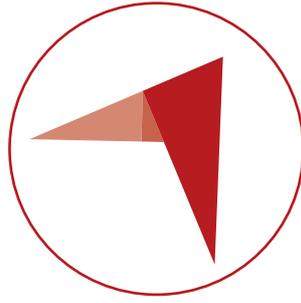


# The Lindau Guidelines

for global, sustainable  
and cooperative open science  
in the 21st century

2020 Edition



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## INTRODUCTION

The Lindau Guidelines 2020 are based on an initiative first introduced by Elizabeth Blackburn during the 68th Lindau Nobel Laureate Meeting held in Lindau, Germany, in June 2018.

She called upon the 600 young scientists in the audience to develop and support a new approach for global, sustainable and cooperative open science. While it was formulated with basic research as its primary focus, its principles and goals can be applied to all types and disciplines of science.

This initiative was met with very positive feedback from the audience, and was discussed widely during the remainder of the meeting. Based on this, Elizabeth Blackburn and the Lindau Nobel Laureate Meetings started to explore what such a project would encompass and how to bring it to fruition.

As the Lindau Nobel Laureate Meetings focus on young scientists at all stages of academic training as well as early-career scientists, the idea emerged

of developing helpful and practical guidelines for scientific research and conduct that will support global, sustainable and cooperative open science in the long-term.

These guidelines, while intended for all those engaged in scientific research, are especially important for those embarking on independent careers. Their goals are to inspire and foster exchange of information and to raise awareness about the impact of their research and the need for collaborative efforts to sustain public support for science.

These guidelines also respond to the current emergence of distrust of significant parts of the public in science in many parts of the world. Furthermore, public opinion and scientific consensus increasingly diverge drastically, with probably very serious consequences for humankind.

This document offers the 2020 edition of the guidelines, released after the Lindau Nobel Laureate Meetings' Online Science Days 2020.

## GOAL 01

### *Adopt an Ethical Code*

It has often been argued that science is always neutral and cannot be blamed for its abuses stemming from the misapplication of technological advances. And yet, humankind is currently facing very serious challenges that only exist due to scientific progress. Two of these challenges – nuclear weapons and climate change – have been addressed in the Mainau Declarations 1955 and 2015.

Scientific research cannot be divorced from its consequences, and neither can a scientist's actions. An ethical code provides ethical and moral foundations that help one to consider the likely consequences of one's actions.

Whether or not one agrees with all its stipulations, even considering to work by a personal ethical code will already be inspiring and will serve to raise awareness. Various such codes have already been suggested, and instead of formulating a new one, we refer to the existing "Universal Ethical Code for Scientists", which was developed by Sir David King (Former UK Government Chief Scientific Adviser & Head of the Government Office for Science), and adopted by the Royal Society.

Documents such as the United Nations Declaration of Human Rights, which also addresses science, provide further guidance for moral and ethical decisions of scientists.

While the ethical principles are universal and timeless in nature, the remaining goals are more current and practical and accordingly may be amended or changed in the future.

### *The Universal Ethical Code for Scientists*

#### **Rigour**

*Rigour, honesty and integrity*

- Act with skill and care in all scientific work. Maintain up-to-date skills and assist their development in others.
- Take steps to prevent corrupt practices and professional misconduct. Declare conflicts of interest.
- Be alert to the ways in which research derives from and affects the work of other people, and respect the rights and reputations of others.

#### **Respect**

*Respect for life, the law and the public good*

- Ensure that your work is lawful and justified.
- Minimise and justify any adverse effect your work may have on people, animals and the natural environment.

#### **Responsibility**

*Responsible communication: listening and informing*

- Seek to discuss the issues that science raises for society. Listen to the aspirations and concerns of others.
- Do not knowingly mislead, or allow others to be misled, about scientific matters. Present and review scientific evidence, theory or interpretation honestly and accurately.

#### GOAL 02

### *Cooperate Globally on Global Problems*

The vast majority of the most pressing problems of today are global in nature: They affect large parts of the world and its population, they do not stop at borders, and they cannot be solved alone.

Therefore, scientists, funders and politicians must cooperate globally to increase efficiency, speed, and effectiveness. While the creative benefits of differing approaches and the stimulus of competition are to be acknowledged, inefficiency by unnecessary parallelism or obstruction must be avoided.

#### GOAL 03

### *Share Knowledge*

Knowledge becomes most powerful when it is shared with others. By sharing information, progress can be achieved faster and ultimately more efficiently. This includes sharing information about failures or negative results of studies.

Thus, all scientific results and data shall be made openly available, first within research groups, and once reliable, to the whole scientific community.

Modern technologies allow for systems that can guarantee correct attribution of ideas to those who generated them.

Furthermore, scientists shall engage in fighting false or fake information and data.

#### GOAL 04

### *Publish Results Open Access*

Scientific results shall be published in an open access mode. Many approaches such as open access journals or pre-print archives as well as new initiatives already exist. While it is not yet clear which modes and models will ultimately succeed, it remains imperative to publish all relevant scientific findings in an open access mode.

Published science shall not refer to unpublished data, code, materials, etc., obstructing further reference, use, or sharing.

#### GOAL 05

### *Publish Data to Repositories*

Publishing is not limited to scientific findings. Any kind of data found, generated or used shall also be archived in appropriate data repositories. As this means storing vast amounts of data, the technological and administrative infrastructure must be continuously improved and adapted to guarantee safe and secure long-term storage.

The publication of data, formulas, algorithms and other background used to generate findings will become a new requirement of scientific publishing. All scientific content shall be preserved, connected, and versioned to foster discovery, accumulation of evidence, but also respect for uncertainty.

#### GOAL 06

### *Work Transparently & Truthfully*

Research must be transparent and truthful:

First, in methodology, data and findings, meaning that these have to be performed and documented in the most precise and comprehensible way.

Second, in communication, and collaboration, meaning that relevant findings shall be communicated and provided to others in a precise, timely and constructive manner.

Third, in disclosure of funding, affiliations, and political or ideological motivations, meaning that all motivations outside of a pure scientific interest shall be communicated openly.

#### GOAL 07

### *Change Reward Systems*

Currently, investing in transparency, openness, accessibility etc. is not appropriately rewarded. For the future, implementation and adherence to the aforementioned practices must be rewarded, e.g. in reviewing and job employment and promotion.

Evaluations of scientists shall be based on both the significance and quality of their research as well as the process by which discoveries were made, not on where the results are published or where the research has been performed. Credit will also be given for generating useful data, authoring code or creating resources that can be reused by others.

Evaluation criteria and metrics shall always be made transparent.

#### GOAL 08

### *Support All Talent*

Scientific talent exists in all parts of the world and all parts of society. All work and research environments as well as all structures related to that shall support scientific talent regardless of its background in an inclusive, diverse and non-discriminatory manner. Equal access and opportunities shall be provided and actively promoted.

#### GOAL 09

### *Communicate to Society*

Science has a distinct responsibility to communicate its procedures and results to society. Not only is most basic research funded by tax-payer money, research and its applications have all-pervasive effects on people's lives. Particularly for global issues such as climate change, proper communication becomes an important duty.

The scientific community must also constructively work on providing usable information to the decision-making process in politics, society, industry and other areas.

Furthermore, the importance of science in general as well as of basic science shall be emphasized more clearly.

## GOAL 10

### *Engage in Education*

While research is at the core of the scientific discovery process, engaging in the education of the next generation is equally crucial.

Enabling and supporting aspiring young pupils, students and scientists ensures a sustainable process of mutual learning and empowers the subsequent cohort of researchers.

Engaging in education can take multiple forms, from classroom lectures to mentoring, from cooperative lab-work to off-campus activities.

Fostering this engagement requires appropriate resources to educate the educators.

## BACKGROUND INFORMATION

### INITIATORS

This initiative has been inspired by Nobel Laureate Elizabeth Blackburn's opening ceremony keynote at the 68th Lindau Nobel Laureate Meeting in June 2018.

Elizabeth Blackburn has a long-standing interest not only in science but also to science policy.

While their main focus is on science, the Lindau Nobel Laureate Meetings have always been a forum for discussions of the wider role of science in society. This has, for example, resulted in the 1955 Mainau Declaration on Nuclear Weapons and the 2015 Mainau Declaration on Climate Change.

Elizabeth Blackburn and the Lindau Nobel Laureate Meetings have developed this initiative jointly.

### ENDORSEMENT & SIGNATORIES

The Lindau Nobel Laureate Meetings seek to get the endorsement from Nobel Laureates who share the ideals and aspirations of these guidelines.

Academic and scientific institutions are invited to support the Lindau Guidelines as well.

Finally, signature will be open to all scientists via an online register beginning June 28, 2020.

### CURRENT STATUS

As of mid 2020, the open contribution period for the 2020 edition has come to an end. Discussions were continued during the Online Science Days in summer 2020, and the text has been finalized in fall of the same year. The version presented in this document is the final edition 2020.

Further suggestions may be added into future versions of the guidelines.

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