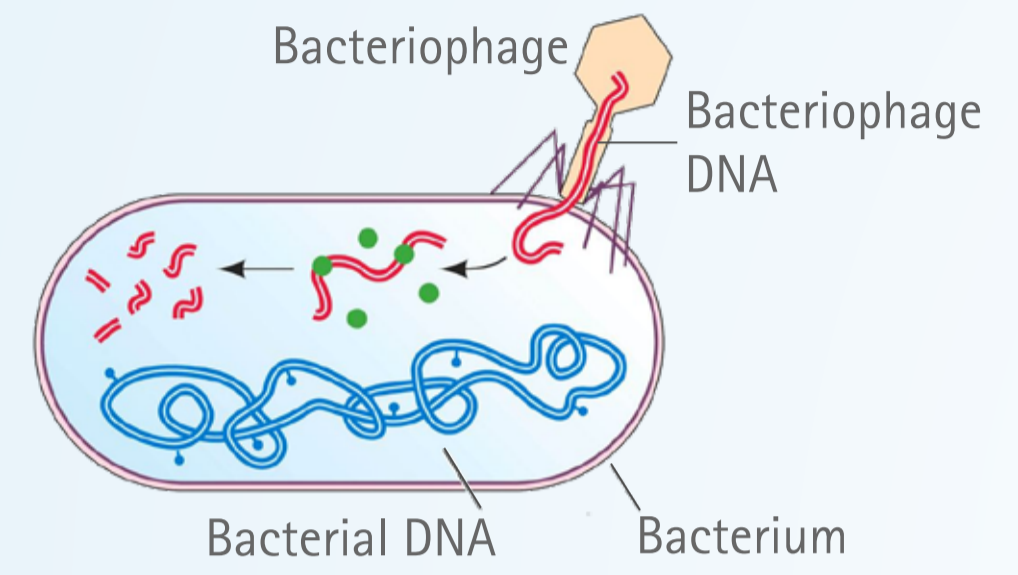


WERNER ARBER IMAGINING AND DISCOVERING THE TOOLS OF GENOME EDITING

The Discovery of Restriction Enzymes: Molecular Scissors

Hypothesis:

This idea of restriction enzymes started as a hypothesis by Werner Arber who noticed that certain bacteria fought off bacteriophages (viruses that infect and replicate in bacteria) by chopping up their DNA



Why don't these enzymes cut up the bacterial cell's DNA?

Arber hypothesized that bacterial cells produce two types of enzymes:
A. one called a "restriction" enzyme that can identify and cut foreign DNA;
B. and a "modification" enzyme that recognizes the host DNA and protects it from cleavage

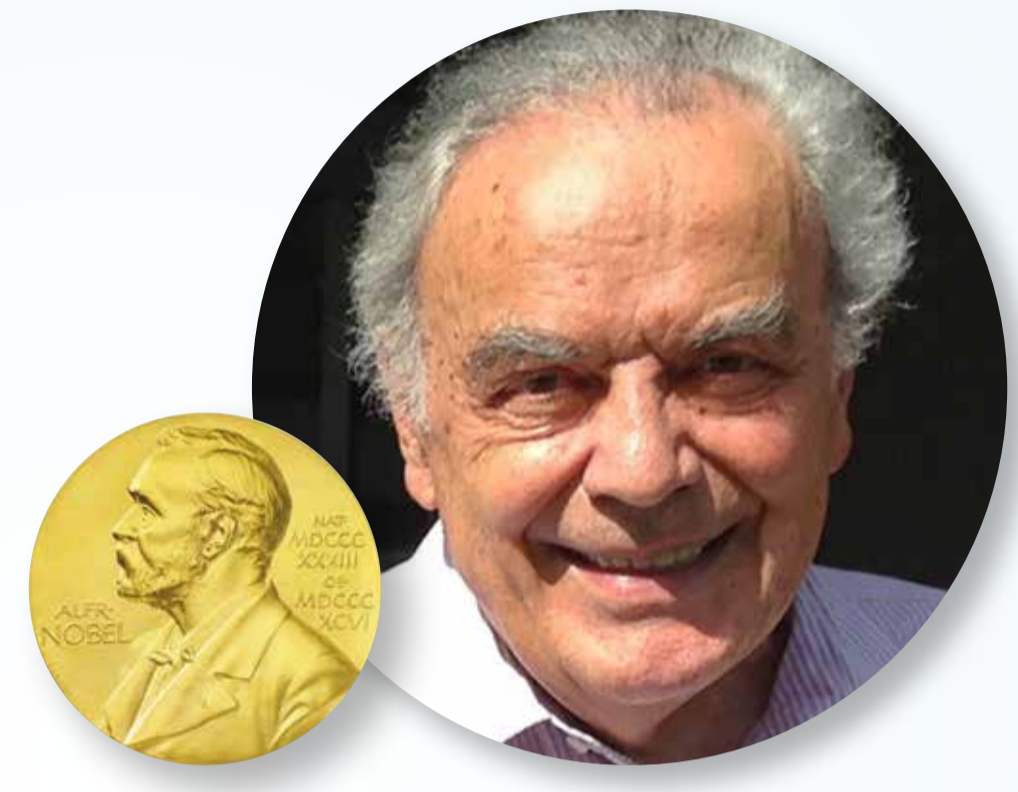
What's the value of these restriction enzymes?

Today, researchers rely on restriction enzymes to perform virtually any process that involves manipulating, analyzing, and creating new combinations of DNA sequences:

- DNA cloning
- Hereditary disease diagnosis
- Production of proteins for treatment of disease
- Genomics
- Gene editing
- Gene replacement therapy

Without the discovery of restriction enzymes, the fields of recombinant DNA technology, biotechnology, and genomics as we know them today would not exist

The Importance of Werner Arber's Work Resulted in Award of the Nobel Prize in 1978



Werner Arber's Activities in the Biotechnology Sector

Research in areas of the mechanisms of biological evolution – Three Strategies of the Natural Process of Genetic Variation assumed:

- A.** Local mutation
- B.** Intragenomic translocation of a shorter genome segment
- C.** Horizontal gene transfer (gave rise to experimental gene transplantation, which facilitates: "Functional testing, DNA sequence analysis")

Bacterial restriction and modification:

- A.** Detecting invading foreign DNA, which leads to its degradation (modulator of the frequency of genetic variation)
- B.** Protection of cellular DNA by site-specific methylation: many hundreds of specificities of DNA tagging inherent (restriction enzymes commercially available from New England Biolab)
- C.** Restriction enzymes serve to break down the genome into many shorter fragments, which facilitates gene analysis

Trinational Biotechnology Program of the Universities of Strasbourg, Basel, Freiburg i.Brs. and Karlsruhe:

- A.** Based in Strasbourg: ESBS (Ecole Supérieure de Biotechnologie de Strasbourg)
- B.** Program proposed by W. Arber in his rectorate period in December 1985 and kicked off at the beginning of the 1990s:
 - University of Basel: focus on microbiology
 - Freiburg i. Brsg: focus on physiology and molecular biology of plants
 - Karlsruhe: focus on process engineering, stopped few years ago and moved to Strasbourg

SUCCESS CATEGORIES

- ★ Completed achievement with lasting impact
- ★ Scientific break-through
- ★ New technology
- ★ Strong impact on society
- ★ Involvement of one or more Swiss citizens
- ★ Swiss-based company / institution
- ★ Enabler for the biotech industry