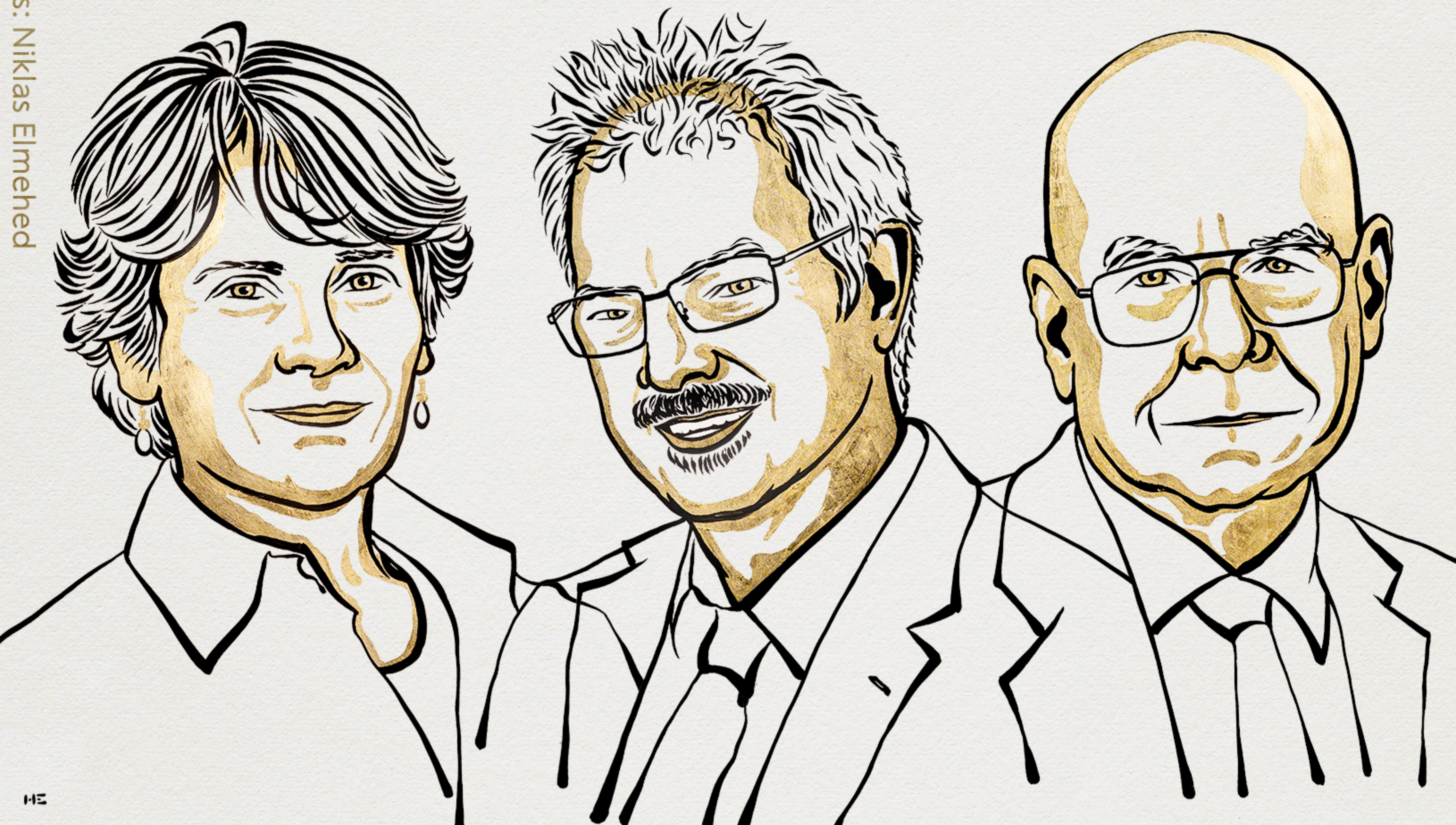


# THE NOBEL PRIZE IN CHEMISTRY 2022

Illustrations: Niklas Elmehed



Carolyn R.  
Bertozzi

Morten  
Meldal

K. Barry  
Sharpless

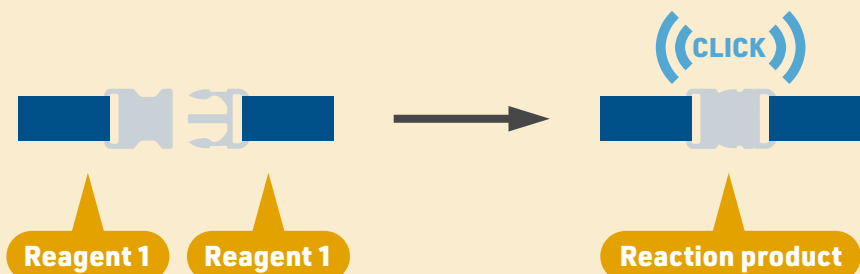
"for the development of click chemistry  
and bioorthogonal chemistry"

THE ROYAL SWEDISH ACADEMY OF SCIENCES

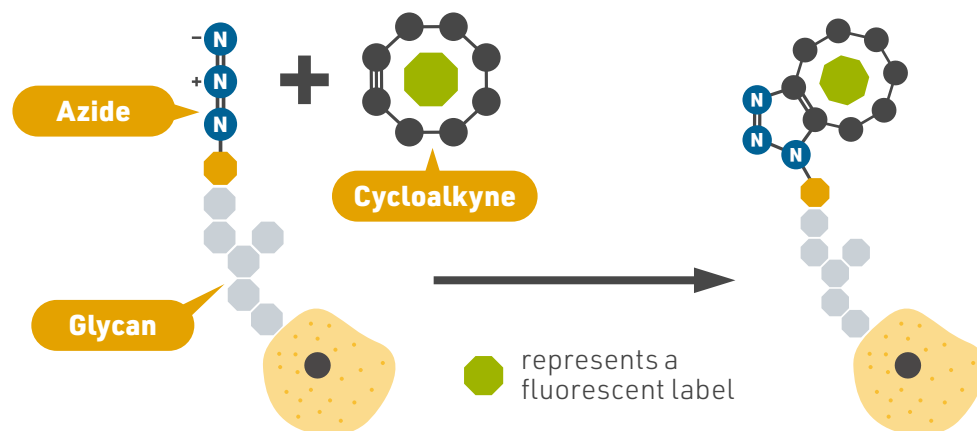
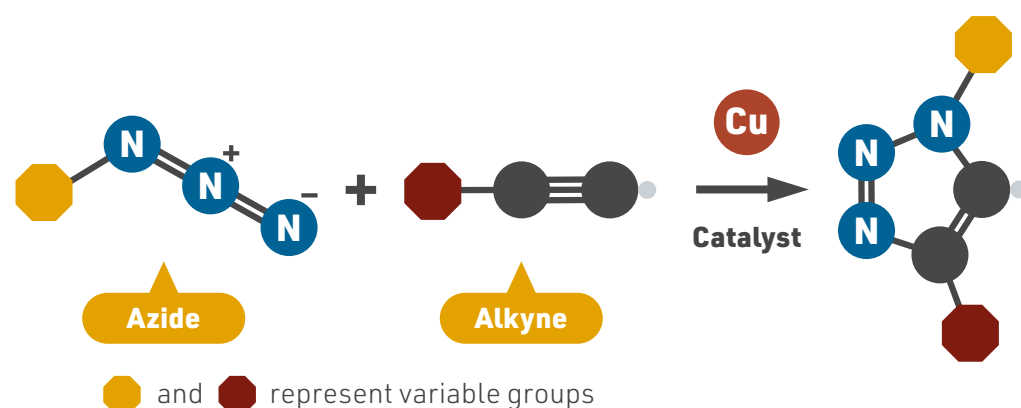
# 2022 NOBEL PRIZE IN CHEMISTRY



The 2022 Nobel Prize in Chemistry was awarded jointly to **Carolyn R. Bertozzi**, **Morten Meldal** and **K. Barry Sharpless** for their development of click chemistry and bioorthogonal chemistry.



**Barry Sharpless** coined the concept of “click” chemistry in 2001: the idea of reactions that efficiently snap together small molecular building blocks using easily achieved reaction conditions, avoiding unwanted byproducts.



Independently, **Barry Sharpless** and **Morten Meldal** developed the first click reaction: a reaction in which an azide is added to an alkyne with a copper catalyst. The two reagents click together to form a single cyclic product, with the copper catalyst making the reaction quick and selective. Chemists could add useful groups onto the azide and alkyne to change the product formed by the reaction.

**Carolyn Bertozzi** introduced the concept of bioorthogonal chemistry – chemical reactions that happen in cells without affecting their normal chemistry – in 2003. Copper is toxic to living cells, so she modified the original click reaction to produce a copper-free version. She used this reaction to track molecules called glycans on cell surfaces, which she had been investigating since the early 1990s.

## WHY DOES THIS RESEARCH MATTER?

Additional click chemistry reactions have been developed, useful in the synthesis of new drugs. Bioorthogonal reactions allow researchers to study biological molecules and help identify targets of new drugs, and are also being trialled to produce ‘clickable’ antibodies to target cancerous tumours.

Nobel Prize in Chemistry press release: <https://www.nobelprize.org/prizes/chemistry/2022/press-release/>

5 October 2022

# The Nobel Prize in Chemistry 2022

The Royal Swedish Academy of Sciences has decided to award the Nobel Prize in Chemistry 2022 to

## Carolyn R. Bertozzi

Stanford University, CA, USA  
Howard Hughes Medical Institute, USA

## Morten Meldal

University of Copenhagen, Denmark

## K. Barry Sharpless

Scripps Research, La Jolla, CA, USA

*“for the development of click chemistry and bioorthogonal chemistry”*

## It just says click – and the molecules are coupled together

The Nobel Prize in Chemistry 2022 is about making difficult processes easier. Barry Sharpless and Morten Meldal have laid the foundation for a functional form of chemistry – *click chemistry* – in which molecular building blocks snap together quickly and efficiently. Carolyn Bertozzi has taken click chemistry to a new dimension and started utilising it in living organisms.

Chemists have long been driven by the desire to build increasingly complicated molecules. In pharmaceutical research, this has often involved artificially recreating natural molecules with medicinal properties. This has led to many admirable molecular constructions, but these are generally time consuming and very expensive to produce.

“This year’s Prize in Chemistry deals with not overcomplicating matters, instead working with what is easy and simple. Functional molecules can be built even by taking a straightforward route,” says Johan Åqvist, Chair of the Nobel Committee for Chemistry.

**Barry Sharpless** – who is now being awarded his second Nobel Prize in Chemistry – started the ball rolling. Around the year 2000, he coined the concept of click chemistry, which is a form of simple and reliable chemistry, where reactions occur quickly and unwanted by-products are avoided.

Shortly afterwards, **Morten Meldal** and Barry Sharpless – independently of each other – presented what is now

the crown jewel of click chemistry: *the copper catalysed azide-alkyne cycloaddition*. This is an elegant and efficient chemical reaction that is now in widespread use. Among many other uses, it is utilised in the development of pharmaceuticals, for mapping DNA and creating materials that are more fit for purpose.

**Carolyn Bertozzi** took click chemistry to a new level. To map important but elusive biomolecules on the surface of cells – glycans – she developed click reactions that work inside living organisms. Her *bioorthogonal reactions* take place without disrupting the normal chemistry of the cell. These reactions are now used globally to explore cells and track biological processes. Using bioorthogonal reactions, researchers have improved the targeting of cancer pharmaceuticals, which are now being tested in clinical trials.

Click chemistry and bioorthogonal reactions have taken chemistry into the era of functionalism. This is bringing the greatest benefit to humankind.

**Carolyn R. Bertozzi**, born 1966 in USA. PhD 1993 from UC Berkeley, CA, USA. Anne T. and Robert M. Bass Professor at Stanford University, CA, USA and Investigator, Howard Hughes Medical Institute.

**Morten Meldal**, born 1954 in Denmark. PhD 1986 from Technical University of Denmark, Lyngby, Denmark. Professor at University of Copenhagen, Denmark.

**K. Barry Sharpless**, born 1941 in Philadelphia, PA, USA. PhD 1968 from Stanford University, CA, USA. W. M. Keck Professor at Scripps Research, La Jolla, CA, USA.

**Prize amount:** 10 million Swedish kronor, to be shared equally between the Laureates.

**Further information:** [www.kva.se](http://www.kva.se) and [www.nobelprize.org](http://www.nobelprize.org)

**Press contact:** Eva Nevelius, Press Secretary, +46 70 878 67 63, [eva.nevelius@kva.se](mailto:eva.nevelius@kva.se)

**Expert:** Olof Ramström, +46 70 433 42 60, [ramstrom@protonmail.com](mailto:ramstrom@protonmail.com), member of the Nobel Committee for Chemistry

The Royal Swedish Academy of Sciences, founded in 1739, is an independent organisation whose overall objective is to promote the sciences and strengthen their influence in society. The Academy takes special responsibility for the natural sciences and mathematics, but endeavours to promote the exchange of ideas between various disciplines.

BOX 50005, SE-104 05 STOCKHOLM, SWEDEN  
TEL +46 8 673 95 00 • [WWW.KVA.SE](http://WWW.KVA.SE)  
BESÖK/VISIT: LILLA FRESCATIVÄGEN 4A, SE-114 18 STOCKHOLM, SWEDEN



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