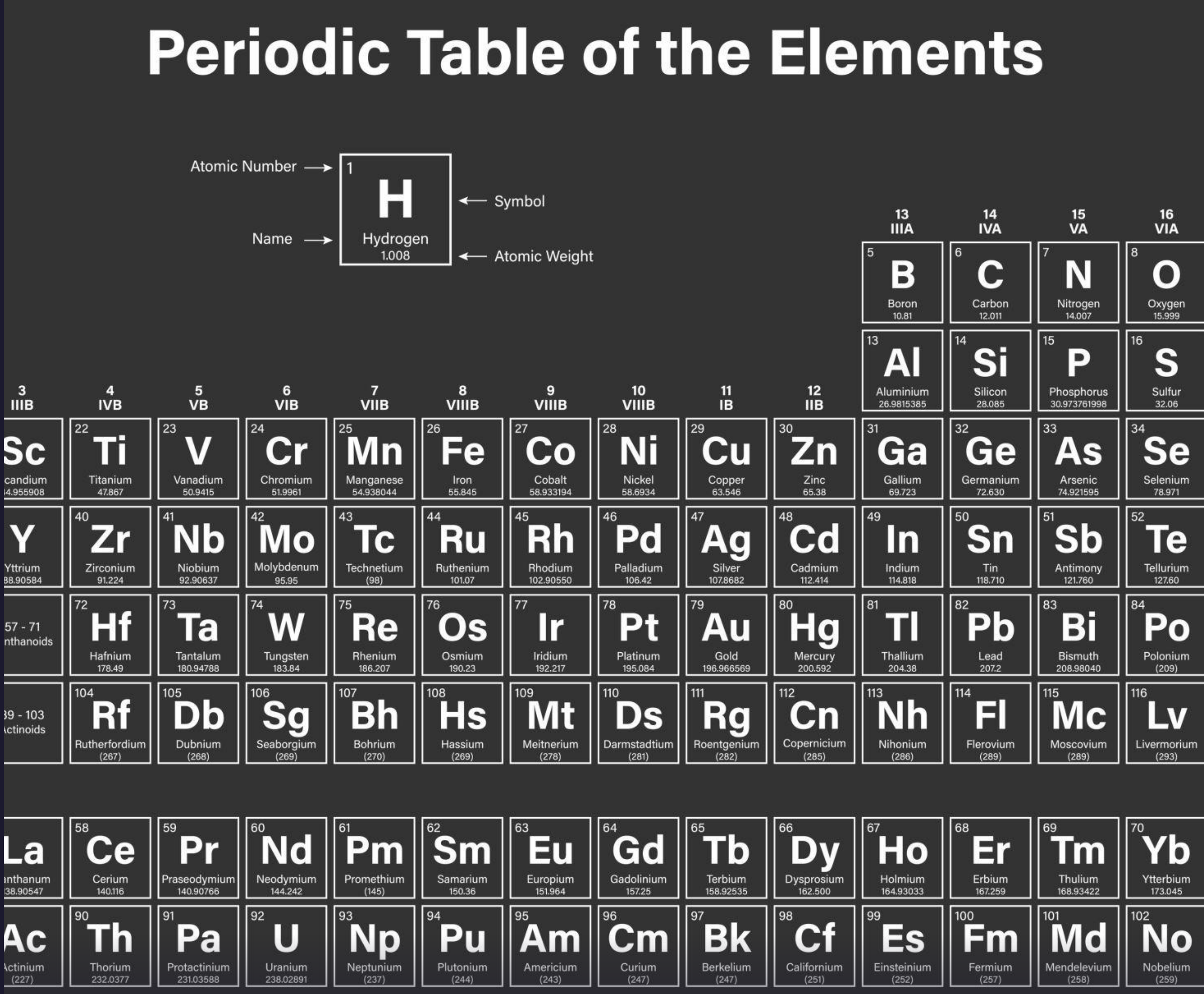
InterceptAge

Conversion of biowaste into metals using microorganisms

Annotation

- This presentation examines the process of biomineralization of organic waste using microorganisms to obtain valuable metals. It explores the mechanisms of transforming biowaste into metallic compounds, as well as the prospects for the practical application of this process.

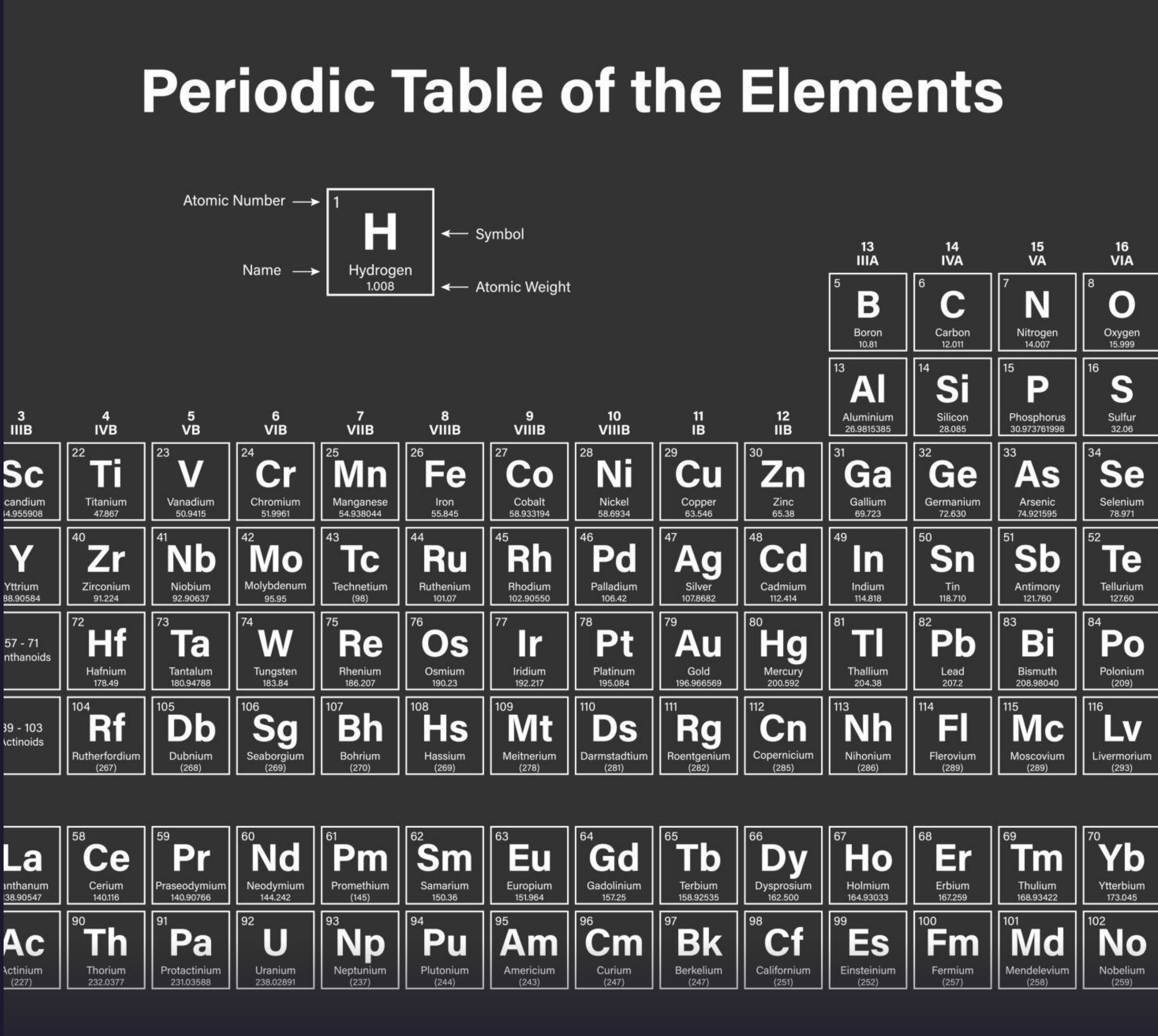


Introduction

- The problem of biowaste disposal is one of the key environmental challenges of our time. The search for efficient methods of processing organic waste is becoming particularly relevant in the context of increasing anthropogenic impact on the environment. One promising approach is the use of microorganisms to transform biowaste into valuable metallic compounds.

Theoretical basis

- Biomineralization is a natural process of the formation of inorganic compounds by living organisms. Microorganisms are capable of accumulating and transforming various elements, including metals, through biochemical reactions.



The main mechanisms of biomineralization include:

- **Precipitation of metals as insoluble compounds.**

- Formation of organometallic complexes

- **Biosorption of metal ions**
  Biocatalytic

- **Biosorption of metal ions**
  Biocatalytic reduction of metals

- **The objects of the study were various types of biowaste (plant residues, food waste, livestock waste). Strains of bacteria from the genera *Pseudomonas* and *Bacillus*, other bacterial strains, and several species of fungi were used as biological agents.**

The research methodology included:

- **Preparation of biowaste samples**
- **Incubation with microbial cultures**
- **Monitoring of the mineralization process**
- **Analysis of the obtained metallic compounds**

Research Results In the course of the experiment, it was established that microorganisms are capable of effectively transforming organic substances with the formation of the following metallic compounds:

- Iron and manganese oxides
- Copper and zinc sulfides
- Calcium carbonates
- Complex organometallic compounds

Efficiency of the process depends on:

- The chemical composition of the raw material
- Temperature and humidity conditions pH of the medium

Discussion of the Results

Perfect. Here is the translation:

- The obtained results demonstrate the promise of using microorganisms for processing biowaste to obtain valuable metallic compounds. This approach makes it possible to solve two important tasks: waste disposal and the production of useful products.

- The study showed that the biomineralization process is an effective method for transforming biowaste into valuable metallic compounds. The further development of this approach can contribute to the creation of environmentally friendly technologies for processing organic waste and producing in-demand metallic products.

Research Prospects

- Optimization of the biomineralization process conditions
- Search for new strains of microorganisms
- Development of industrial technologies
- Economic assessment of the process

Methods for obtaining precious metals using microorganisms

- Current research demonstrates the promise of using microorganisms to extract valuable metals from various sources, including industrial waste.
- Particular attention is paid to bacterial leaching methods, which make it possible to efficiently extract gold and copper.

Mechanism of metal extraction

The extraction process is based on the ability of specific bacterial strains to:

- Oxidize sulfide minerals
- Transform metals into a soluble form
- Catalyze chemical reactions

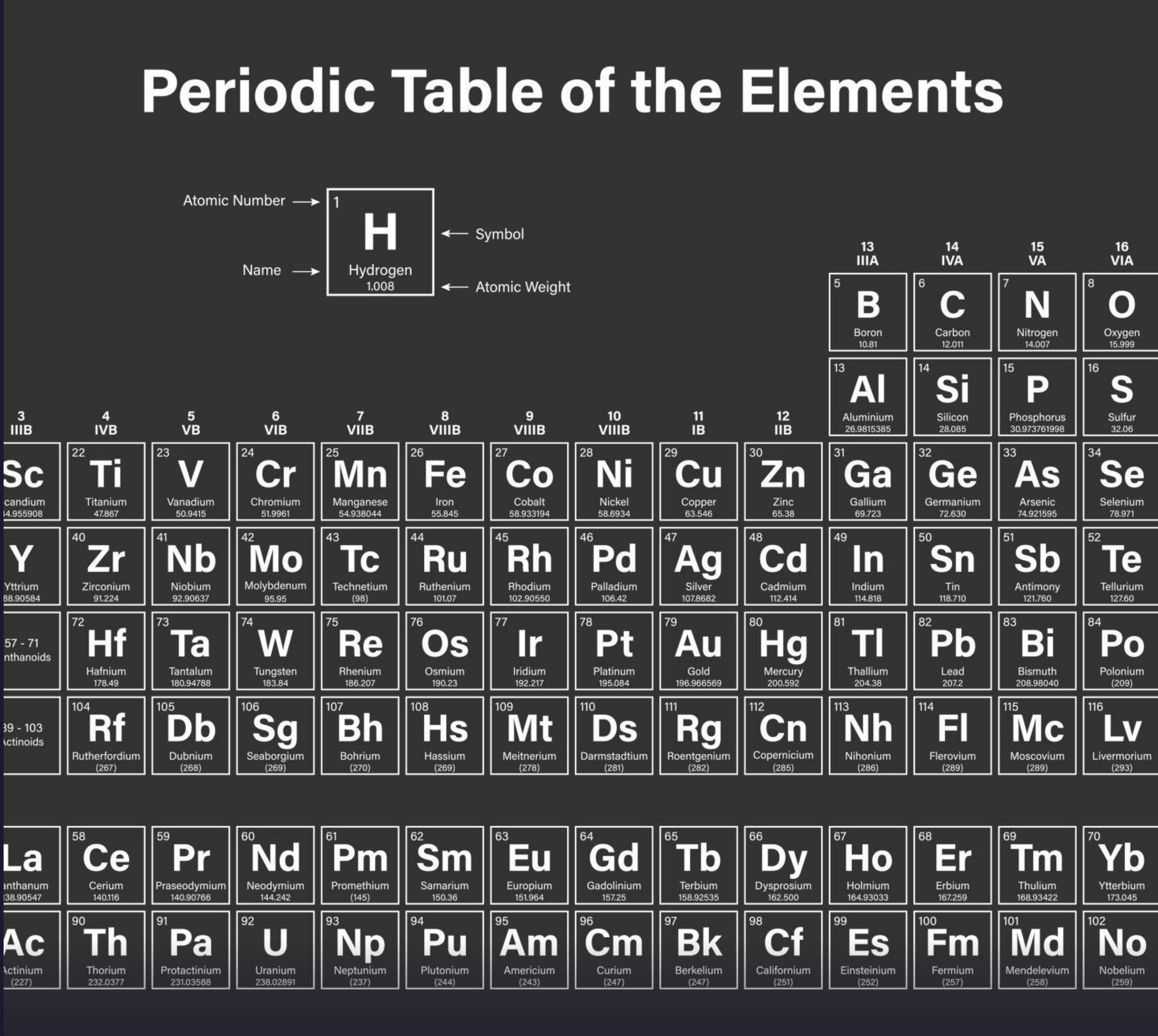
The most effective microorganisms for the process:

- Bacteria of the genus *Acidithiobacillus*
- Bacteria of the genus *Leptospirillum*
- Bacteria of the genus *Sulfobacillus*
- Strains of *C. Metallidurans*
- Others

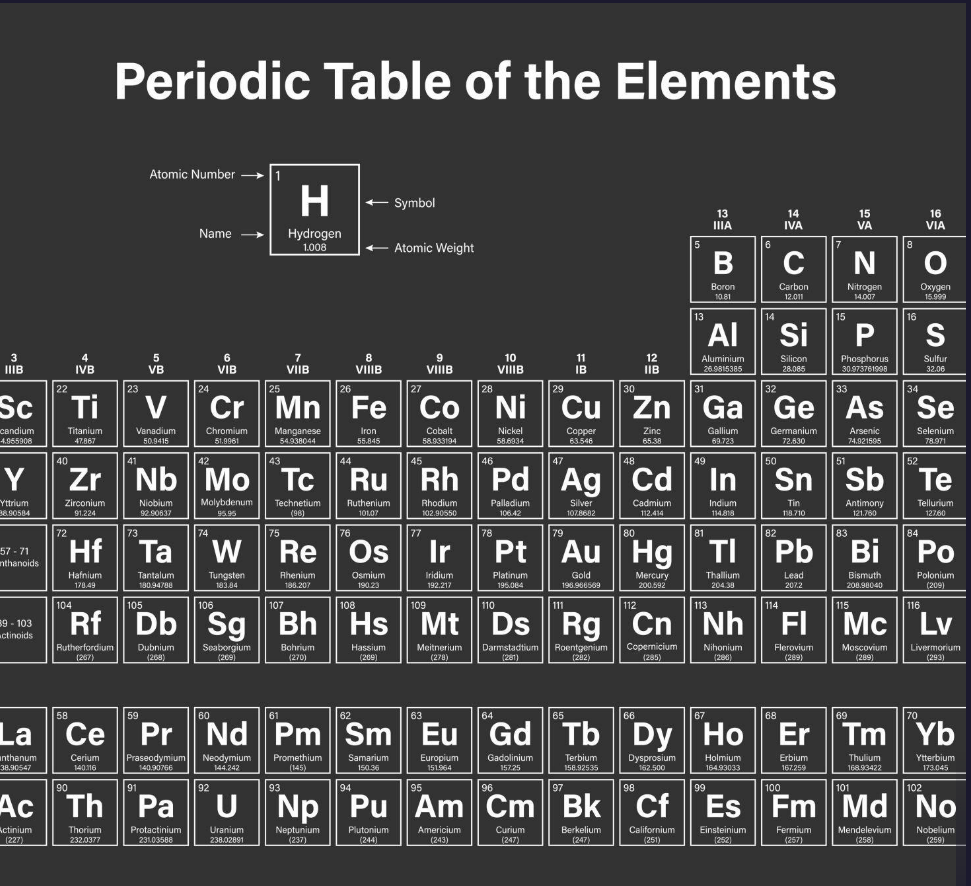
Technological features of the process

The process is carried out under the following conditions:

- Acidic medium (pH 1-2.5)
- Temperature range of 2-80°C
- Aeration control
- Maintenance of optimal humidity



Practical application



Russian research has demonstrated the possibility of extracting metals from:

- Electronic waste (printed circuit boards)
- Ash waste
- Technogenic waste
- Refractory ores

When processing 1 million electronic devices, it is possible to obtain:

- 16 tons of copper
- 34 kg of gold
- 350 kg of silver
- 15 kg of palladium

The unique properties of certain bacteria are based on:

- Ability to absorb toxic metals
- Controlled removal of toxic compounds
- Formation of gold nanoparticles

Technology Development Prospects

Key improvement directions:

- Selection of new microbial strains
- Optimization of technological parameters
- Development of combined methods
- Creation of industrial installations

Economic significance

Advantages of the method:

- Environmental safety
- Reduced processing costs
- Utilization of new raw material sources
- Rational resource use

- The technology of metal extraction using microorganisms represents a promising direction in the field of technogenic waste processing. The further development of this method will make it possible to solve waste disposal problems and ensure the production of valuable metals from non-traditional sources.

Recommendations for scaling up

For industrial implementation, it is necessary to:

- Conduct pilot tests
- Develop control systems
- Create automated production lines
- Assess economic efficiency

Mechanisms of Transmutation of Chemical Elements in Microorganisms

Theoretical Foundations of the Process

Nuclear transmutation in microorganisms represents a unique biological process of converting one chemical element into another.

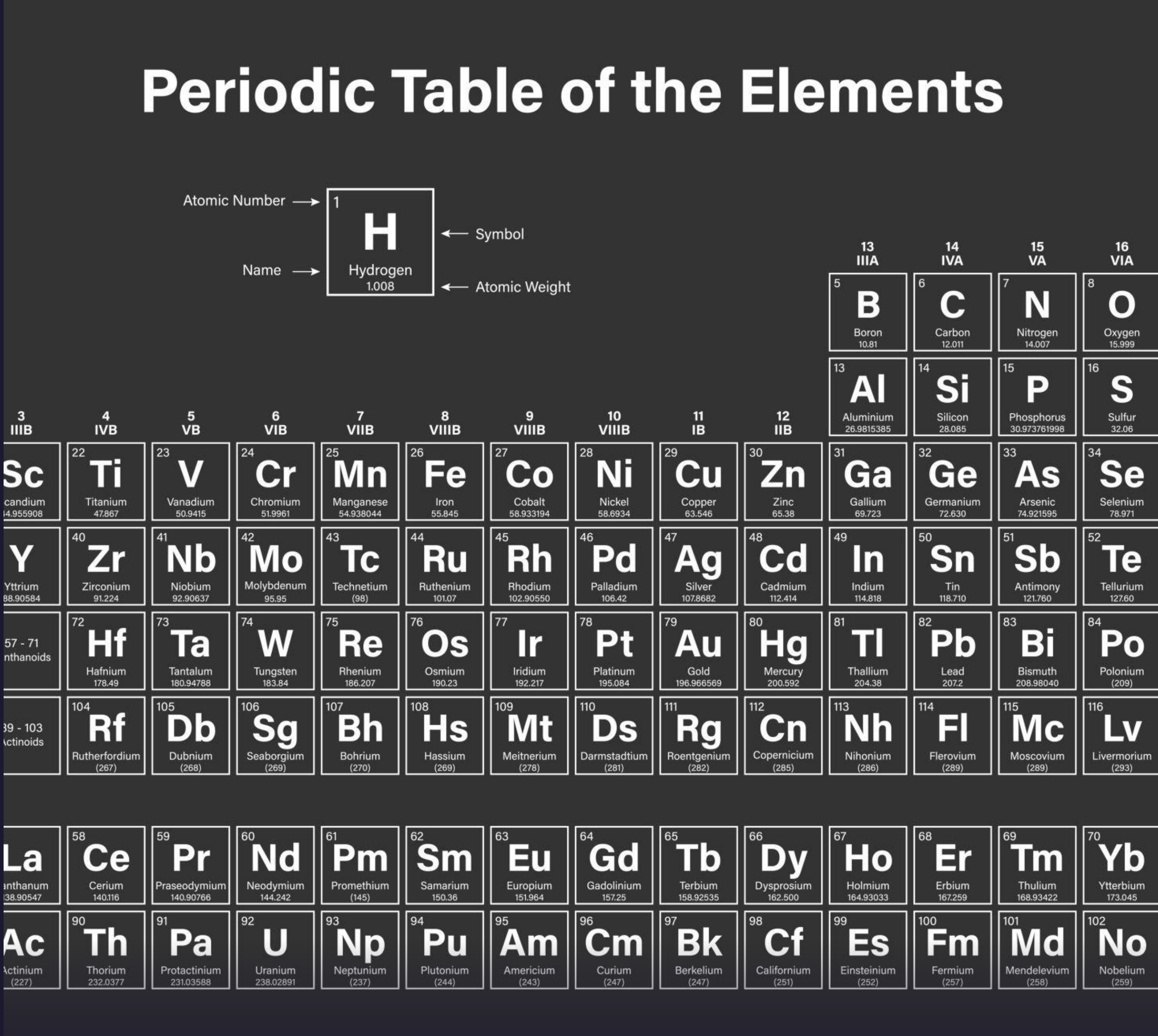
This phenomenon is carried out with the participation of specific strains of microorganisms and is characterized by the following features:

- Process occurring at relatively low temperatures
- No need for complex equipment
- Environmental safety of the procedure

The following microorganisms play a crucial role in transmutation:

Объяснение перевода / Explanation of the translation:

- Deinococcus radiodurans is capable of transmutation when exposed to ionizing radiation.
- Thiobacillus initiates and accelerates various types of radioactive decay.
- Special associations of 3000 microorganisms (according to A. Kornilova's technology).



The process is realized through the following biochemical pathways:

Объяснение перевода / Explanation of the translation:

- Beta decay – a process of electron emission initiated and accelerated by bacteria.
- Electron capture – the transfer of electrons between atomic nuclei.
- Oxidation-reduction reactions on the cell wall surface.
- Nuclear fusion under specially created conditions

Practical Application

The technology enables:

Convert radioactive waste into stable elements

Obtain valuable metals from non-traditional sourcesв

Obtain rare isotopes for:

- Medicine
- Nuclear Power
- Aerospace Instrumentation
- Decontaminate liquid nuclear waste

Promising Directions

- Optimization of microbial consortium composition
- Investigation of new microorganism strains
- Development of scalable technologies
- Creation of specialized bioreactors

Economic Significance

The technology opens up opportunities for:

- Disposal of hazardous waste
- Production of valuable isotopes
- Reduction of nuclear processing costs
- Creation of new industrial sectors
- Obtaining valuable metals from non-traditional sources

Microbiological transmutation represents a revolutionary approach to the transformation of chemical elements.

Further study of the mechanisms of this process could lead to the creation of new technologies in the fields of nuclear physics, ecology, and industry.