Sound check

Present-day Practicals webinar series ’25/’26

PRESENT-DAY PRACTICALS

Welcome to webinar 4:

“Fostering sustainability in lab education”

Marit de Kort
UMC Utrecht, The Netherlands

Dr Gina Washbourn & Dr Cate Cropper
University of Liverpool, UK

We teach students to handle chemicals with care. But how often do we ask them to care for the planet at the same time? Imagine labs where sustainability isn’t an afterthought, but a core part of scientific learning. What would it take to make our teaching labs greener without losing their educational power?

We encourage you to **turn on your camera** to help create a more personal and interactive atmosphere.

This webinar will **not be recorded** to help create an open, interactive atmosphere where everyone feels comfortable to share ideas and ask questions. Instead, we’ll share a **recap** afterwards

PRESENT-DAY PRACTICALS

Who are we?

Marjo de Graauw

Janine Geerling

LACDR

UMC Utrecht

Carolien Koppejan

Charita Furumaya

labbuddy®

Who are you?

86 registrations, 19 different countries:

- Aruba
- Australia
- Austria
- Belgium
- Canada
- Denmark
- Germany
- Greece
- Israel
- Jordan
- Latvia
- Norway
- South Africa
- Sweden
- Switzerland
- The Netherlands
- Turkey
- United Kingdom
- United States of America

Regional distribution PDP webinar 4

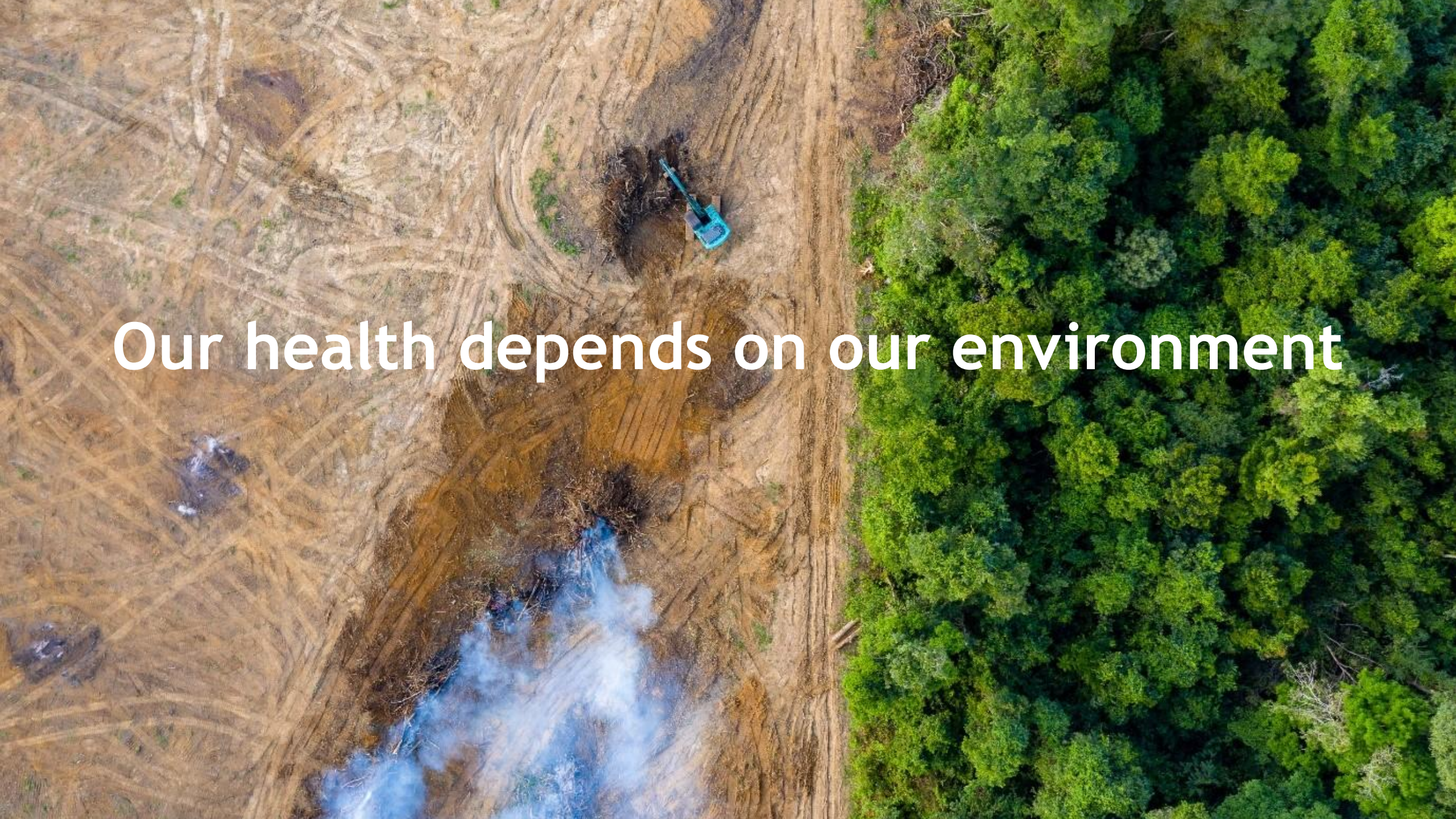
NL BE UK Other

PRESENT-DAY PRACTICALS

We encourage you to **turn on your camera** to help create a more personal and interactive atmosphere.

Use the **chat** to post your questions and share your ideas

After the webinar, we'll share a **recap** containing slides, lessons learned, and additional information and resources


Our health depends on our environment

Healthcare – 4-8% of Dutch CO_2 emmissions

Steenmeijer, et al. The Environmental Footprint of the Dutch Healthcare Sector: Beyond Climate Impact. Lancet 2022

Waste

Different aspects of laboratory work contribute to different amounts of environmental impact.

Which aspect of working in a lab do you think has the highest CO_2 footprint?

- Commutes
- Business travel
- Heating
- Purchasing goods, services and materials
- Electricity

Submit | Show feedback | Next

Waste

slide 6/13

Different aspects of laboratory work contribute to different amounts of environmental impact.

Which aspect of working in a lab do you think has the highest CO_2 footprint?

- Commutes ✗
- Business travel ✗
- Heating ✗
- **Purchasing goods, services and materials** ✓
- Electricity ✗

Submit | Show feedback | Next

Animal-free research

Animal-derived products

Apart from being used as experimental models, animals are also used for procuring products for research. Examples of such products include Fetal Calf Serum (FCS), Basement Membrane Extracts (3D support for cell cultures such as organoids), antibodies, and enzymes or proteins.

FCS is a widely used supplement for in vitro culture of human cells. Less than a liter of serum is obtained from one fetal calf.

How many fetal calves do you think are needed worldwide per year to meet the FCS demand of researchers?

- 75,000
- 500,000
- 350,000
- 2,000,000

Submit | Show feedback | Next

slide 13/16

Animal-free research

Animal-derived products

Apart from being used as experimental models, animals are also used for procuring products for research. Examples of such products include Fetal Calf Serum (FCS), Basement Membrane Extracts (3D support for cell cultures such as organoids), antibodies, and enzymes or proteins.

FCS is a widely used supplement for in vitro culture of human cells. Less than a liter of serum is obtained from one fetal calf.

How many fetal calves do you think are needed worldwide per year to meet the FCS demand of researchers?

- 75,000 ✗
- 500,000 ✗
- 350,000 ✗
- **2,000,000** ✓

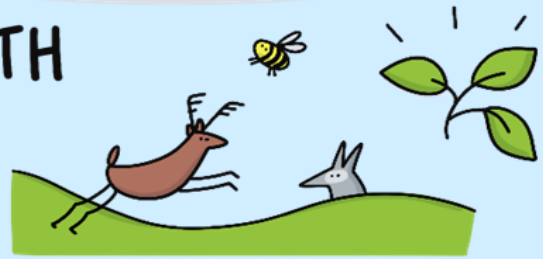
Submit | Show feedback | Next

Paradox of (life) science

SCIENTISTS

E.g. vaccines, life style guidelines, anti-cancer drugs

HEALTH

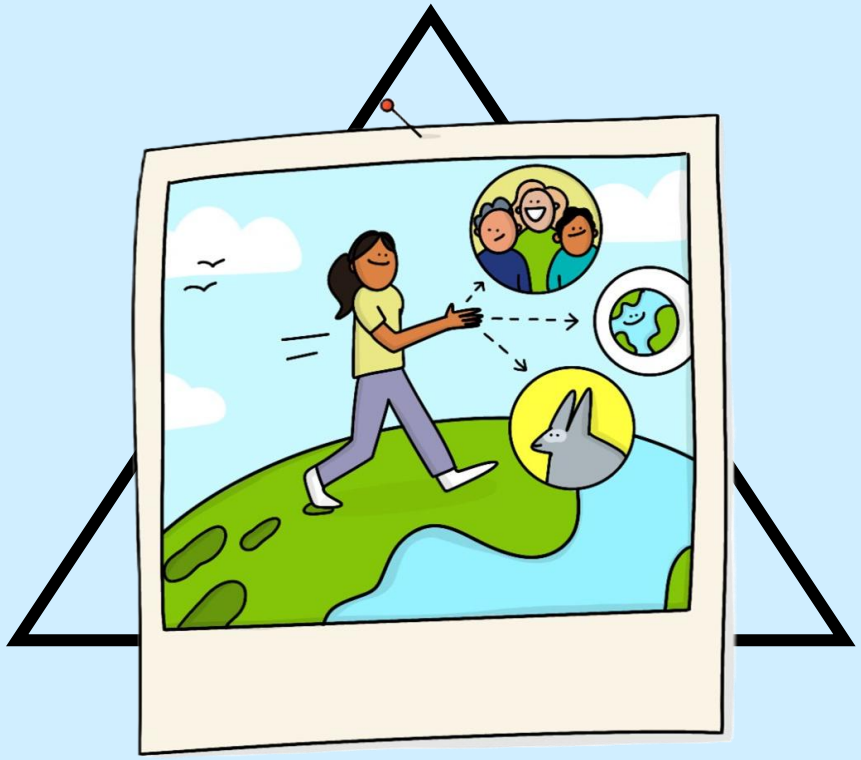


E.g. Waste, flying, data storage

E.g. air pollution, climate anxiety, infectious diseases

Green handshake

Scientific value



Ecological footprint

Societal value

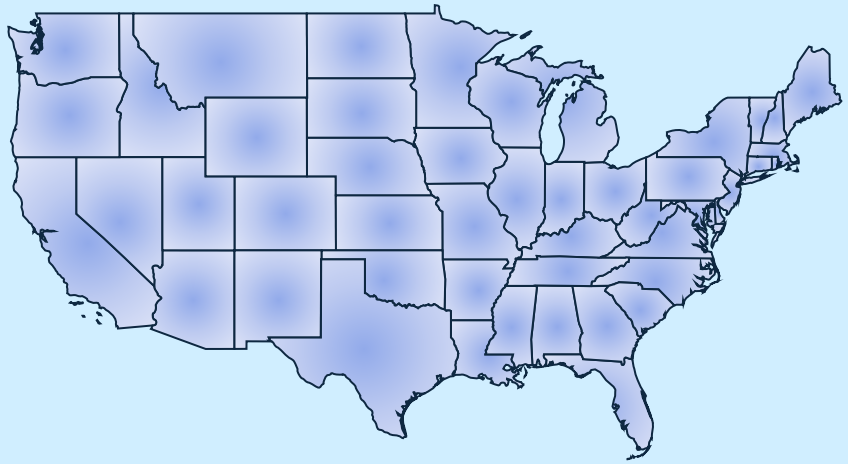
Concrete tools & actions relevant to their field of study

Connect with the sustainable lab community

It’s a team effort!

my green lab.

I2SL
International Institute for Sustainable Laboratories



Green Labs NL

green labs austria

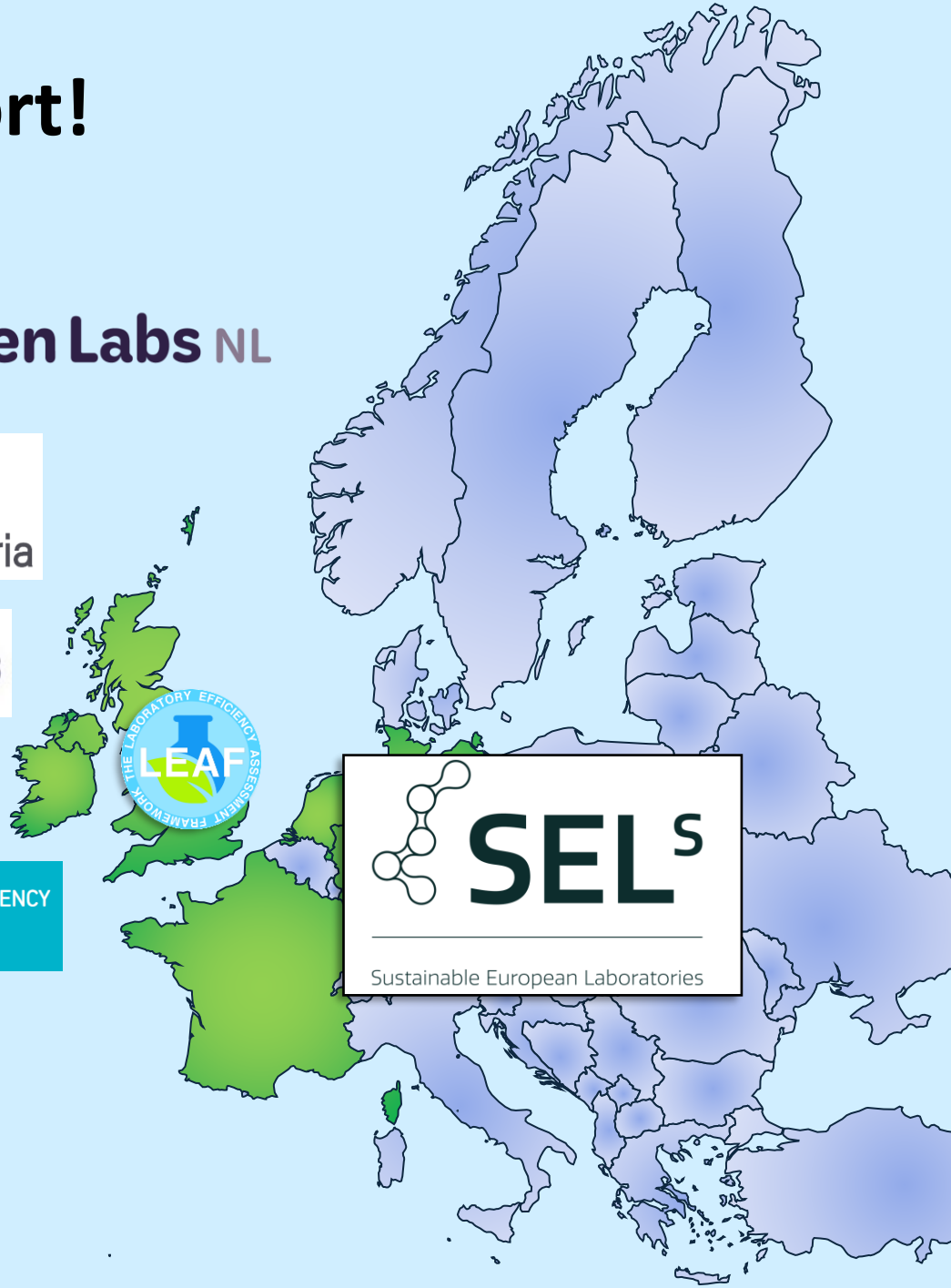
Irish Green Labs

Labos 1point5

LEAN LABORATORY EFFICIENCY ACTION NETWORK

GreenLabs Portugal

MAX PLANCK SUSTAINABILITY NETWORK



SELS
Sustainable European Laboratories

It’s a team effort!

Local Green Teams

Green Deal

NFU

LEAF

Amsterdam UMC

Maastricht UMC+

Erasmus MC

UMC Utrecht

Universiteit Leiden
The Netherlands

Hubrecht Institute

WAGENINGEN
UNIVERSITY & RESEARCH

LUMC Leids Universitair Medisch Centrum

Radboudumc
university medical center

UNIVERSITY OF TWENTE.

university of groningen

umcg


The next generation
of life sciences professionals

LEAF at UMC Utrecht

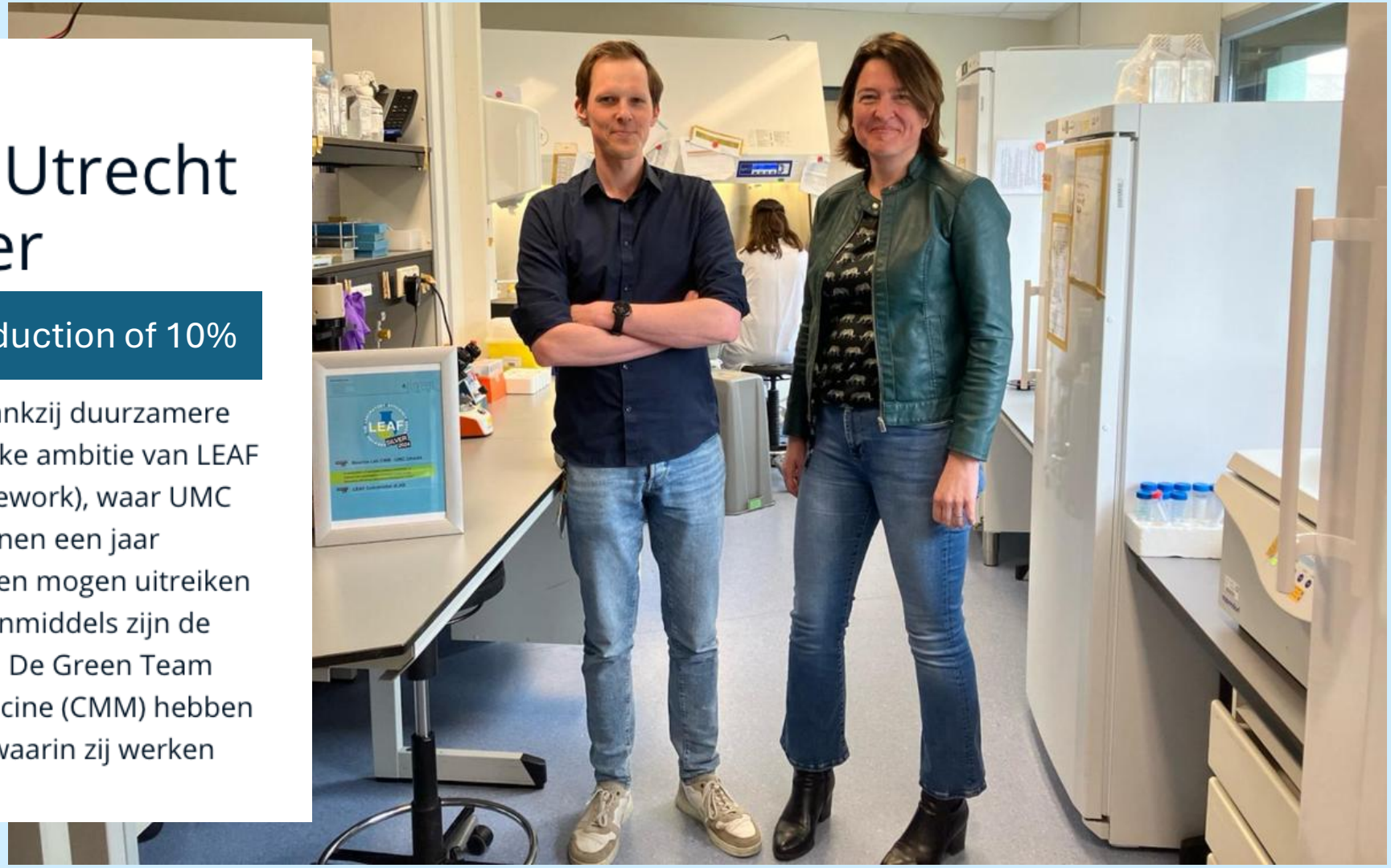
29-03-2024 | Gezonde samenleving

Labs in het UMC Utrecht steeds duurzamer

Lees voor

LEAF: CO2 reduction of 10%

Een CO2-reductie van wel 10 procent, dankzij duurzamere laboratoria. Dat is de mooie én belangrijke ambitie van LEAF (Laboratory Efficiency Assessment Framework), waar UMC Utrecht zich begin 2023 bij aansloot. Binnen een jaar hebben we al 41 bronzen LEAF-certificaten mogen uitreiken aan labs en ondersteunende teams. En inmiddels zijn de eerste vijf zilveren certificaten uitgereikt! De Green Team leden van het Center for Molecular Medicine (CMM) hebben diverse acties ondernomen om de labs waarin zij werken een stuk duurzamer te maken.




The next generation
of life sciences professionals

UNIVERSITY OF LIVERPOOL

Central Teaching Laboratories

Department of Chemistry

BUILDING SUSTAINABLE LABS

POWERED BY STAFF–STUDENT PARTNERSHIP

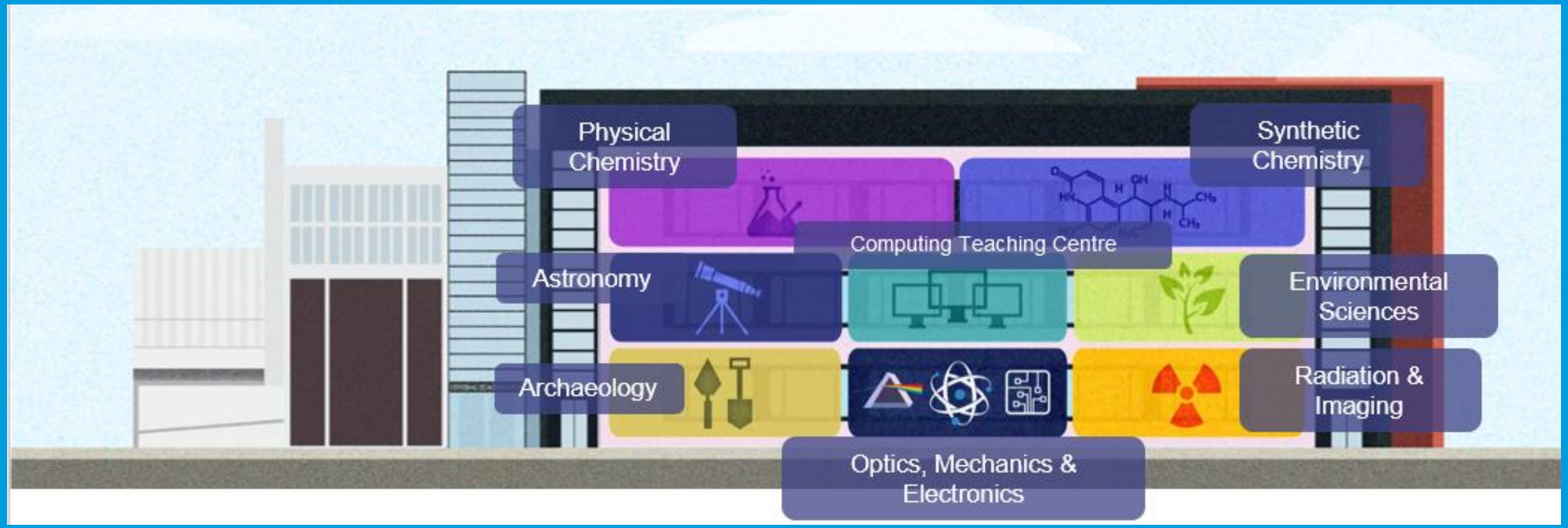
Dr Cate Cropper (Senior Lecturer in Chemistry)
Dr Gina Washbourn (Senior Lecturer in Chemistry)

January 2026

OUTLINE

- Setting the scene in Liverpool
- Moving towards waterless laboratories
- Cutting our energy usage
- Recycling solvents
- Sustainability in the curriculum

WHAT IS A CTL?


Physical Chemistry
Synthetic Chemistry
Computing Teaching Centre
Astronomy
Environmental Sciences
Archaeology
Radiation & Imaging
Optics, Mechanics & Electronics

SETTING THE SCENE IN LIVERPOOL

Past

- Awarded Laboratory Efficiency Assessment Framework (LEAF) Silver → Gold

- Student led projects:
  Switch to waterless condensers
  Trial solvent waste recycling
  Dry-syn testing and Lab Armor beads - successful

Present

- Whole-scale curriculum review, changes to RSC accreditation
- Curriculum focussed sustainability projects
  Student behaviour change
  Waste management

CATEGORY	Bronze	Silver	Gold
Waste	Provide recycling bins in the lab	Single-use plastic waste has been reduced (guidance provided)	Recycling rates have been increased, or overall waste produced has been decreased
People	Samples owned by departing staff are cleared or tracked	The lab has engaged other labs on LEAF and sustainability	One action to reduce travel has been implemented
Sample & Chemical Management	Labels are legible, and there's a common labeling system in place	Procedures are in place in case cold storage equipment breaks down	At least 80% of all samples and/or chemicals are clearly catalogued
Equipment	Equipment is turned off when not in use	There is a system in place for communal equipment booking	Excess equipment is repaired, sold, and/or donated
Ventilation	There is a clear reporting system for building issues	Fume cupboard sashes are kept closed when not in use	Solvent vapours are condensed and disposed and not released into the atmosphere

Snapshot of LEAF criteria -
https://www.ucl.ac.uk/sustainable/leaf/take-part-leaf

LEAF
The Laboratory Efficiency Assessment Framework

Asynt

Home | Products | Asyntise Your Lab | About Us | News | Events

CondenSyn Sustainability Report, University of Liverpool

Posted on November 24, 2022 by Kirsty

Scan here for our Asynt Waterless Condenser Report

SCAN ME

Work by Alex Rain (Summer Student 2022)
Bhavini Shah (BSc Project 2023)

PAST PROJECT WATERLESS CONDENSERS

Partnership with Asynt

Brief

Investigate how much water could be saved by undergraduate students

- 24 L/hour per student
- 38 hours reflux over a degree
- 109,440 L per 120-student cohort

Cost

- Traditional Leibig ~ £25
- Waterless Condenser ~ £200 (Total cost for 60 = £12,000)

Usage

- Easier to set up
- No need for tubing
- No leaks!

Solvents

- Low-boiling solvents (e.g. DCM, ether, THF): up to 1% loss at 100 mL scale
- Heat ≤10% above boiling point

We use these in all our undergraduate courses and outreach sessions
Now embedded in research labs

PAST PROJECT
LAB ARMOUR BEADS

Brief

Investigate how much water could be saved by undergraduate students using water baths

Cost

- 4L of beads = £373 - 2L to fill a large water bath
- We have 64 in one lab ~£12,000

Usage

- Some recrystallisation experiments
- Kinetics experiments
- Can also be frozen - replacement for an ice bath

Things to Note

- Faster than ice bath: –10 to 4 °C in 30 min
- Not suitable for volatile-solvent recrystallisation
- Saves ~1.55p per bath per day (water, use-dependent)

Work by Bhavini Shah (BSc Project 2023)

We now use these for kinetics experiments in teaching labs

PAST PROJECT
SOLVENT RECYCLING

Brief

- Explored solvent recycling in undergraduate teaching labs Specialist rotavap costs too high for a trial (~£50,000)
- Trialed using existing rotavap with waste from a small number of 3rd-year CTL research students

Usage

- Acetone (GPR) washing solvent: worked well; suitable for rewashing glassware
- 80–85% recycled yield
- Hexane/EtOAc mixtures: purified enough for re-columning, but cannot fully separate without tighter pressure/temperature control

Feasibility

- Can be done quickly (students or technicians)
- We use around 540L acetone per year – need a bigger set up
- Cost – energy cost is around 3p/L - cheaper than fresh acetone GPR ~£1.75 p/L

Work by Zhihao Ling (BSc Project 2023)

Not currently used – volume and technical time required to high

CURRENT PROJECT - CURRICULUM REVIEW

Brief and Considerations

- Students evaluating current and new curriculum for sustainability skills content (theory and practical)
- Evaluating wider sector need for skills

Extrinsic Factors

- RSC accreditation
- University Strategy 2031
- QAA Benchmarks

Intrinsic Factors

- Professional growth – changes in the sector / employability opportunities
- Moral responsibility / accountability

Methods

- Ethics submitted
- Questionnaire/ Focus Groups with undergraduate students

Intended Outcomes

- Use this to inform design of new curriculum content

Amelia Smith, Zilin Xu and Fatma Haidar (Year 3 BSc Chemistry)

David Price (BSc Chemistry, 2024)

CURRENT PROJECT WASTE MANAGEMENT

Brief

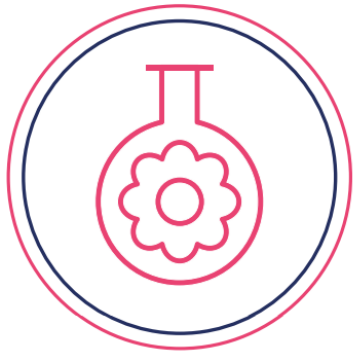
- Students working with the University Sustainability Team on a project called “Living Labs”
- Compare chemical Waste Management between teaching and research labs

Methods

- Lab Audits
- Informal questionnaires

Intended Outcomes

- Share good practice between research and teaching spaces
- Help labs with next steps towards LEAF
- Develop activities for waste management activities in the taught provision



86% of labs have achieved a LEAF award, 36 are silver and **7 gold**

43% reduction in waste sent for incineration with energy recovery from our baseline

University of Liverpool Progress so far for Strategy 2031

Scan here to see the University of Liverpool’s Living Labs Home Page

Brooke Mills and Emma Collings (Year 3 BSc Chemistry)

CURRENT PROJECT BEHAVIOUR CHANGE

Brief

- Student derived project
- Linked to waste management and living labs project
- Investigate student attitudes toward waste management (personal and chemical)

Methods

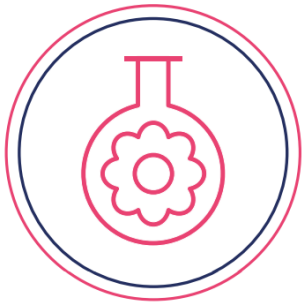
- Ethics submitted
- Questionnaire to undergraduate students
- Autoethnography

Intended Outcomes

- Understand students' perceptions of social and chemical responsibility
- Design activities for students to think about their waste management behaviour
- Improve training and sign-posting for waste management

Scan here to see the University of Liverpool's Living Labs Home Page

Brooke Mills (Year 3 BSc Chemistry)



86% of labs have achieved a LEAF award, 36 are silver and **7 gold**

43% reduction in waste sent for incineration with energy recovery from our baseline

CONCLUSION

- Sustainability improvements have been tested in our undergraduate teaching labs
- Still comes down to cost and ease of use – Universities and labs need funding for this type of implementation – we need to weigh up whether this is cost effective
- Bonus: Change in practice across ENVS and research laboratories.

Student Impact

- Undergraduate students have successfully completed this work as part of a staff-student partnership goal
- New student projects – students influencing curriculum change, departmental and university policy
- Potential for publication
- Students seeking out jobs and further qualifications in sustainability related fields!

ACKNOWLEDGMENTS

CTL Staff
Stephen Brough
Stephen Chappell
Lynne Chapman
Emma Coates
Josh Hicks
And the rest of the CTL Team!

Project Students
Alex Rain
Bhavini Shah
Zhihao Ling
David Price
Brooke Mills
Emma Collings
Amelia Smith
Zilin Xu
Fatmas Haidar

ASYNT
Kerry Elgie

ANY QUESTIONS?

CONTACT

Dr Cate Cropper
Senior Lecturer in Chemistry
ccropper@liverpool.ac.uk

Dr Gina Washbourn
Senior Lecturer in Chemistry
gwashb@liverpool.ac.uk

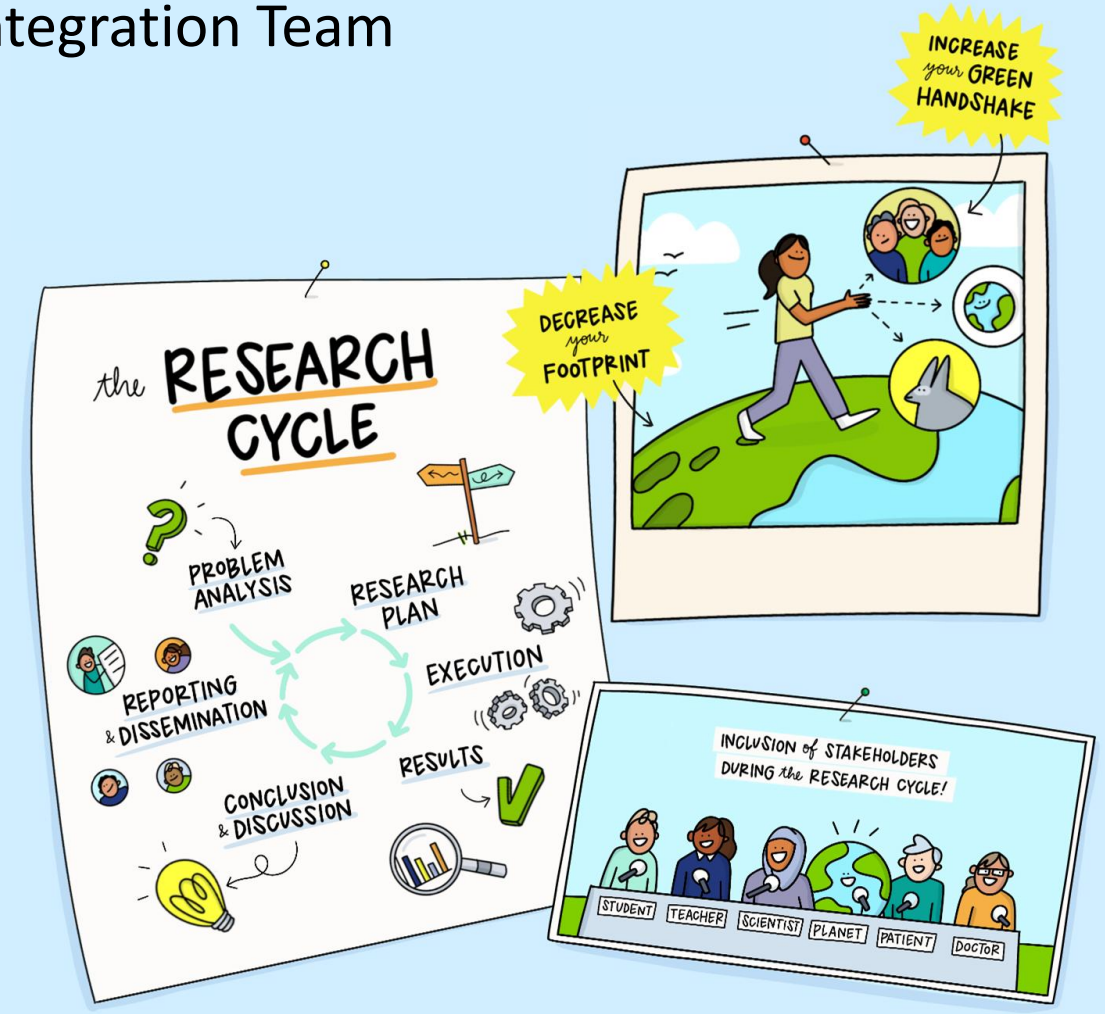
QR code for the next activity – link also in chat!

UNIVERSITY OF LIVERPOOL

Please scan this code to participate in our interactive activity!

Towards Green Science Education

Tools from UMC Utrecht's Planetary Health Integration Team



Green Labs NL

de CO_2-assistent

UMC Utrecht

PLANETARY HEALTH INTEGRATION TEAM

Educational tools

www.kcgh.nl

E-MODULE

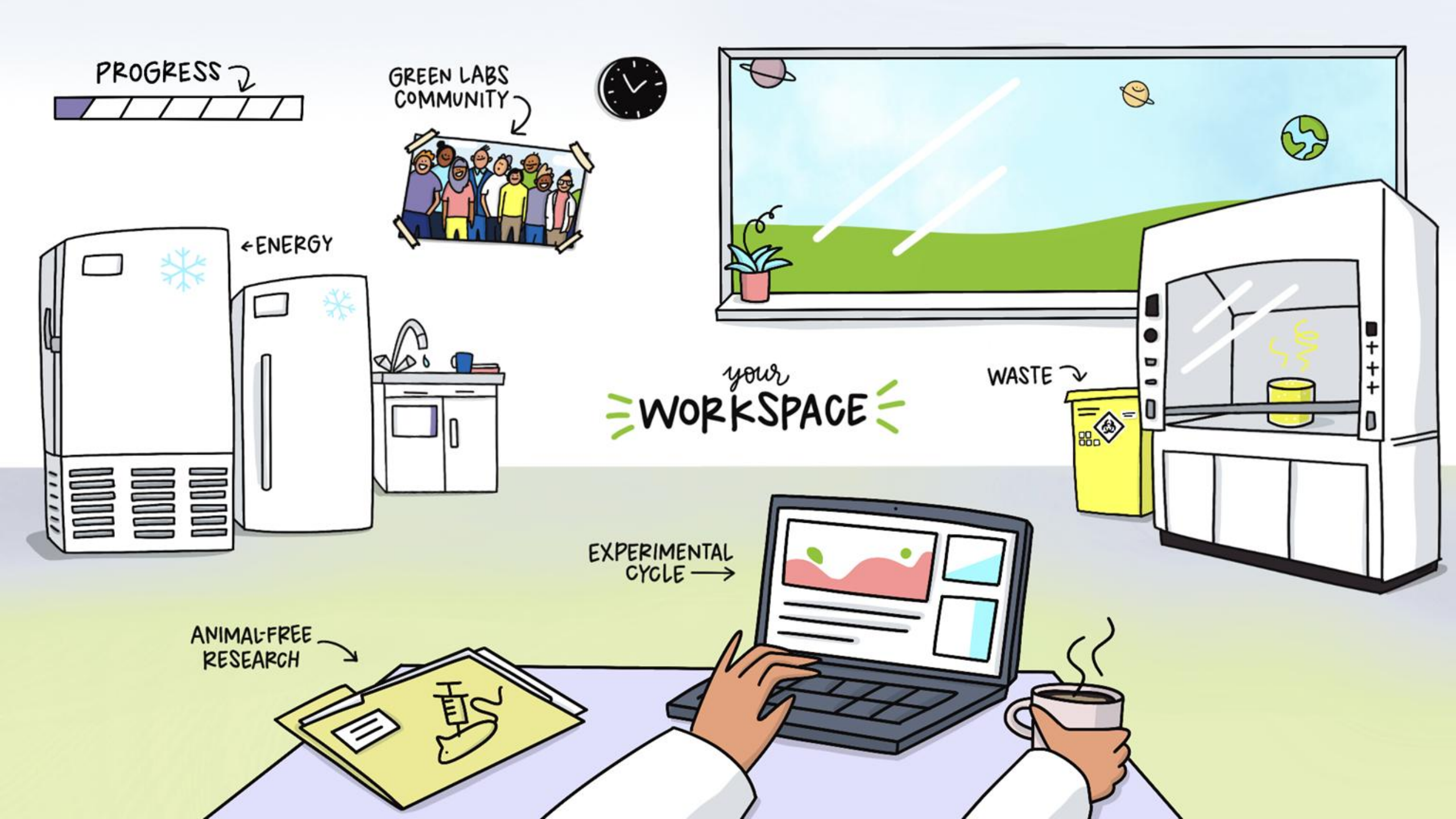
JUST and SUSTAINABLE LABORATORY RESEARCH

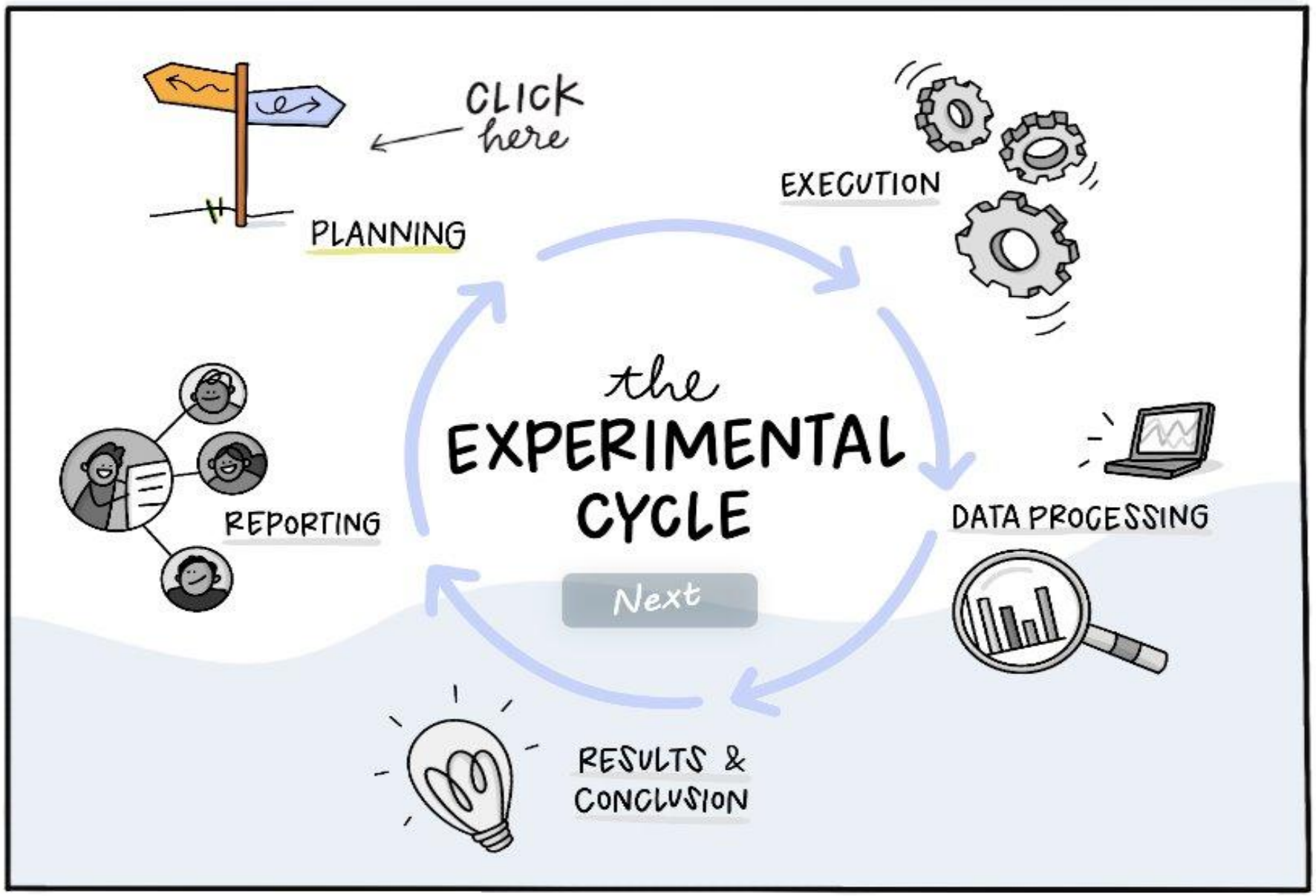
DEVELOPED by

UMC Utrecht

Green Labs NL

PROEFDIERVRIJ


PROGRESS
GREEN LABS COMMUNITY
ENERGY
your WORKSPACE
WASTE
EXPERIMENTAL CYCLE
ANIMAL-FREE RESEARCH


CLICK here
PLANNING
EXECUTION
the EXPERIMENTAL CYCLE
Next
DATA PROCESSING
RESULTS & CONCLUSION
REPORTING

The experimental cycle - Execution

slide 3/10

When selecting a consumable for your experiment, which option would you consider the "greener" choice, ensuring that the decision does not affect the experiment's outcome?

Choice 1

- Filtered tips
- Tips without a filter ✓

Choice 2

- PBS from a shared dispenser ✓
- PBS from a personal bottle

Choice 3

- 5 ml tubes
- 1,5 ml tubes ✓

Submit | Show feedback | Next

The experimental cycle - Data processing

Digitalisation of scientific research

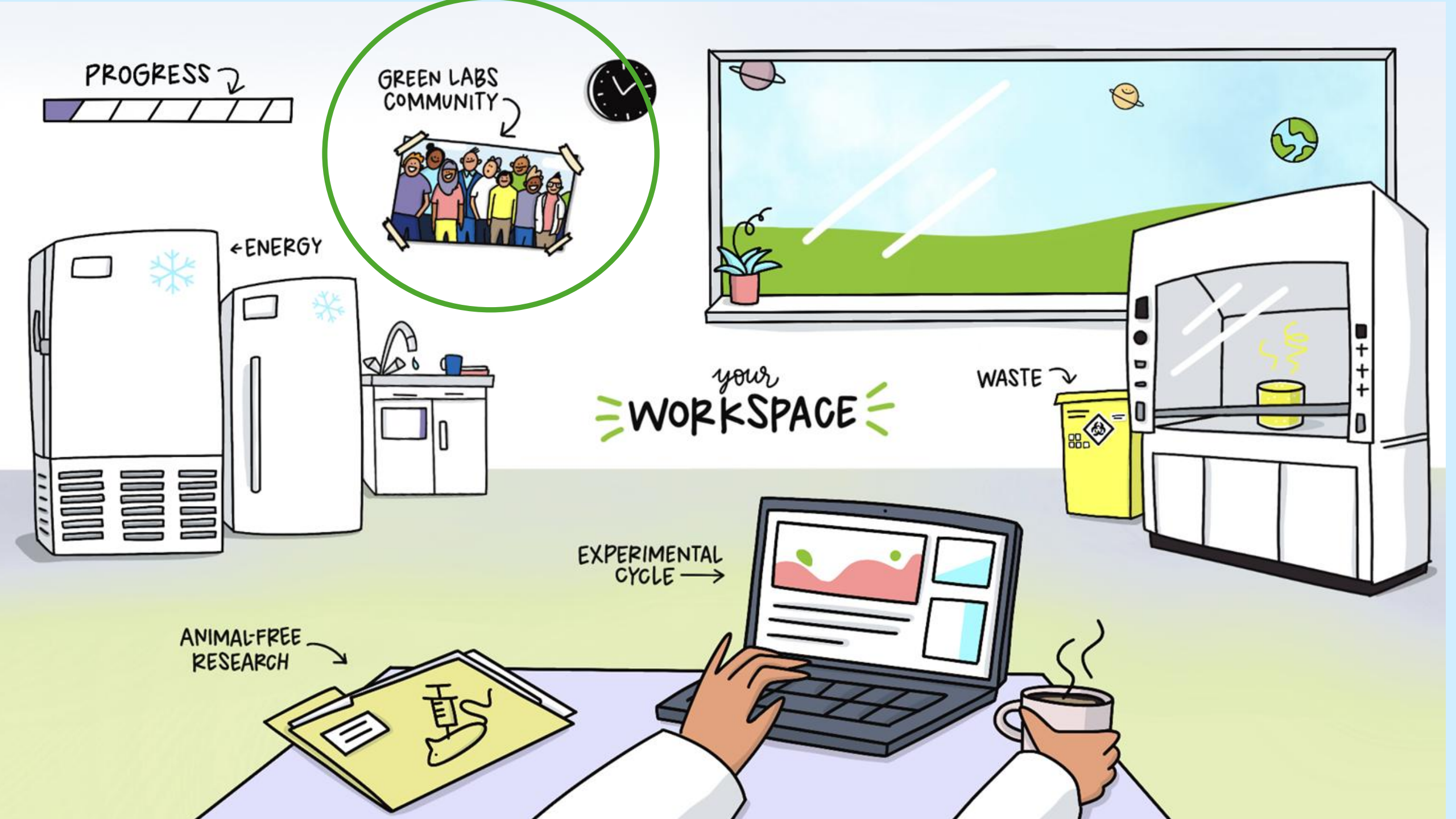
slide 6/10

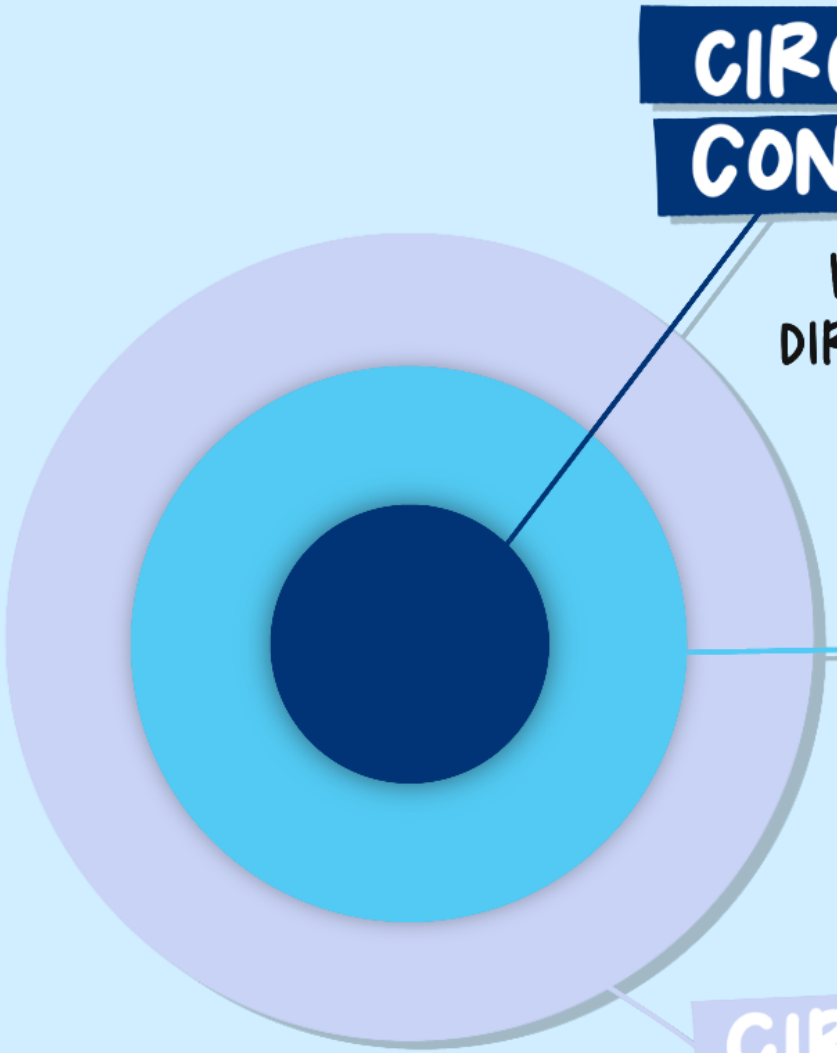
Digitalisation has revolutionised science and healthcare. It fosters better data access, collaboration, and faster discoveries. However, it has environmental impact due to energy use, CO2 emissions, and land use impacts of resource-intensive data centers.

The "digital carbon footprint" represents the share of someone's **carbon footprint** linked to digital activities. What do you think contributes to the digital carbon footprint of scientists? Select the correct answer(s).

- Energy use of computers
- Email storage
- Scientific data storage
- Separating waste
- Computing (e.g. using an algorithm to generate data or training an AI model)
- Use of generative AI tools, such as Chat-GPT
- Performing searches on the Internet
- Online meetings
- Electronic lab journals
- Flying to a conference

Submit | Show feedback | Next


PROGRESS
GREEN LABS COMMUNITY
←ENERGY
your WORKSPACE
WASTE
EXPERIMENTAL CYCLE
ANIMAL-FREE RESEARCH



CIRCLE of CONTROL

WHAT we CAN DIRECTLY CONTROL

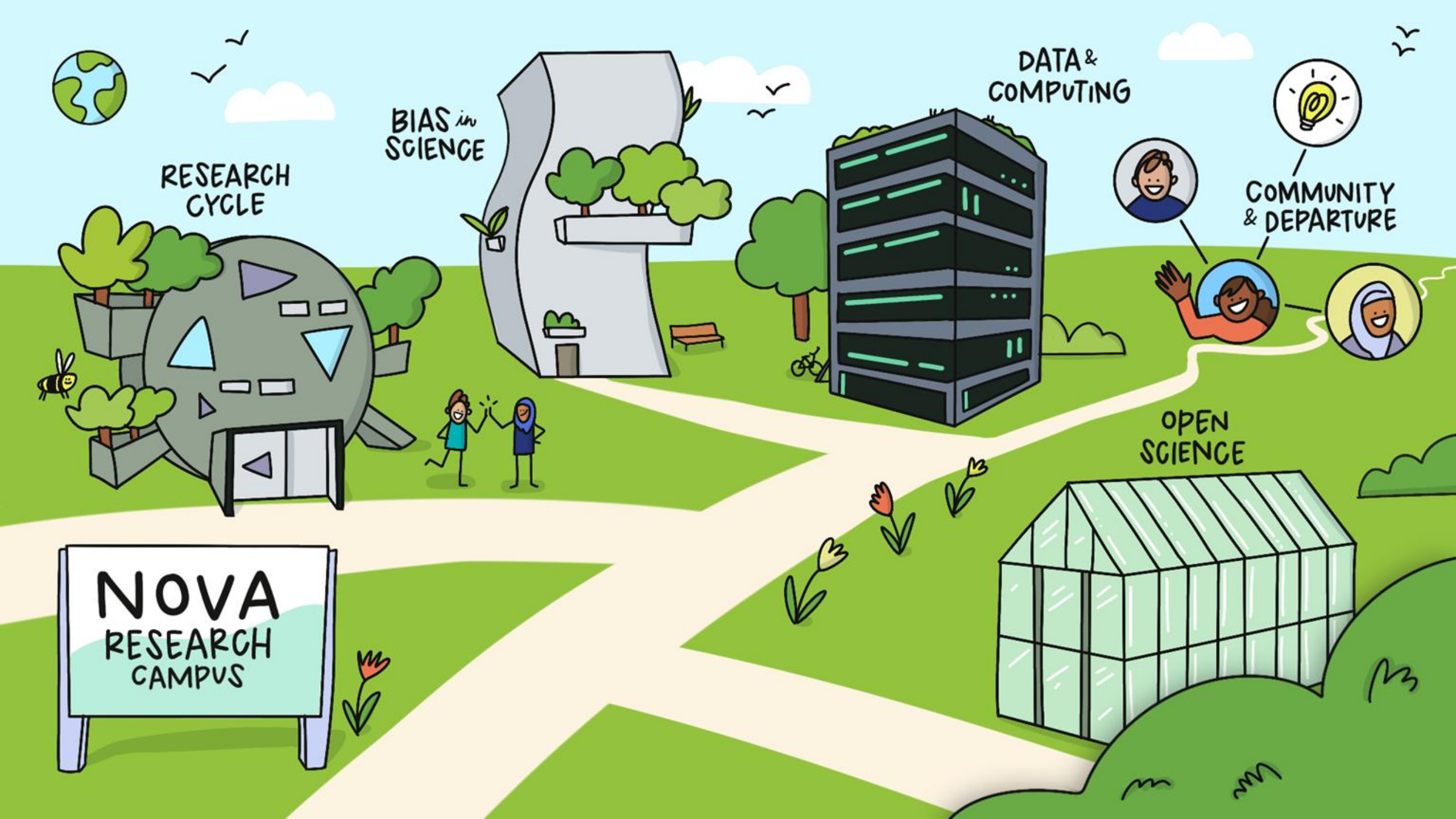
CIRCLE of INFLUENCE

the CONCERNS we CAN DO SOMETHING ABOUT

CIRCLE of CONCERN

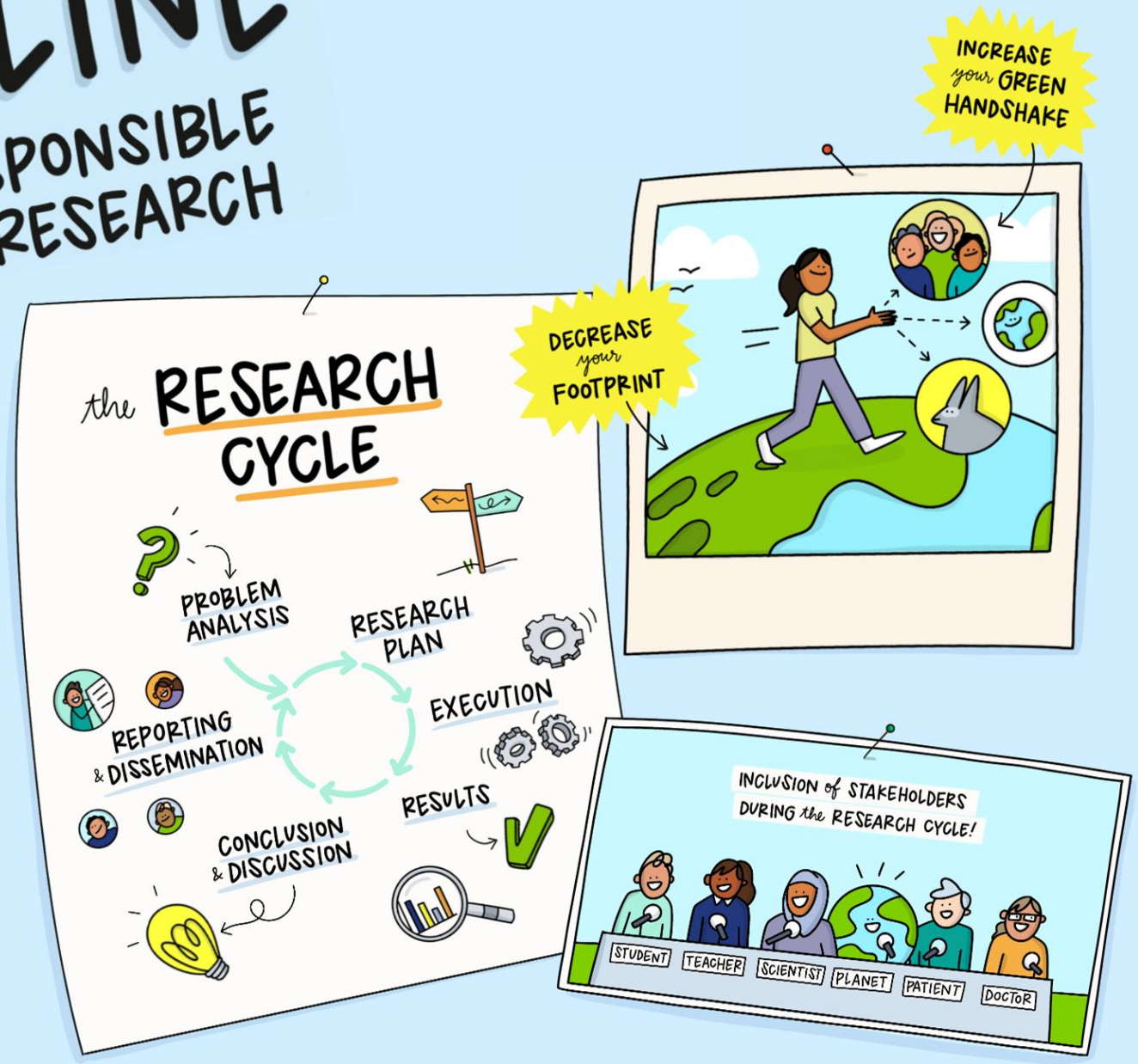
WHAT we CANNOT CONTROL


E-MODULE
JUST and SUSTAINABLE SCIENCE PRACTICES
* TAILORED TO PEOPLE THAT ENCOUNTER SCIENTIFIC RESEARCH
UMC Utrecht
Green Labs NL
de CO2-assistent

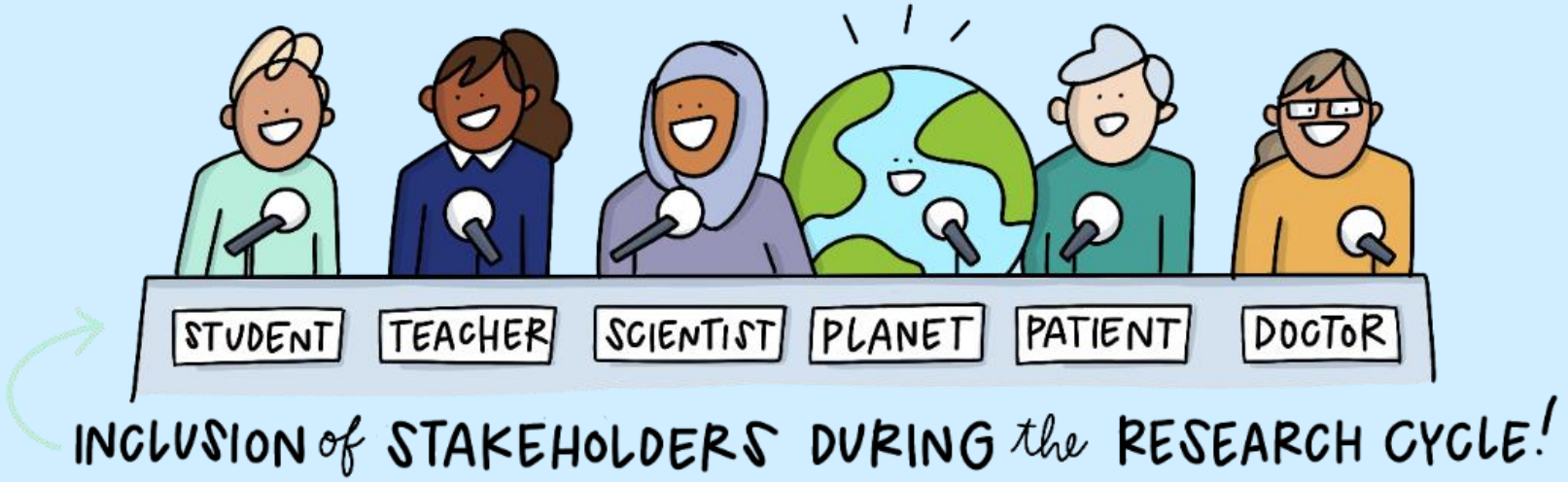

RESEARCH CYCLE
BIAS in SCIENCE
DATA & COMPUTING
COMMUNITY & DEPARTURE
OPEN SCIENCE
NOVA
RESEARCH CAMPUS

GUIDELINE

for SOCIALLY RESPONSIBLE (BIO)MEDICAL RESEARCH



Socially responsible research: Research that is relevant, well-designed, ethical, sustainable, and focused on (future) practical application. A key aspect is active participation and inclusion of relevant community stakeholders during all phases of the research process, thereby incorporating a variety of stakeholder needs, desires and perspectives. The ultimate goal is to minimise the ecological footprint (negative environmental impact) and maximise the 'green handshake' (positive impact on people, animals and the natural environment).



edu.nl/fg69m

Checklist

Component	Paragraph	Space for explanation
1. Problem analysis		
☐ Has sufficient preliminary research been done to avoid research waste?	§1.1	
☐ Is there a clear societal need for this study?	§1.2 §1.3	
☐ Are relevant stakeholders involved in drafting the research question?	§1.4	
☐ Have (un)desired side effects been considered?	§1.5 §1.6	
2. Research plan		
Research team		
☐ Has one's own positionality within the study been considered?	§2.1	
☐ Is the composition of the research team diverse and are different relevant perspectives included?	§2.2	
☐ Is communication within the research team inclusive and understandable?	§2.3	
Methodology		
☐ Is the chosen methodology or (lab) technique the most appropriate, efficient, and effective?	§2.4	
☐ Are relevant stakeholders involved in designing and conducting the study?	§2.5	
☐ Are potential sources of bias minimised as much as possible?	§2.6	
☐ Is pre-registration of research design appropriate to encourage transparency and collaboration?	§2.7	
Participants		
☐ Is the sample composition representative and inclusive?	§2.8 §2.9	
Variables and analysis		
☐ Are appropriate baseline variables chosen to capture relevant diversity characteristics?	§2.10	
☐ Are the predictor and outcome variables relevant to (clinical) practice?	§2.11	

Guiding questions Socially Responsible Research

The questions in the checklist are explained in more detail below. Additional guiding questions are suggested, according to the various steps of the research cycle. These questions serve as a support for designing, conducting, reporting and disseminating (bio)medical research in a societally responsible manner.

1. Problem analysis

Literature review

1.1 Can you justify why this research is valuable and worthwhile? Could the research question perhaps be sufficiently answered using existing literature, by consulting or doing a (systematic) literature review (**Box 1**)? Is there a relevant knowledge gap in the literature? After all, the most sustainable research is the research that does not need to be performed.

Box 1 | Evidence-based research

Evidence-based research is a movement created to prevent research findings with no relevant contribution to society, also known as 'research waste'.[9] An example of research waste is when the research question could be sufficiently answered using existing literature.

An important aspect of evidence-based research is conducting preliminary research, by consulting or doing a (systematic) literature review. In recent years, the number of published systematic reviews has greatly increased. It is therefore important to first check whether an up-to-date review on your topic already exists. This can be checked through databases such as **Cochrane** or **Epistemonikos**. In addition, confirm that there are no similar reviews in progress via **PROSPERO** or the **Open Science Framework**.

If no up-to-date and high-quality literature review is available, you should conduct a systematic review yourself. To do so in a valid way, a critical appraisal of the selected literature is essential. If you need help in preparing a systematic literature review, consider seeking advice from your university library or a methodologist.

Societal value

1.2 Does this study reduce the use of unsustainable (healthcare) systems, therapies or interventions, both now and in the future (**Box 2**)? Or does this research contribute to the transition toward a sustainable society? For example, research about prevention, the protein transition or circularity in healthcare.

1.3 Does this study contribute to increasing equity at the (inter)national level (**Box 2**)? For example, consider genetic predisposition towards prostate cancer. Current knowledge on this is primarily based on populations of European and North American descent, while Asian, South American and African populations are underrepresented.[10] This underrepresentation is a common trend in genetic research.

Educational tools

www.kcgh.nl

Thank you for your participation!

Link to evaluation

Upcoming webinars

Present-day Practicals webinar series ‘25/’26

1.	How do students truly learn in the lab?	Thu 06/11/’25
2.	Extended reality in lab education	Thu 20/11/’25
3.	Refocusing labs: from cookbook to open inquiry	Tue 02/12/’25
4.	Fostering sustainability in lab education	Tue 13/01/’26
5.	Artificial intelligence in lab education	Thu 29/01/’26
6.	Student Research Hub for interdisciplinary education	Tue 17/02/’26

Enhancing lab education with **LabBuddy** Thu 19/03/’26

info@presentdaypracticals.nl

THANK YOU

for attending this webinar

PRESENT-DAY PRACTICALS