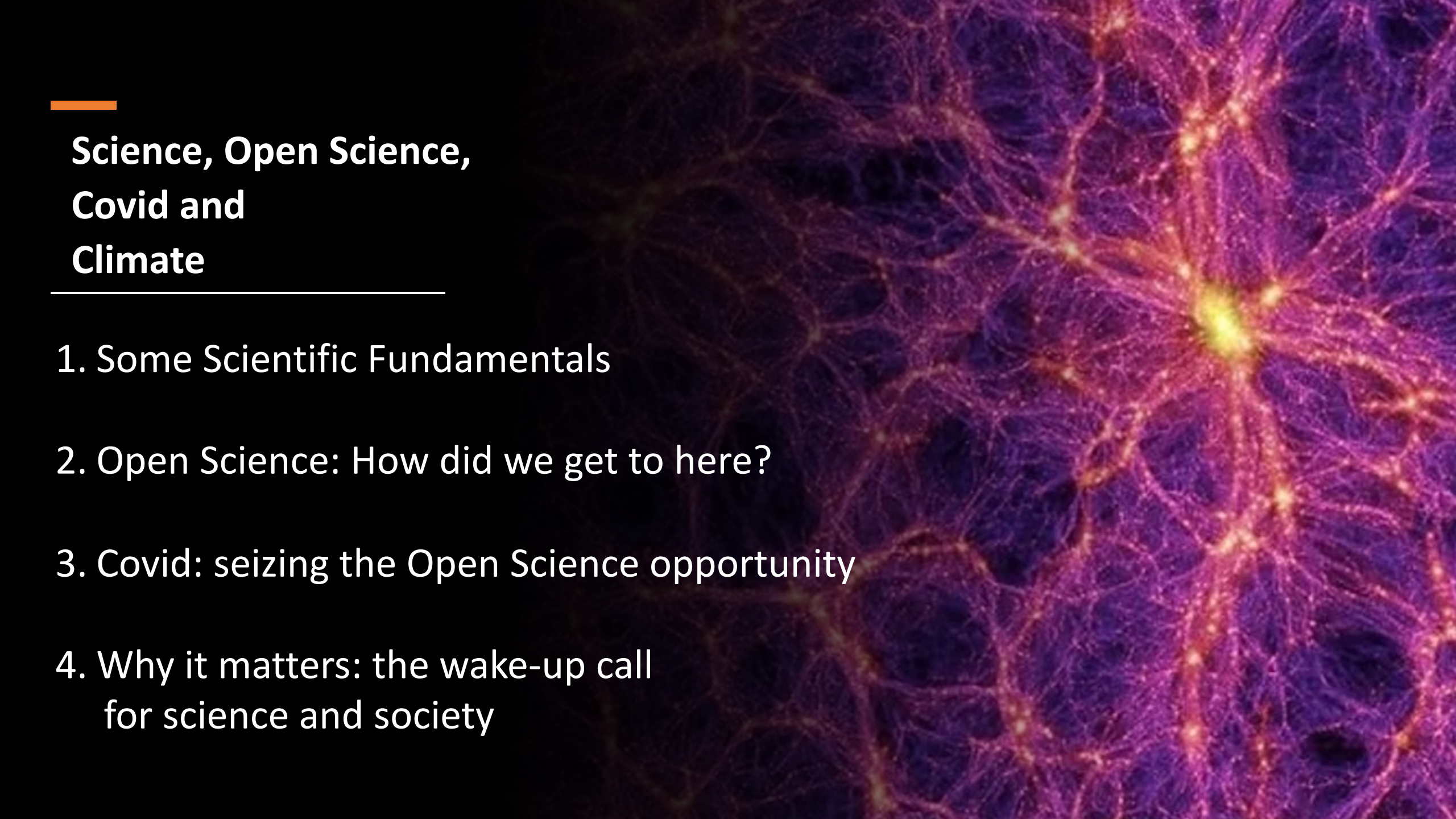


Science, Open
Science, Covid and
Climate

Geoffrey Boulton
International Science Council
& University of Edinburgh

“From Tackling the Pandemic to
Addressing Climate Change”

United Nations Dag Hammarskjöld Library
Open Science Conference 2021



Science, Open Science, Covid and Climate

1. Some Scientific Fundamentals
2. Open Science: How did we get to here?
3. Covid: seizing the Open Science opportunity
4. Why it matters: the wake-up call
for science and society



Scientific Fundamentals and Practices

The fundamentals do not change as we enter a new era of open science:

- maintaining rigour by sceptical scrutiny of accessible concepts and evidence
- communicating and disseminating understanding

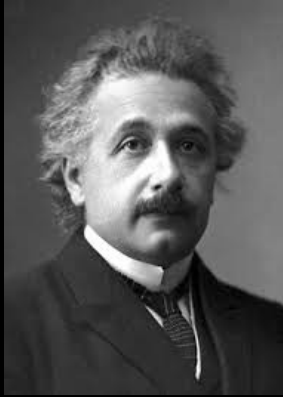
But:

the way science is done and its contribution to the public good are changing because:

- digital technologies have enlarged opportunities for discovery, communication and dissemination
- social and political expectations of science and of the global public good have evolved

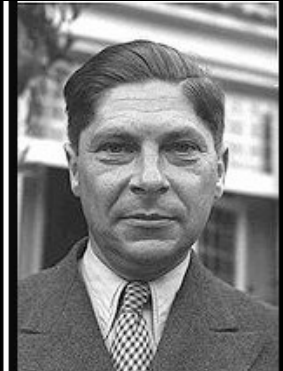
Consequence:

The Open Science Movement



No amount of experimentation can prove me right.
A single experiment can prove me wrong.

Albert Einstein



The progress of science is strewn, like an ancient desert trail, with the bleached skeletons of discarded theories that once seemed to possess eternal life.

Arthur Koestler



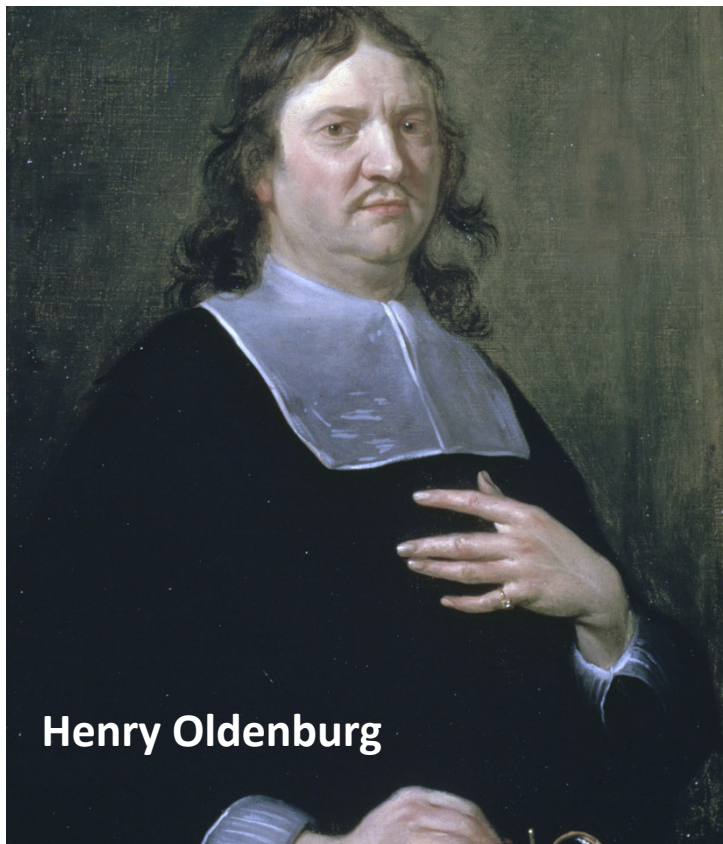
The purpose of science is not to open a door to infinite wisdom, but to set a limit to infinite error.

Bertholt Brecht

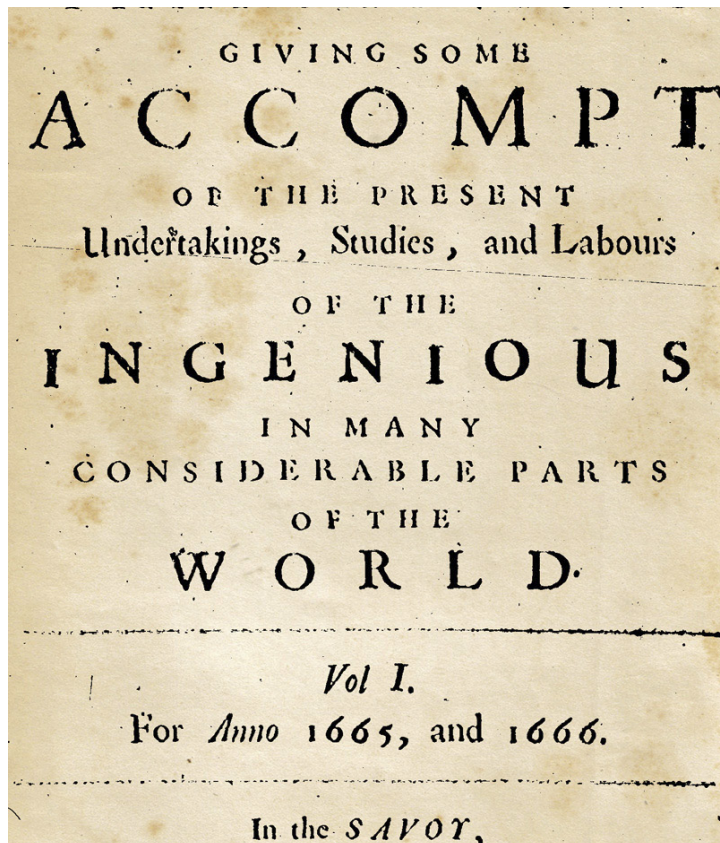


2. Open Science: How did we get here?

Open Science - Act 0 1665



Henry Oldenburg



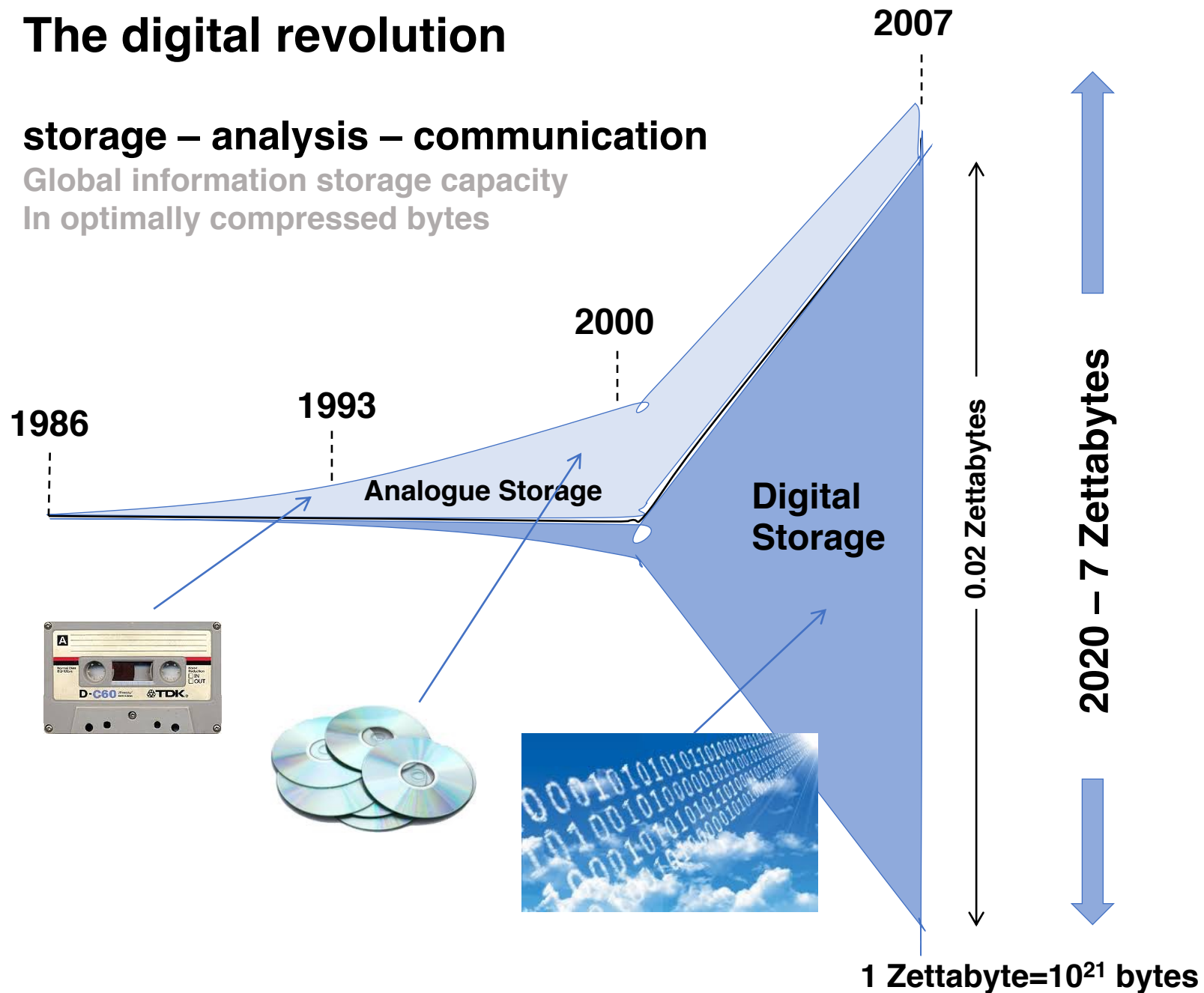
Innovations

- Publicly available (at a price)
- concepts must be supported by evidence (data)
- in the vernacular, not Latin
- peer review by Society's Council members

The digital revolution

storage – analysis – communication

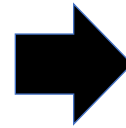
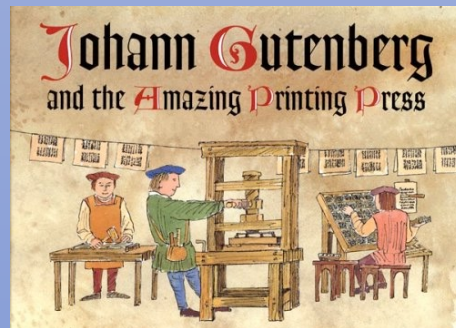
Global information storage capacity
In optimally compressed bytes



A World Historical Event

The technologies by which knowledge is acquired, stored and communicated have always been essential drivers of human material and social progress

Johannes Gutenberg
1400-1468



The Digital Revolution – 1990 - ?

- vast data streams
- vast source diversity
- vast computational capacity
- learning algorithms
- instantaneous communication
- access anywhere anytime
- low cost

A NETWORKED EARTH

TRANSFORMATION
OF THE HUMAN?



Open Science Act 1: Open Access

The Budapest Open Access Declaration – 2002

“An old tradition and a new technology have converged to make possible an unprecedented public good.

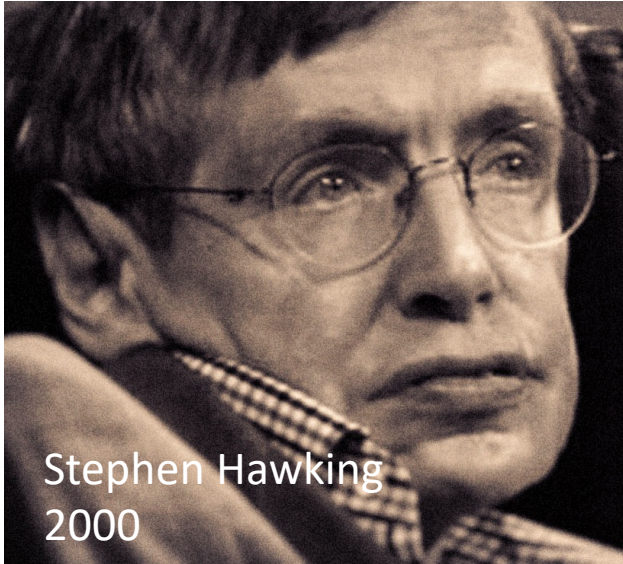
The old tradition is the willingness of scientists and scholars to publish the fruits of their research in scholarly journals without payment, for the sake of inquiry and knowledge.

The new technology is the internet.

The public good they make possible is the worldwide electronic distribution of the peer- reviewed journal literature and completely free and unrestricted access to it by all scientists, scholars, teachers, students and other curious minds.”



Act 2 - Open Data (2002/2012)



Stephen Hawking
2000

“...the next [21st] century will be the century of complexity”

general availability of findable, accessible, interoperable re-useable (FAIR) data



scientific rigour demands:

data, meta-data and code that provides the evidence for a published claim to be concurrently available for scrutiny.



Act 3 - Open to Society Democratisation of science (2018)

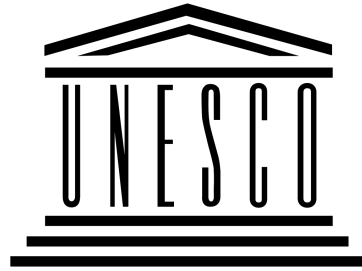
Science in Africa must become a more public enterprise that engages actively with business, policymakers, governments, communities and citizens as knowledge partners in jointly framing questions and jointly seeking solutions rather than one conducted behind closed laboratory and library doors.

The Platform will work to:

- enable scientists and communities to create actionable knowledge;
- enhance the credibility, practical relevance and socio-political legitimacy of science in and for Africa;
- strengthen the pan-African voice in global science.

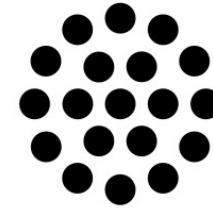
Act 4: Defining Open Science (2020/21)

PURPOSE



PROCESS

- Open Access
- Open Infrastructure
- Open Data
- Open Source
- Open Evaluation
- Citizen Science
- Open Notebook
- Open Labs
- Open Educational Resources
- Open Innovation
- Open Hardware



**International
Science Council**

PURPOSE

- scrutinise and challenge truth claims (**rigour**)
- serve the knowledge needs and interests of wider publics (**democratisation**)
- maintain the record of science, its evolving stock of knowledge, ideas and possibilities accessible and free to all, irrespective of geography, gender, ethnicity or financial circumstance (**efficiency**)
- open the data and evidence of science to be accessible and re-usable by all, subject to constraints of safety, security and privacy (**complexity**)
- engage with other societal actors in the common pursuit of new knowledge, and in supporting humanity in achieving sustainable and equitable life on planet Earth (**sustainability**)

A Barrier to Open Science

how not to Assess Science – use proxy metrics

Proxy measures

- citation indices
- journal impact factors
- university rankings



A dysfunctional market

- paper productivity not science productivity
- drive predatory journal market
- drive price inflation
- fragment the science community
- undermine education
- places record of science behind paywall
- strategic data about science in private hands



Richard Goodhart



Goodhart's Law

“When a measure becomes a target, it ceases to be a good measure”.



3. Covid: seizing the Open Science Opportunity

The Open Science in Action

Communicating to diverse audiences

- Clarity – Credibility
- Communicate uncertainty and risk – a basis for trust
- Context and relevance to varied audiences

Delivering access to knowledge

- Websites & data platforms
- Sharing and rapid release of results

Co-production of knowledge

- Science & civil society
- Supporting community action



The big lesson for science from Covid

A stress test for Open Science. The utility of broad-spectrum Open Science has largely been a matter of conjecture - no longer:

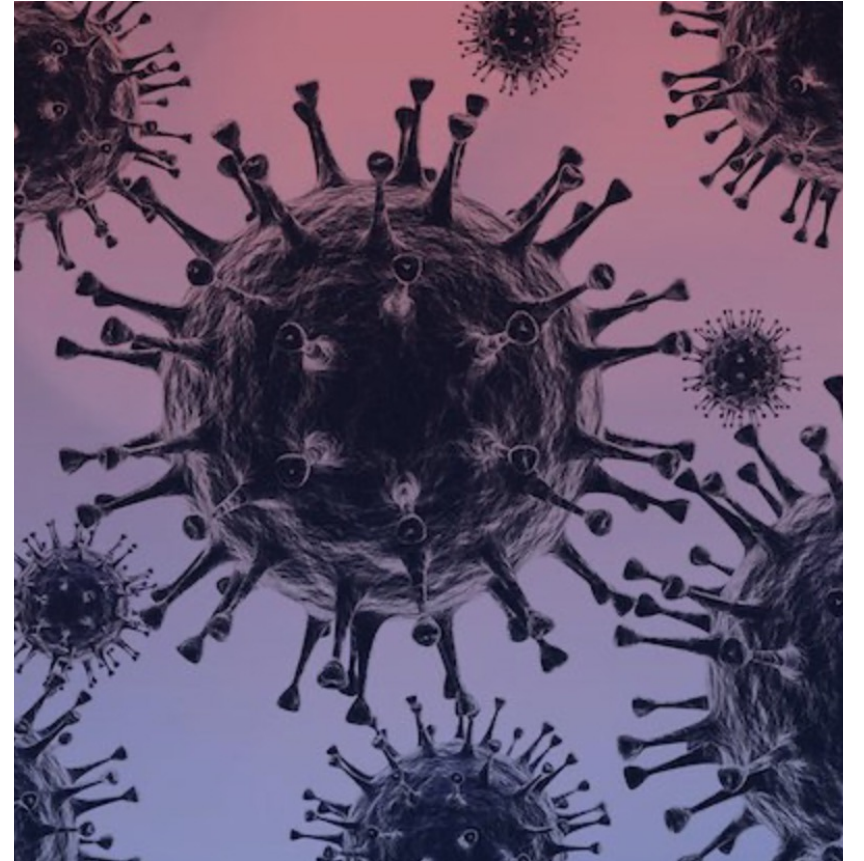
- Spontaneous response from a great diversity of sciences
- Unrivalled sharing, and across the public/private interface
- Agile release of emergent science
- New open data resources
- Rapid publication and pre-prints
- Effective communication of science in the public domain
- Revelation of the richness and relevance of scientific knowledge over a wide spectrum

The Director of the US National Institute of Health: “we have never seen anything like this”

“the phenomenal effort will change science – and scientists – for ever”

The opportunity for this be the new normal for science?

What would make it so?



The Challenge for Science

“Never waste a Good Crisis!”



W.S. Churchill



Priorities for change

- I. Affordable, universal open access
- II. Open licensing
- III. Rigorous, efficient, timely peer review
- IV. Data publication
- V. Maintaining the record of science
- VI. Inter-operation between disciplines
- VII. Digitally enabled publication & dissemination
- VIII. Governance in scientific hands

OPENING THE RECORD OF SCIENCE





Urgent reforms

Normalise:

- Pre-prints, servers, overlay review
- Open Licenses
- Citable data publication

Implement:

- Novel peer review
- Platform-agnostic discovery services
- Global curation infrastructures for the Record of Science

Governance

- Within the science community
- Incentives from bibliometric to open science
- Globally inclusive/nationally efficient
- Distributed functions/common standards

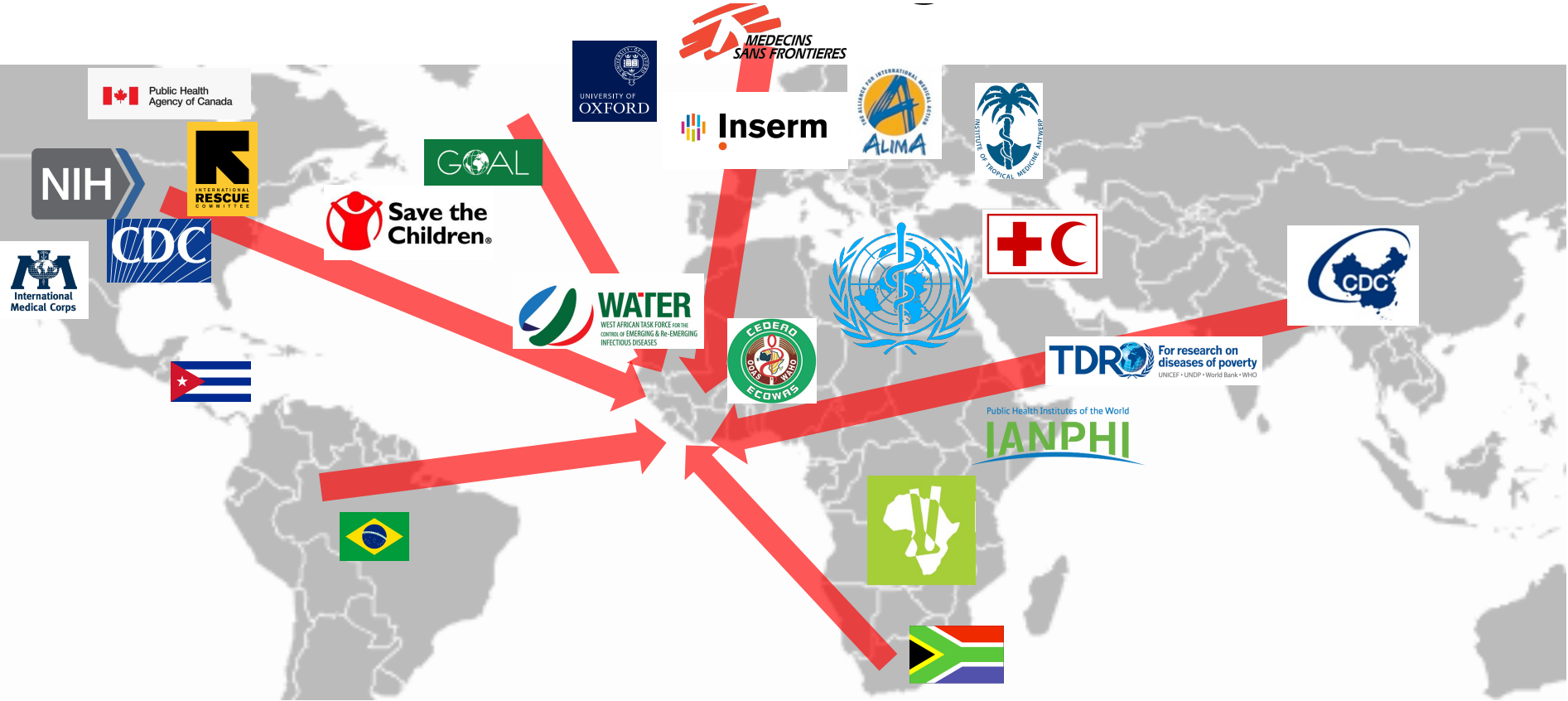
Exploit the Digital




“The Journal is dead, but if its not, it should be. Journals are unnecessary with online publishing. Using a journal to restrict access is outrageous.”

Governance and inclusivity are vital: common standards, distributed functions

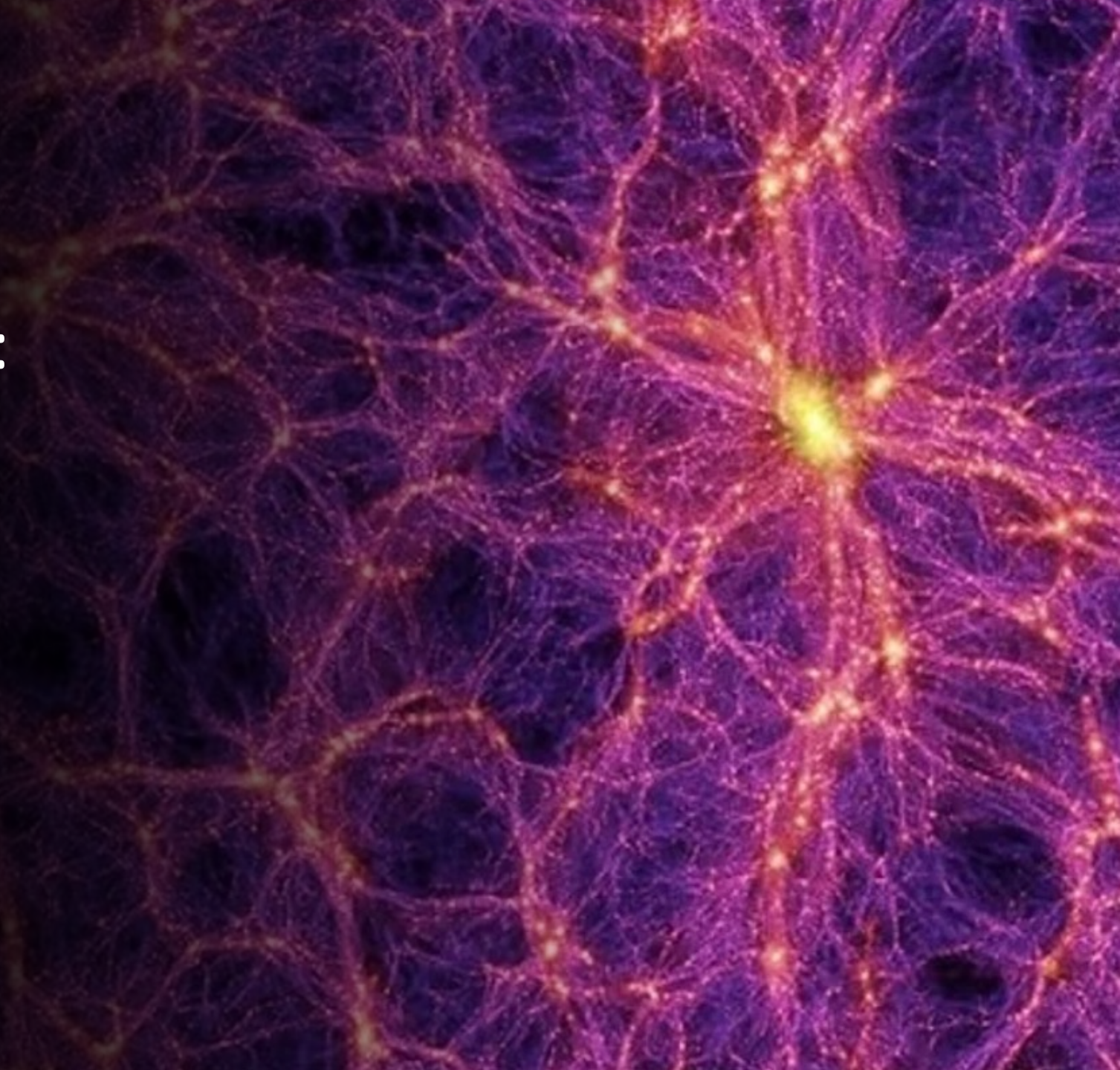
e.g. International response to the 2014-2016 Ebola Crisis



Only a selection of international responders is shown. There were many more.

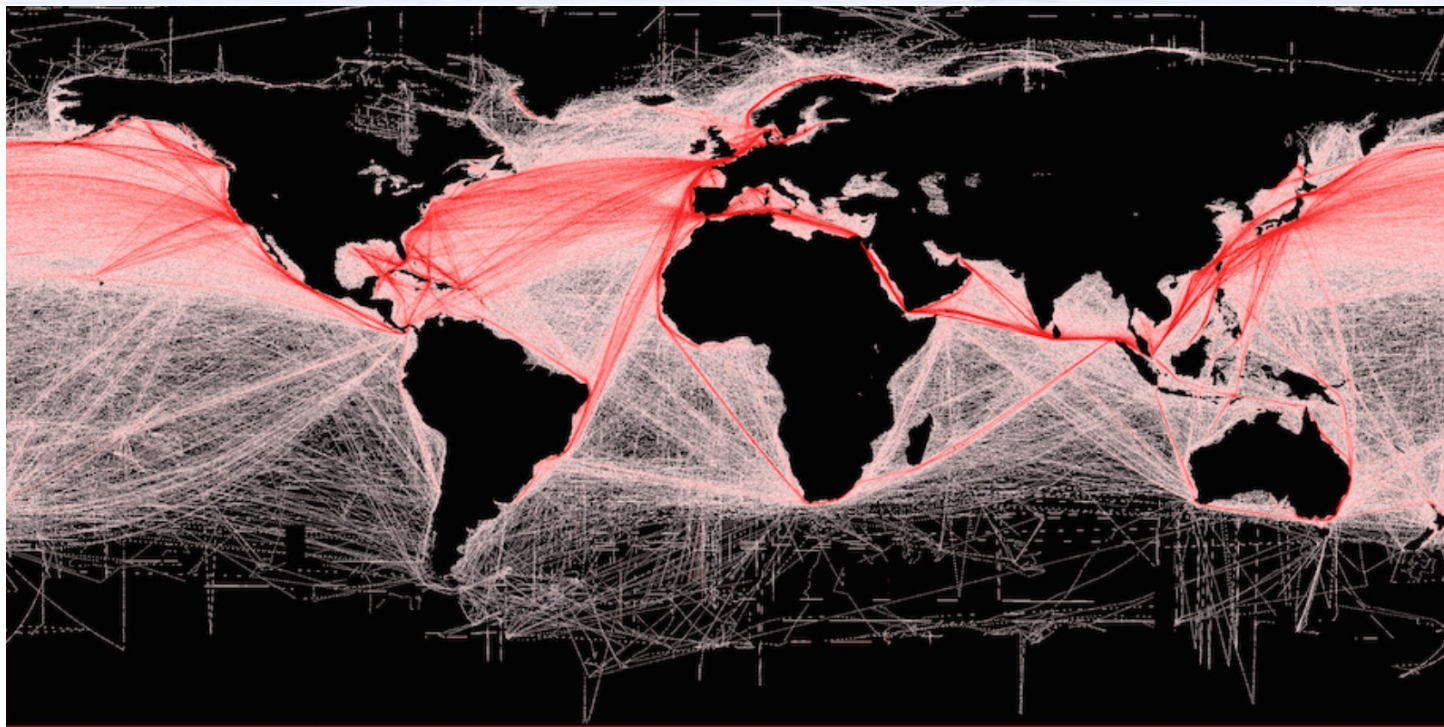
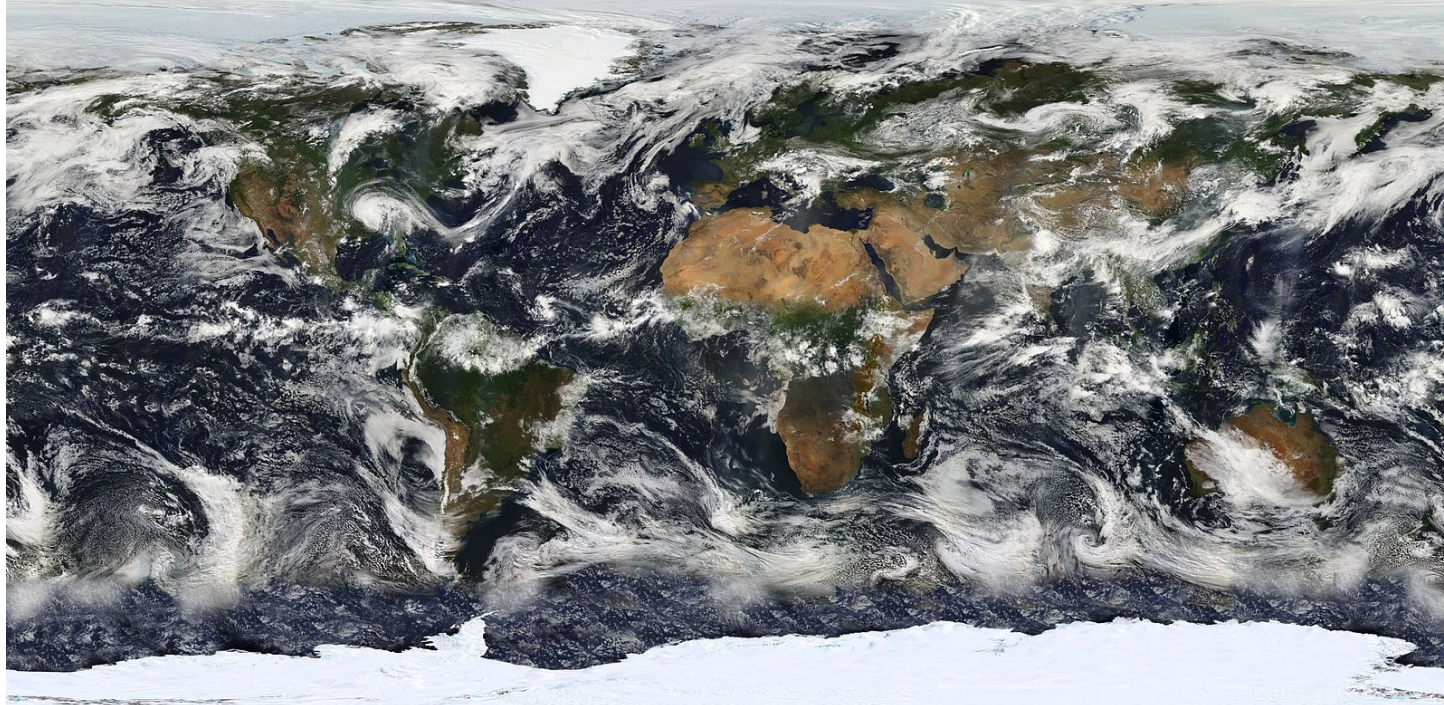


4. Lessons from COVID:
the wake-up call
for science and society

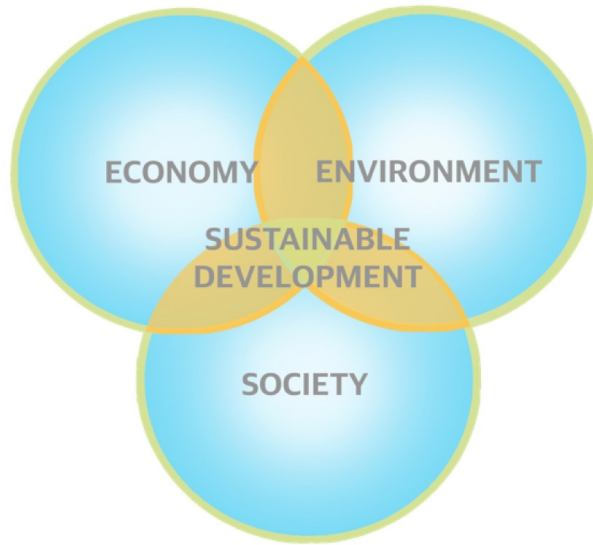


Lesson 1:

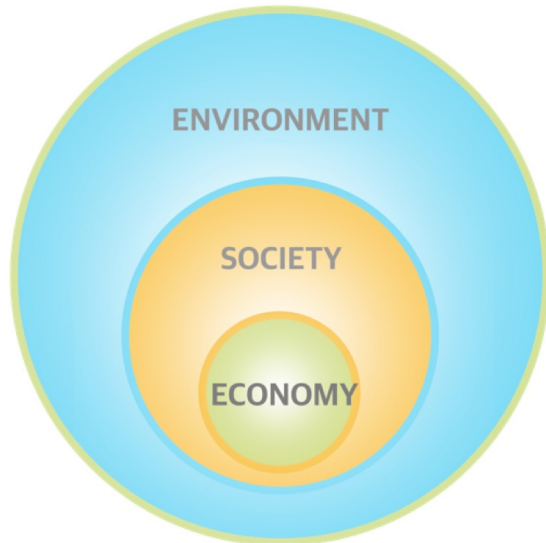
**We're all in
this together**



Perception



Reality



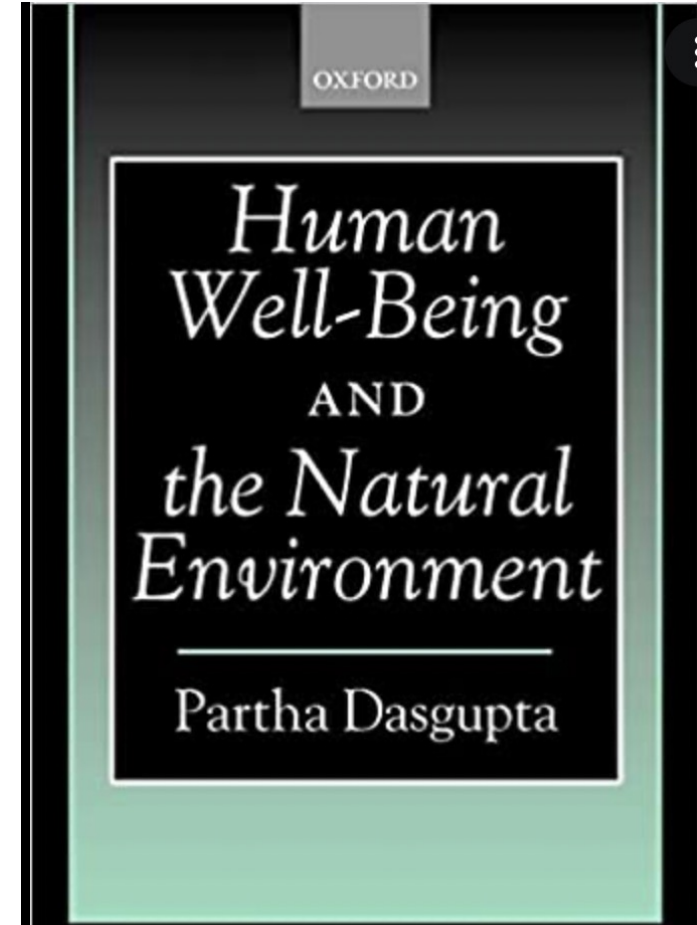
Lesson 2: Nature isn't a random economic externality

COVID and CLIMATE are predictable parts of the planetary economy.

They are not, in any rational meaning of the term, “externalities”.

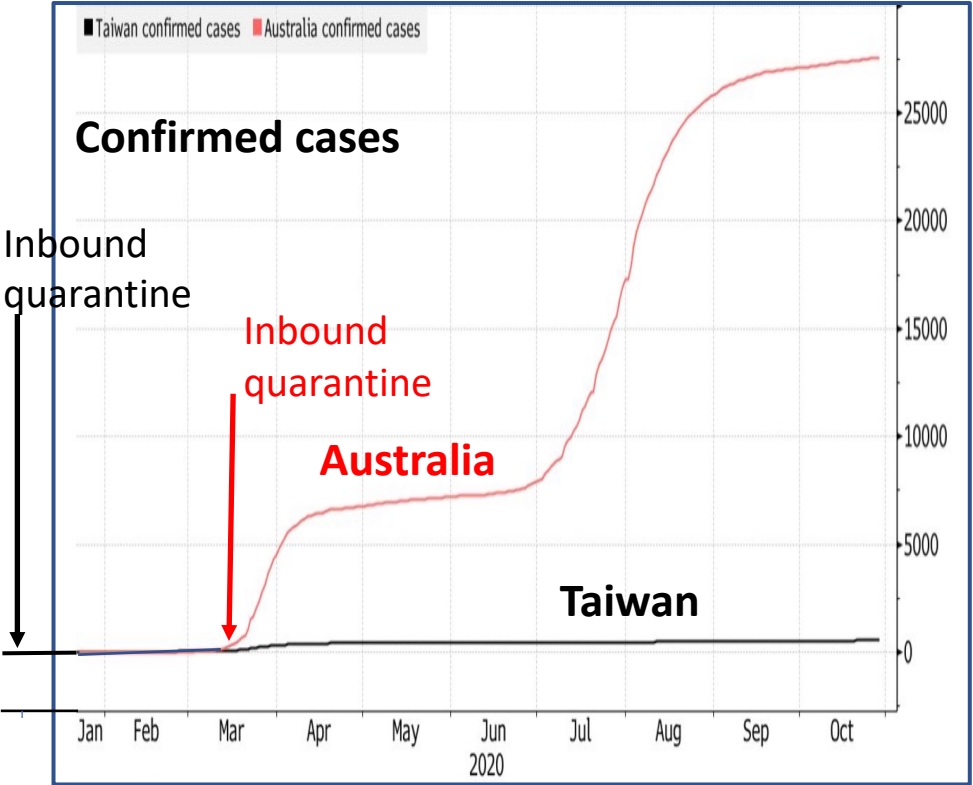
The human economy is also part of the planetary economy, but not, in the short term, so predictable.

Do we have to monetise the environment
In order to deal rationally with it?



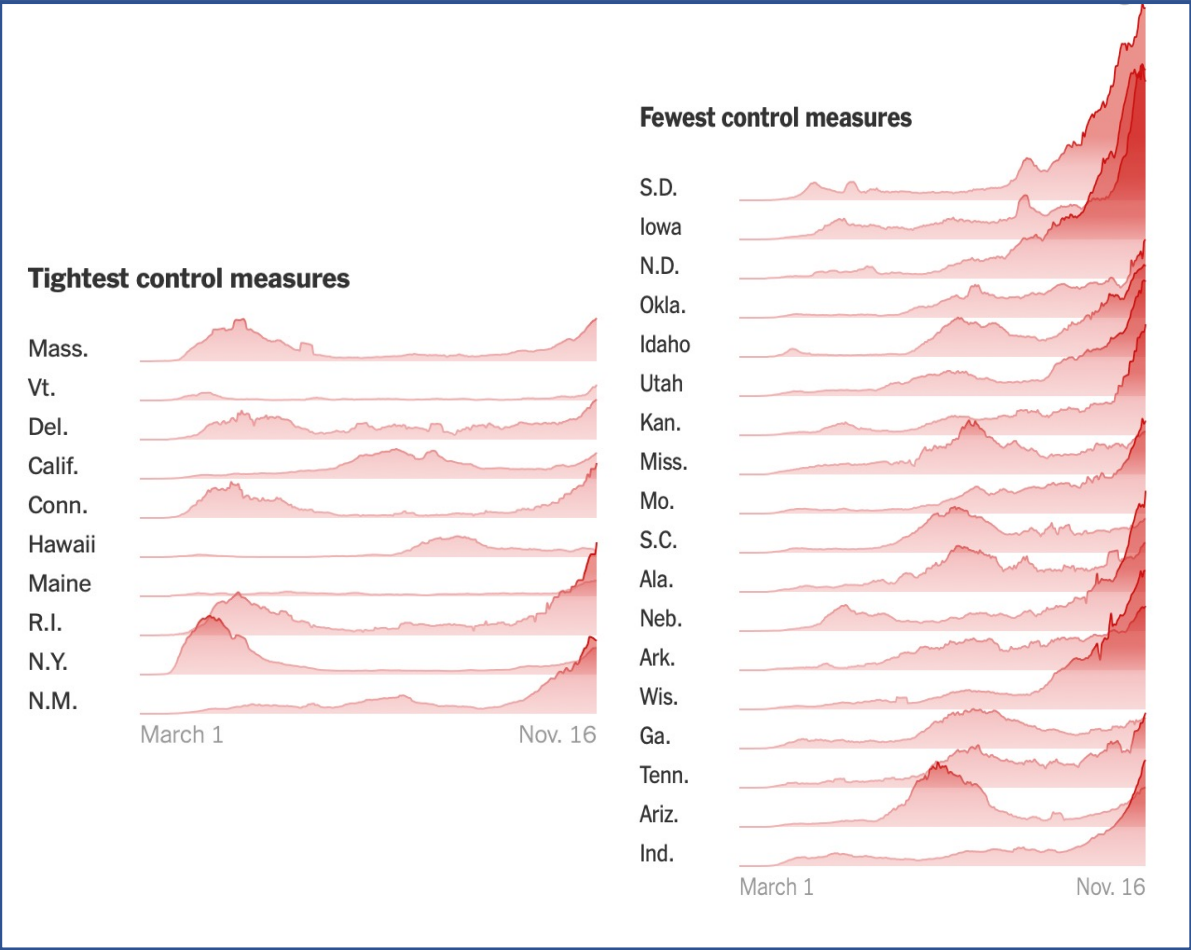
Lesson 3: Act early, act Hard

Early



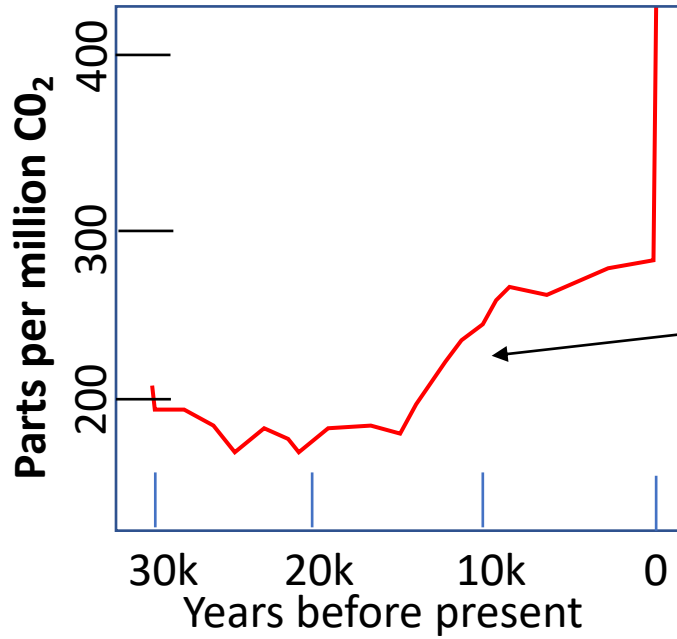
A tale of two islands

Hard

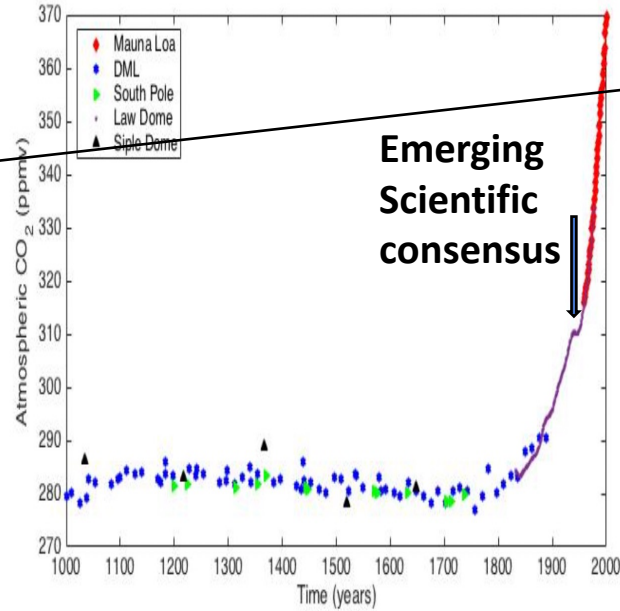


Carbon Dioxide: the global thermostat

It's getting late

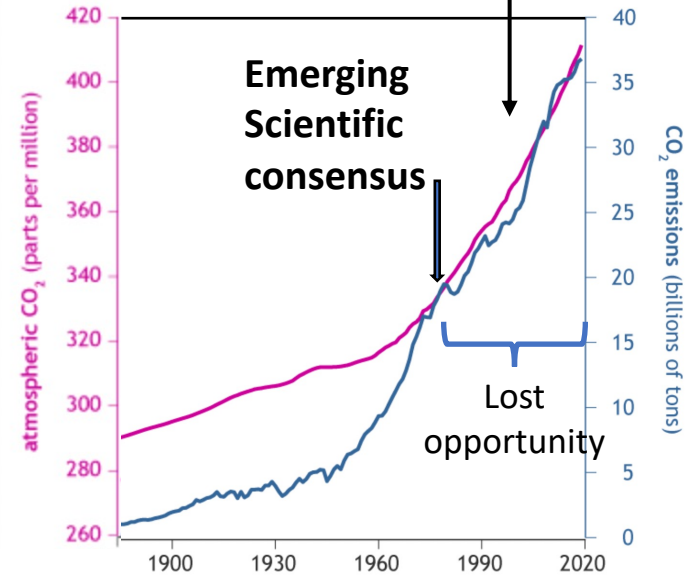


30,000 years



1,000 years

Warming & CO₂
100x faster
than the end of
Ice Age warming



130 years

Why do we fail to act?

- Populist politics – don't be a bringer of bad news?
- Credibility – it's only a theory?
- Hard wired for the immediate?
- Lack of imagination?
- Cheating?



We need to understand these psychologies in an age of pandemics, of climate change and looming planetary boundaries

Lesson 4: Where does all this science come from?

“because of capitalism,
because of greed”

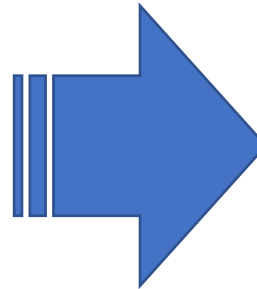
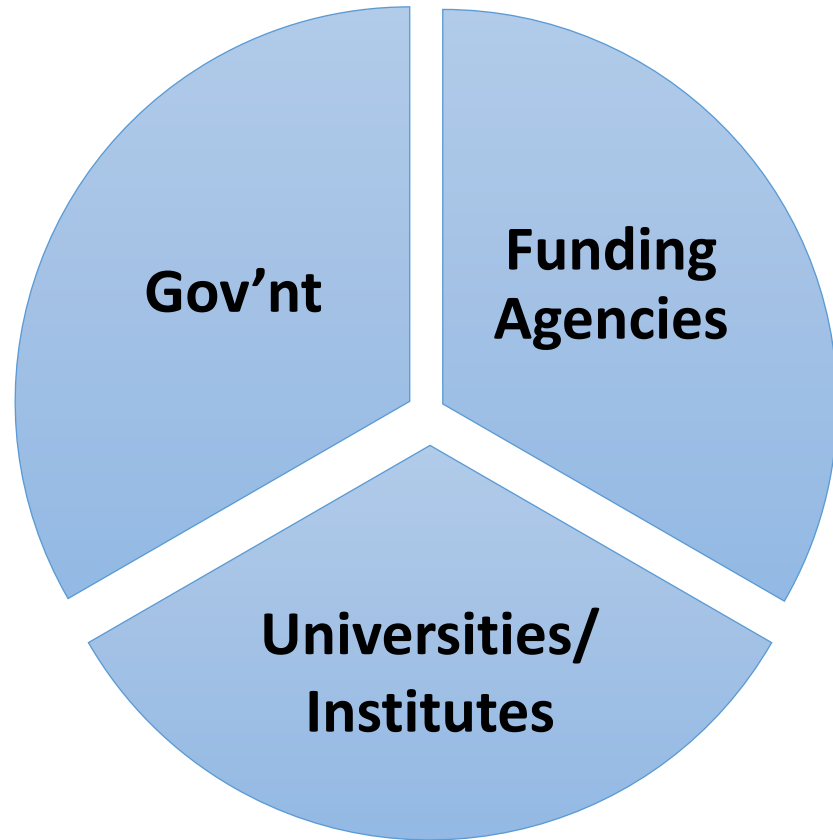


"I'M MAINLY MOTIVATED
BY GREED"



It comes from efficient national science systems

Self-organizing Triad



Priorities

Governments

Jobs/growth/innovation
Knowledge exchange

Funding agencies

Strategic
Excellence

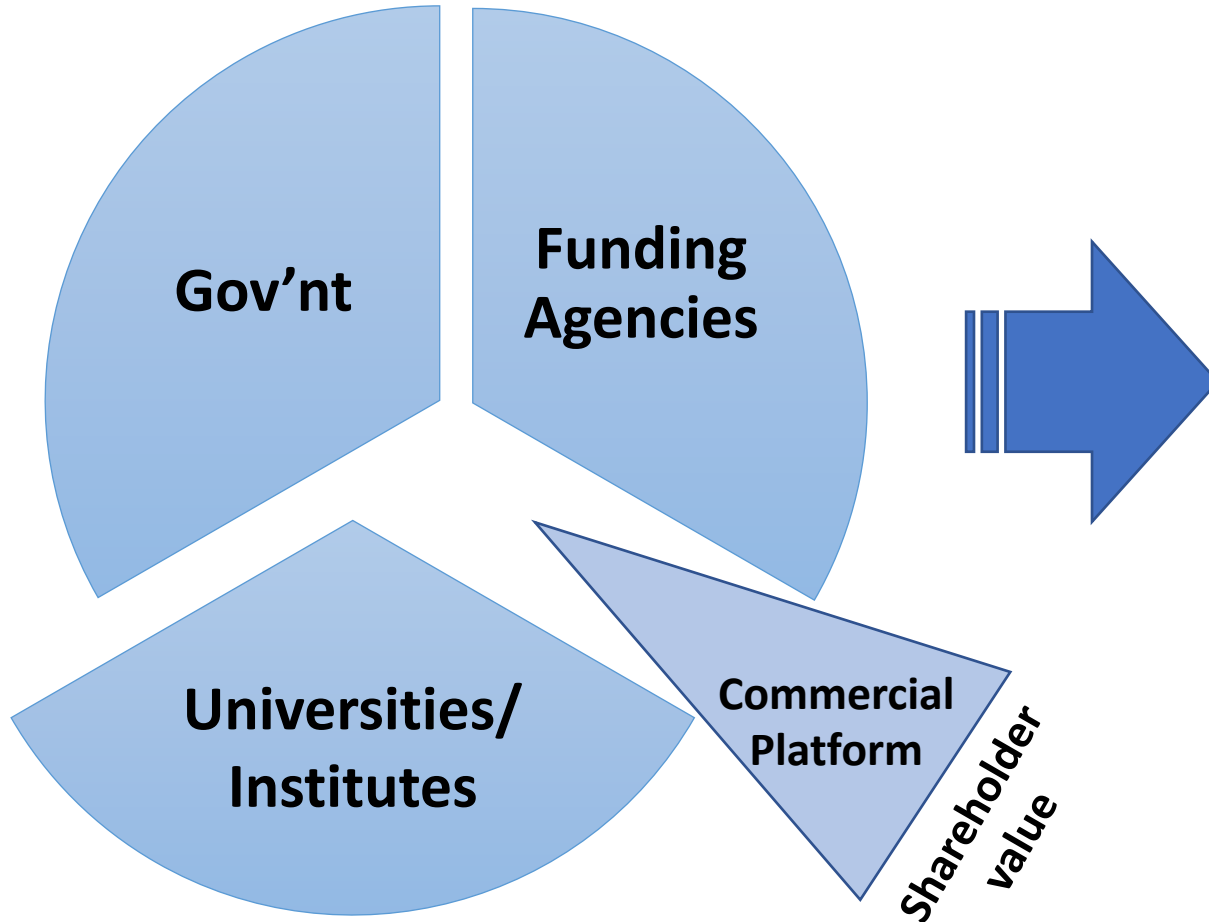
Universities

Highly competitive
Strategic research
Academic freedom as enabler
of broad-spectrum research

**Public
Good
Motivation**

System disruption?

A quartet?



Priorities

Governments

Jobs/growth/innovation
Knowledge exchange

Funding agencies

Strategic priorities
Excellent research

Universities

Highly competitive
Strategic research
Curiosity-driven research

Institutes

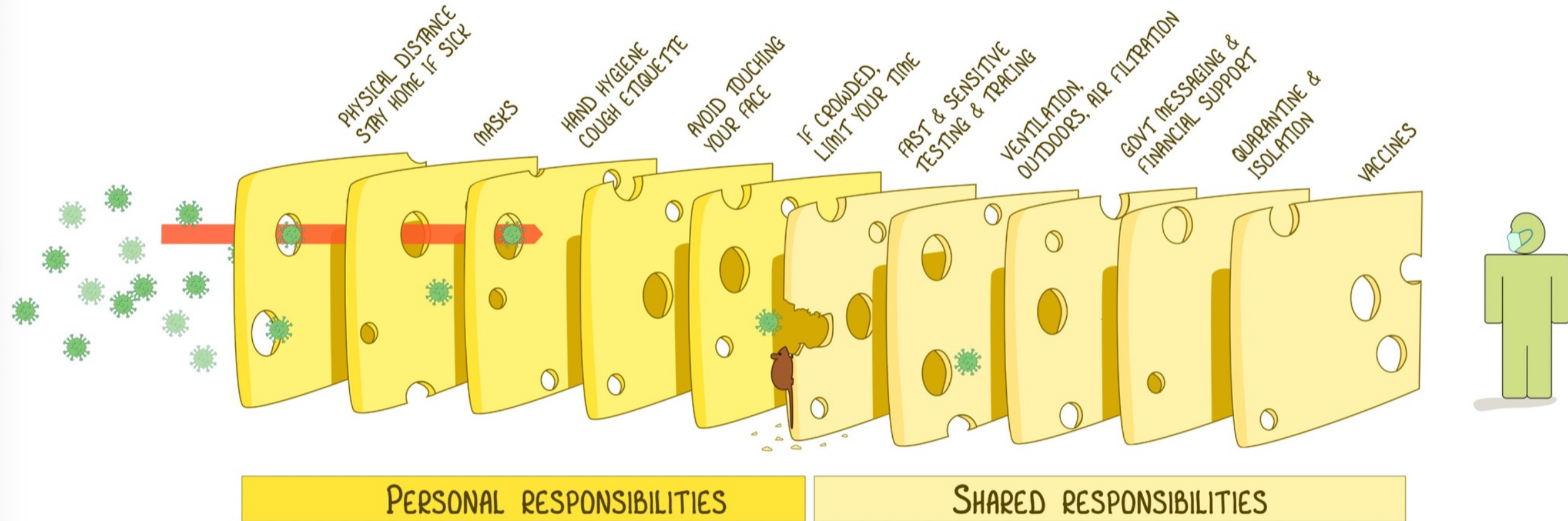
Strategic Research

**Public
Good
Motivation**

Lesson 5: There is no silver bullet

THE SWISS CHEESE RESPIRATORY VIRUS PANDEMIC DEFENCE

RECOGNISING THAT NO SINGLE INTERVENTION IS PERFECT AT PREVENTING SPREAD



EACH INTERVENTION (LAYER) HAS IMPERFECTIONS (HOLES).
MULTIPLE LAYERS IMPROVE SUCCESS.

Ian M. Mackay

Final Lesson: no vaccine for climate change

