HHMI
HOWARD HUGHES MEDICAL INSTITUTE

Winogradsky Column: Microbial Ecology in a Bottle

BioInteractive.org

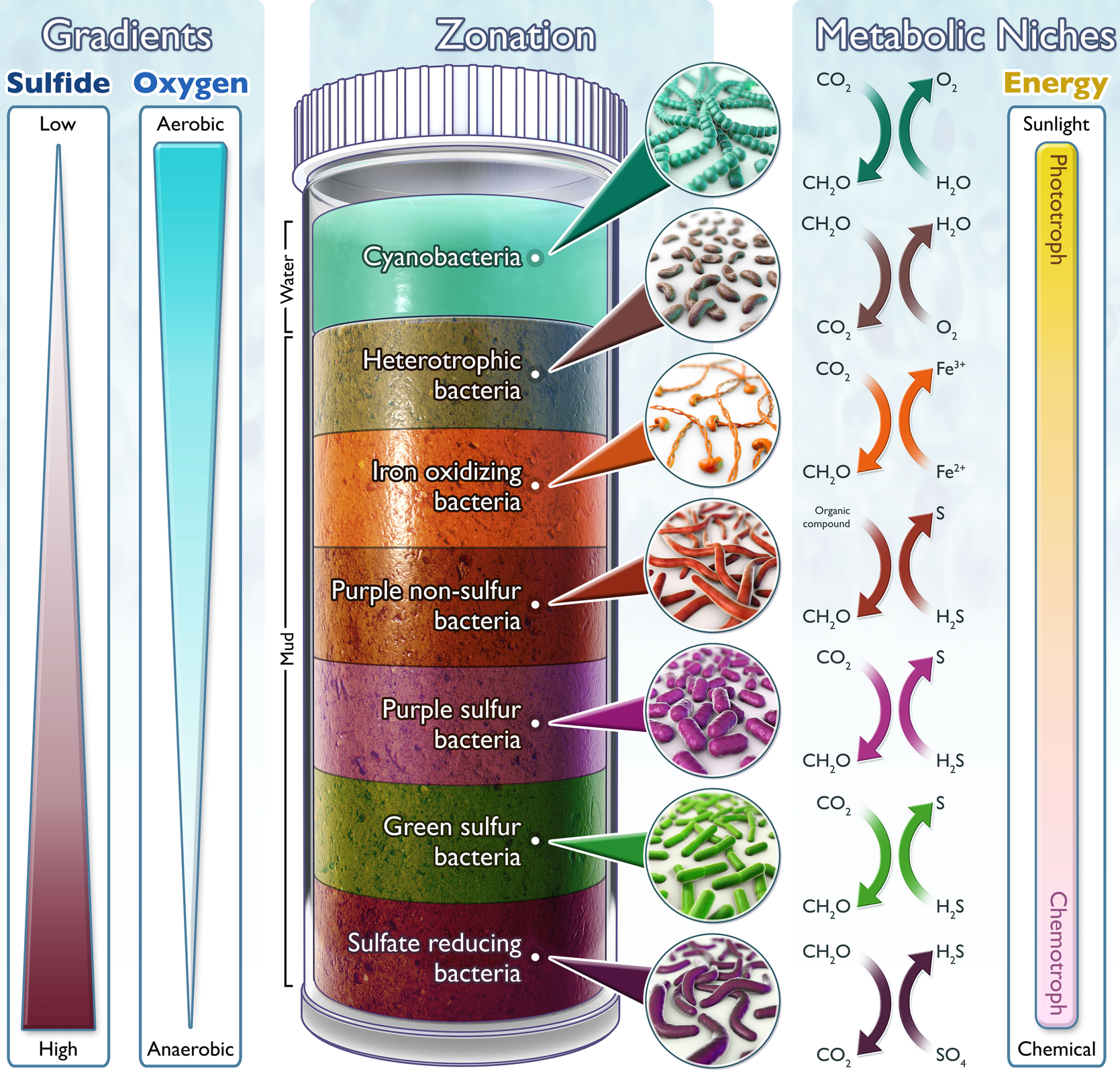
Sergei N. Winogradsky
1856 – 1953

Sergei N. Winogradsky was one of the first microbiologists to study the organisms found in complex biofilm communities. One of the strategies he used to isolate organisms from nature was a miniature model of a pond cross section that is now called a Winogradsky column. It is a simple device for constructing a stratified ecosystem and provides a visual example of various modes of metabolism and zonation in the microbial world. It is a classic demonstration of the metabolic diversity of prokaryotes.

HHMI

H. Olins

A soil or sediment sample is collected from nearly any source and amended with a variety of compounds such as carbon, sulfur, iron, and/or calcium. The mixture is added to a clear container and topped with water; the container is lightly capped to prevent evaporation. The column is incubated for weeks to months in well-lit conditions, thereby establishing gradients of oxygen, nutrients, and light. Different microbial taxa are adapted to different niches within these overlapping gradients, creating a stratified ecosystem defined by metabolic potential.



All life on Earth can be categorized according to an organism's carbon and energy source. Energy can be obtained from light reactions (phototroph) or chemical oxidations (chemotroph), and carbon for cellular synthesis can be obtained from carbon dioxide (autotroph) or from preformed organic compounds (heterotroph). These categories combined form the four basic life strategies and can be found among the bacteria within a single Winogradsky column: photoautotrophy, photoheterotrophy, chemoautotrophy, and chemoheterotrophy. Depending on conditions, Winogradsky columns can enrich for many different types of bacteria. The illustration above lists some common examples.