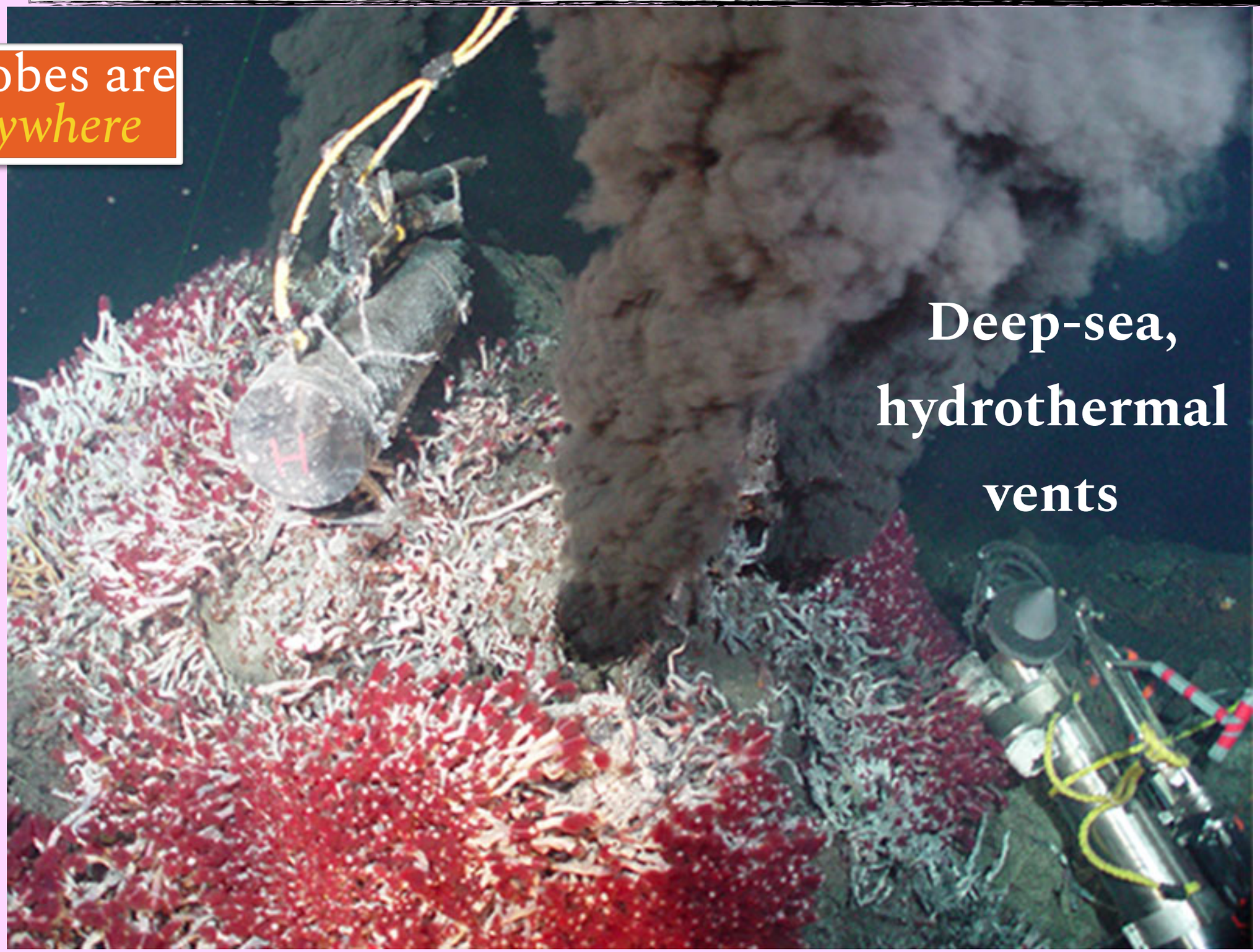
THEY’RE EVEN FOUND IN THE MOST EXTREME PLACES

Microbes are *everywhere*

Hot springs

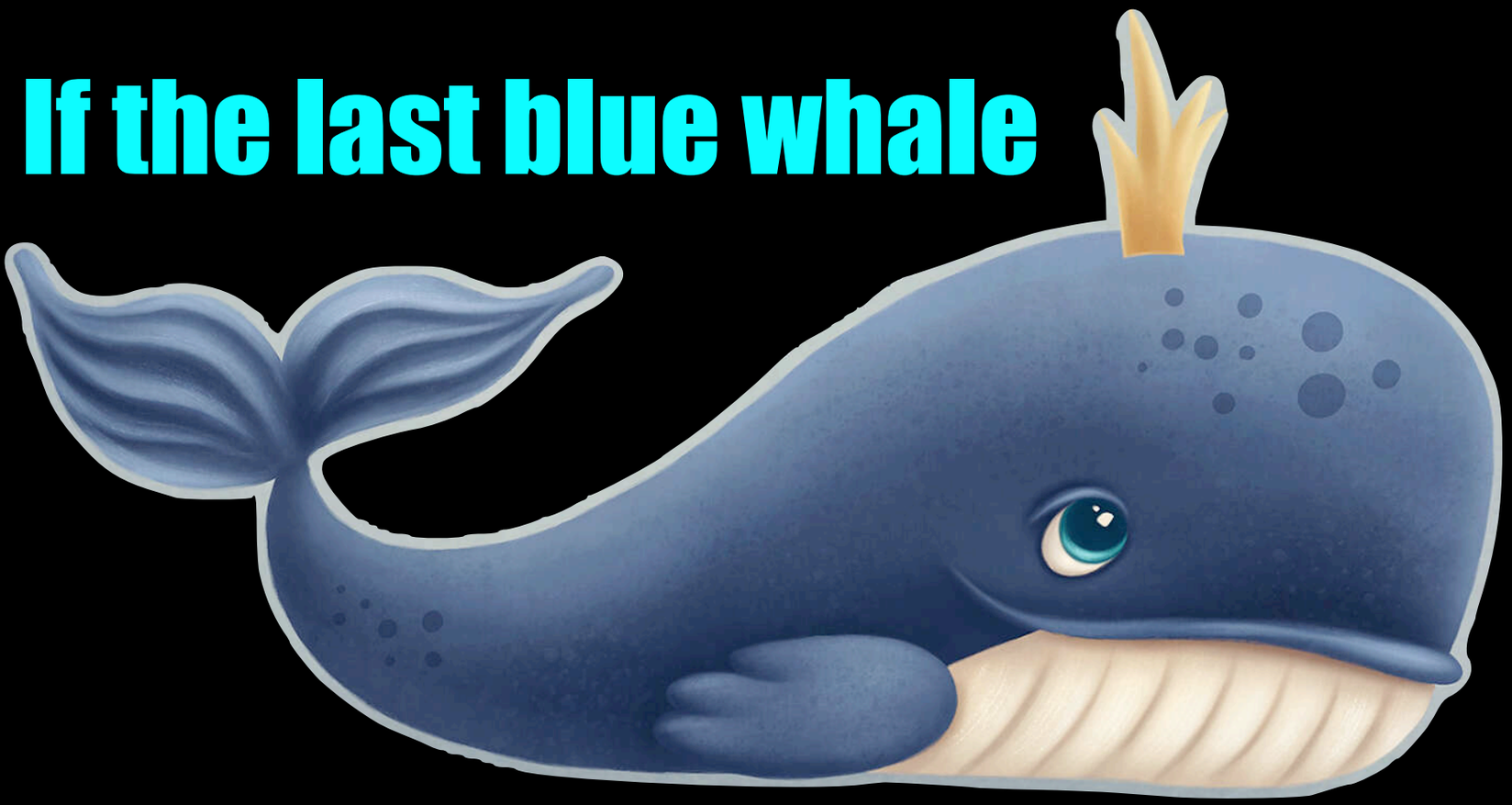
THEY'RE EVEN FOUND IN THE MOST EXTREME PLACES

Microbes are *everywhere*

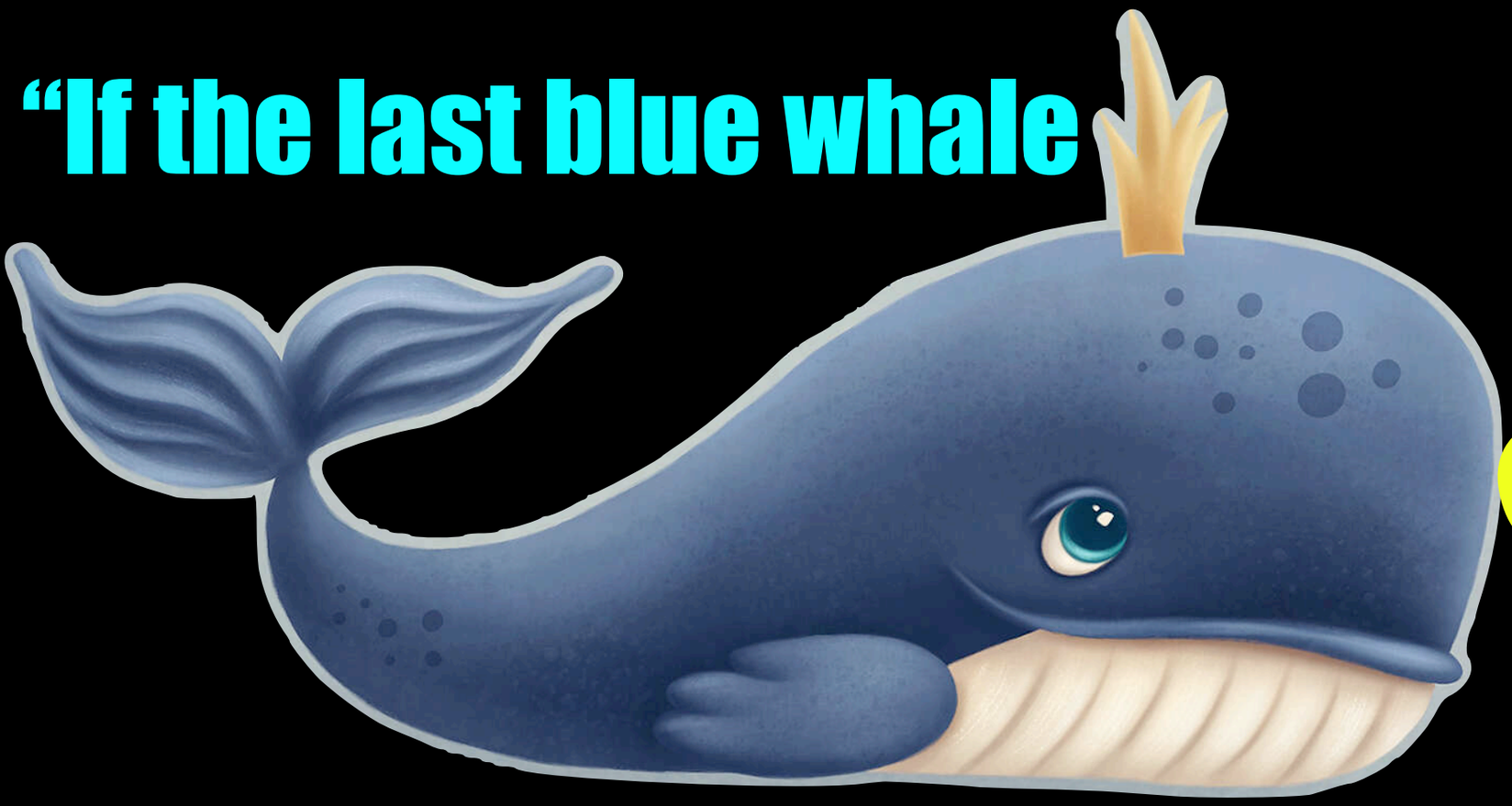


....AND HAVE VERY USEFUL POTENTIAL

If the last blue whale

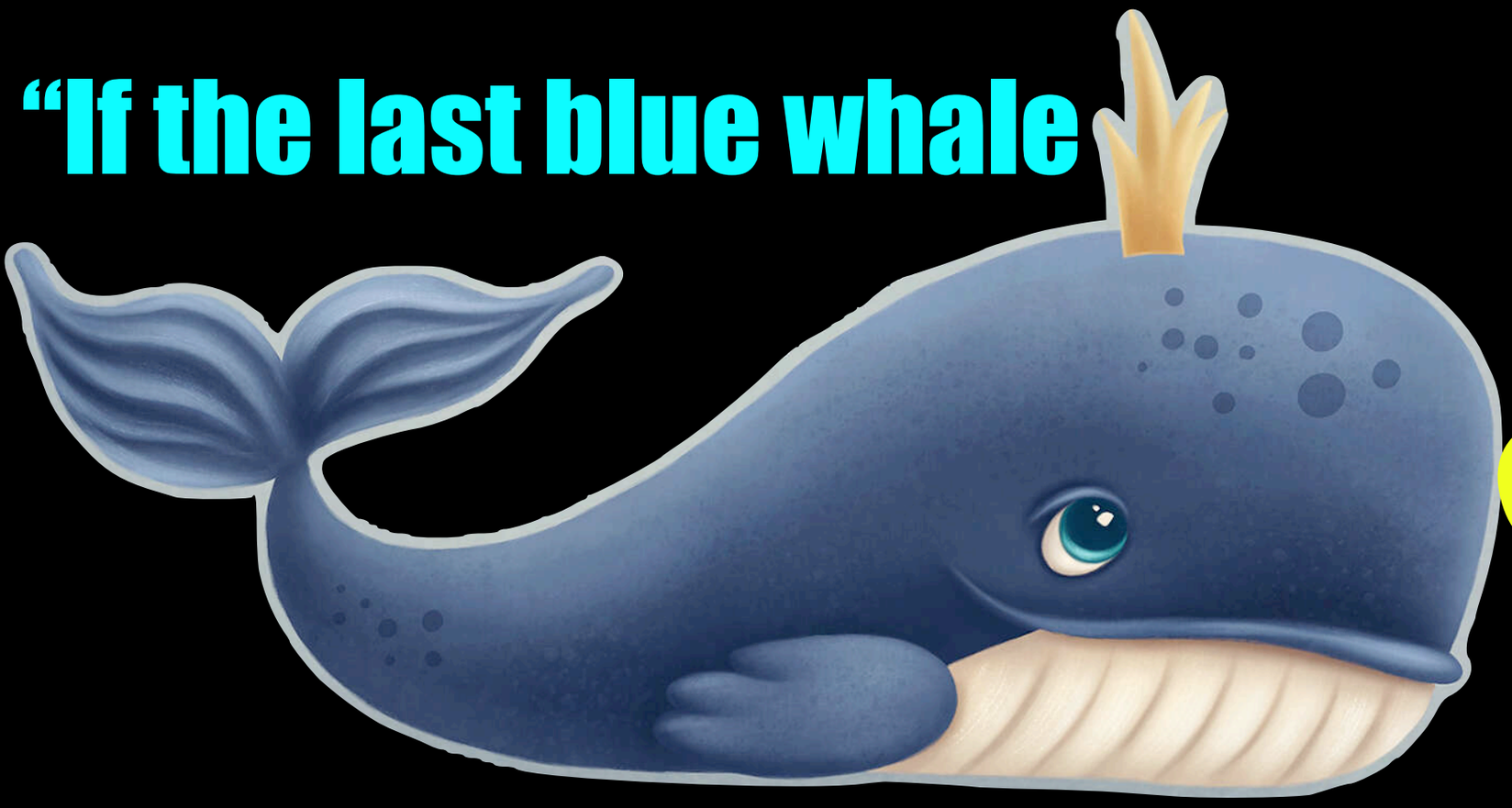


“If the last blue whale



CHOKED
to
DEATH

“If the last blue whale



CHOKED
to
DEATH

on the
LAST
panda

...it would be disastrous...

...it would be disastrous...

...but not the end of the world.

But if we accidentally poisoned the last two species of ammonia oxidizers, that would be another matter.

But if we accidentally poisoned the last two species of ammonia oxidizers,

that would be another matter.

IT COULD BE HAPPENING RIGHT NOW, AND WE WOULDN'T EVEN KNOW

And so,

microbes are useful!

Why would you want to study Microbiology?

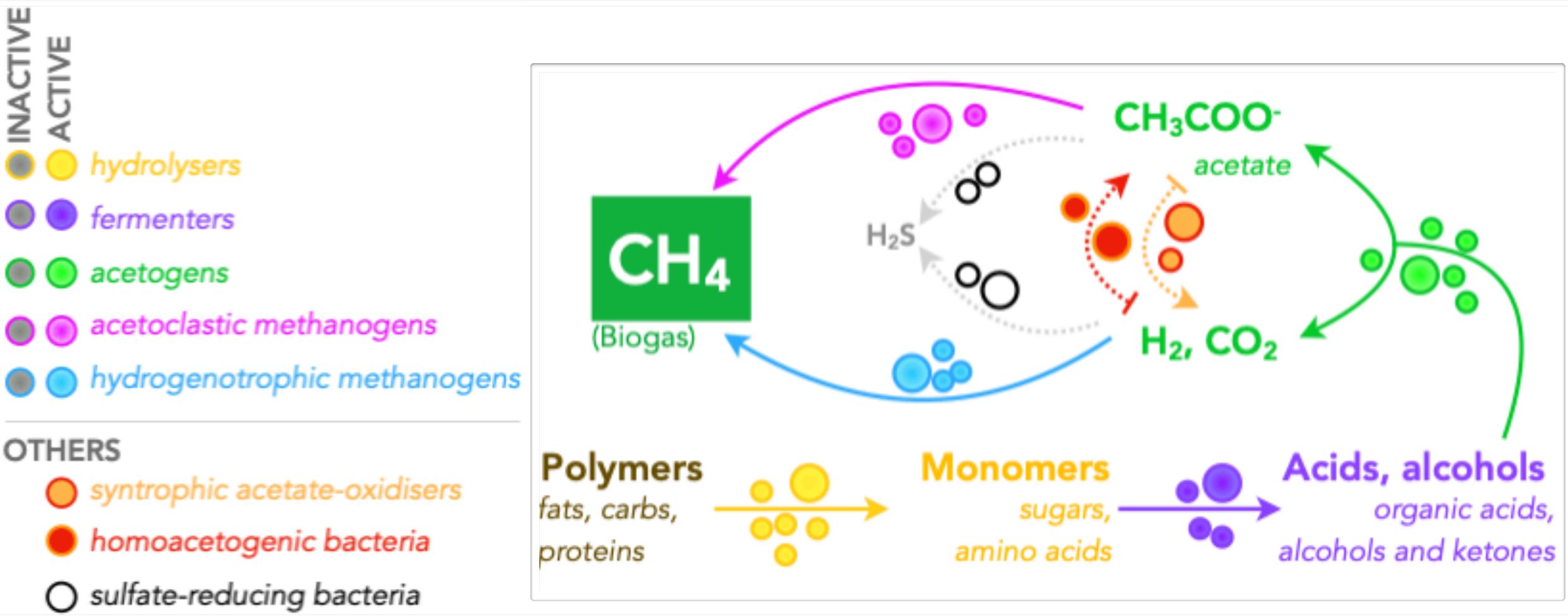
- If you understand how a microorganism 'makes a living', then it may be possible to understand at least two further things:
    - which role, and how big an impact, it has in Nature, Medicine, etc
    - whether, and how, it may be controlled in human health, or even exploited for useful purposes in Biotechnology

EXPLOITING MICROBES

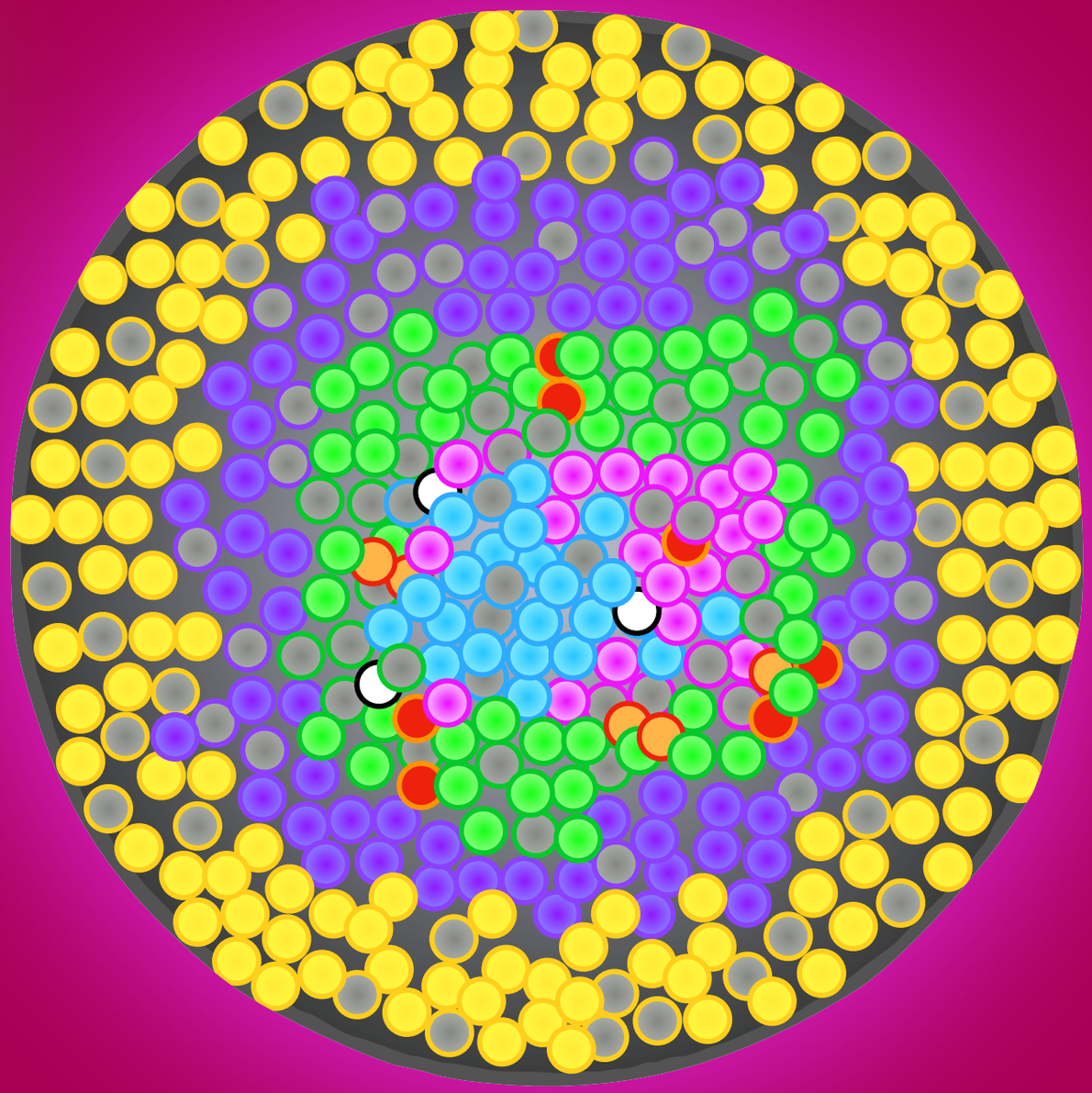
Case Study

Using microbes to make biogas from waste

The Anaerobic Digestion Process



Anaerobic Granules:
a unique phenomenon

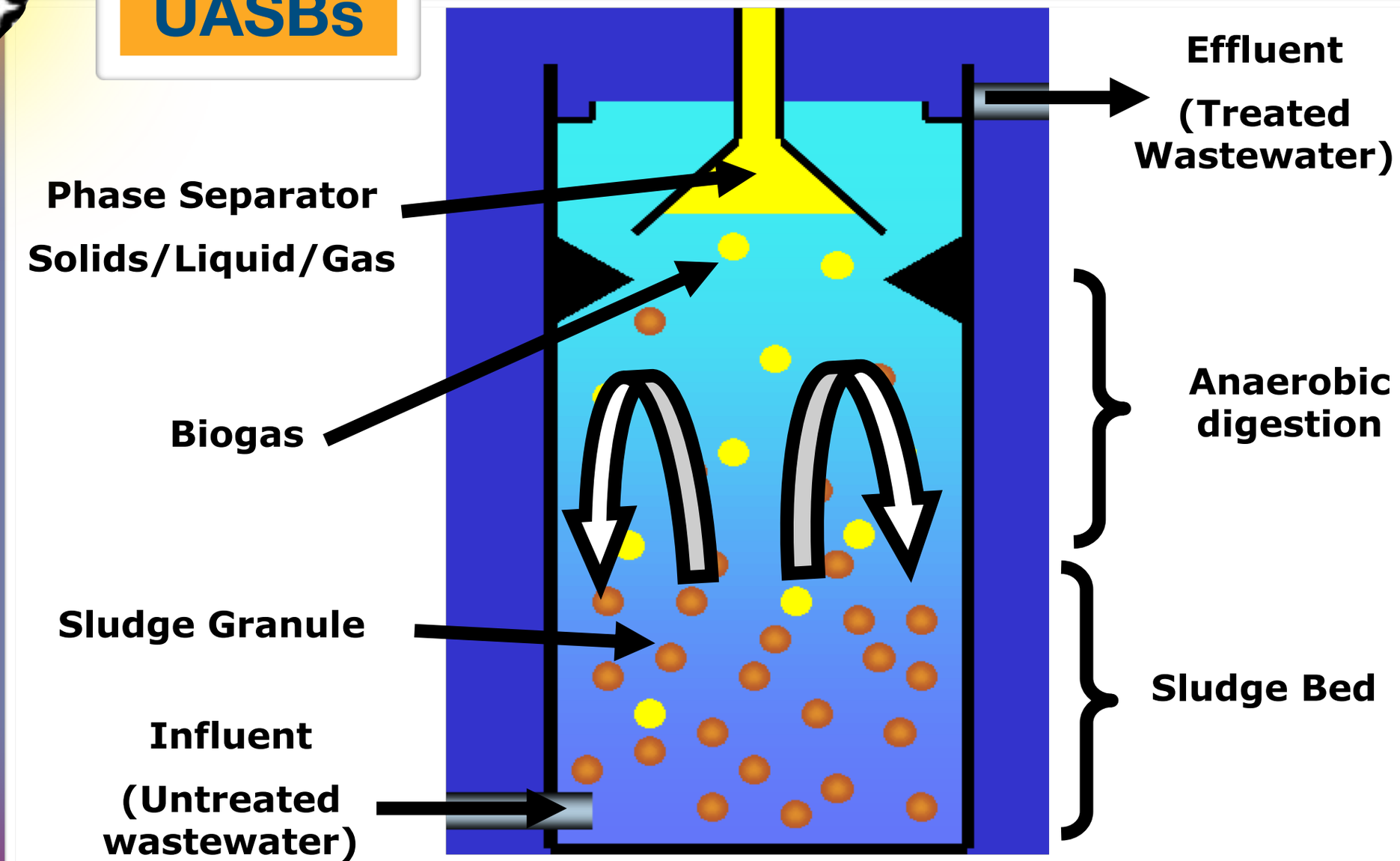


anaerobic
sludge granules

Anaerobic digestion

‘Granular’ bioreactors: *putting granules to work*

UASBs



our MAIN B.Sc. degree

You can take the Microbiology pathway

MICROBIOLOGY

WHAT YOU'LL DO...

Microbiology Topics to be covered in First Year Microbiology include:

- Meet the microbes: cells, organisms, impact
- A short history of man and the microbe
- The microbial planet: life at the extremes
- How and why we study microbes
- Medical microbiology
- Microbes and the food we eat
- Microbes for a sustainable world

our MAIN B.Sc. degree

You can take the Microbiology pathway

MICROBIOLOGY

WHAT YOU'LL DO...

Microbiology Topics to be covered in **Second Year** Microbiology include:

- **Semester 1**
  - MI202: Lab Skills in Microbiology I
  - BO201: Molecular and Cellular Biology
  - BO202: Evolution and the Tree of Life
- **Semester 2**
  - MI203: Lab Skills in Microbiology II
  - MI204: Microbes and the Environment

our MAIN B.Sc. degree

You can take the Microbiology pathway

MICROBIOLOGY

WHAT YOU'LL DO...

Microbiology Topics to be covered in Third Microbiology include:

- **Semester 1**

- MI323: Food & Industrial Microbiology
- MI326: Microbial Genetics & Metabolic Systems
- MI3101: Microbial Genomics

- **Semester 2**

- MI324: Immunology & Recombinant Protein Technologies
- MI322: Environmental Microbiology
- MI325: Microbial Infectious Diseases

our MAIN B.Sc. degree

You can take the Microbiology pathway

MICROBIOLOGY

WHAT YOU'LL DO...

Microbiology Topics to be covered in Final-Year Microbiology include:

- **Semester 1**
- Major Research Project
- Scientific Communication
- MI413: Problem-Solving

- **Semester 2**
- Bacterial Pathogenesis
- The Meaning of Life: Bioinformatics
- Dynamics of Microbial Gene Regulation
- Bioprocessors and Recombinant Protein Production
- Host-Microbe Interactions
- Microbial Ecosystems Services & Systems Biology
- Environmental Biotechnology

YOU WILL HAVE THOSE PRIZED, CORE SKILLS

- THOSE **CORE SKILLS** WILL BE RECOGNISED THE WORLD OVER FOR A VARIETY OF POSITIONS
- YOUR SPECIALISATION e.g. in Microbiology WILL STEER YOU TOWARDS A SPECIFIC AREA

2024-2025

College of Science and Engineering

YOUR FUTURE in MICROBIOLOGY

You will be part of the largest cohort of Microbiology graduates from any university in Ireland or the UK

Galway microbiology graduates are recognised the world over

2020-2021

College of Science and Engineering

JOBS in MICROBIOLOGY

- **Industry:** Food, Biomedical, Biopharmaceutical, Medical devices, etc
- **Research:** Energy, Healthcare, Infection and Immunity, Environment
- **Compliance:** Health and Industrial
- **Health Sector:** Med labs, etc
- **Education:** secondary and 3rd-level

THE JOBS OF THE FUTURE

- WE DON'T YET KNOW WHAT WILL BE THE HOT JOBS IN **2029 OR 2030!**
- BUT YOUR **CORE SKILLS** IN SCIENCE WILL BE YOUR CALLING CARD

2024-2025

College of Science and Engineering