

Microbial Ecology

DNA extraction

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Introduction

Historical perspective:

- DNA is first discovered in 1860
- Friedrich Miescher - Swiss scientist from Basel
- DNA called “Blueprint of Life”



Friedrich Miescher[1]



The development of various methods:

- Chromatography (1950)
- EtBr-CsCl Gradient Centrifugation (1957)
- Silica Column-Based (1980)
- Salting-Out (1988)
- Magnetic Beads (1998)



Method : ZymoBIOMICS™ DNA Miniprep Kit for DNA extraction

1. Mechanical lysis to release DNA

- Bead beating
- Centrifugation

2. Filtration process

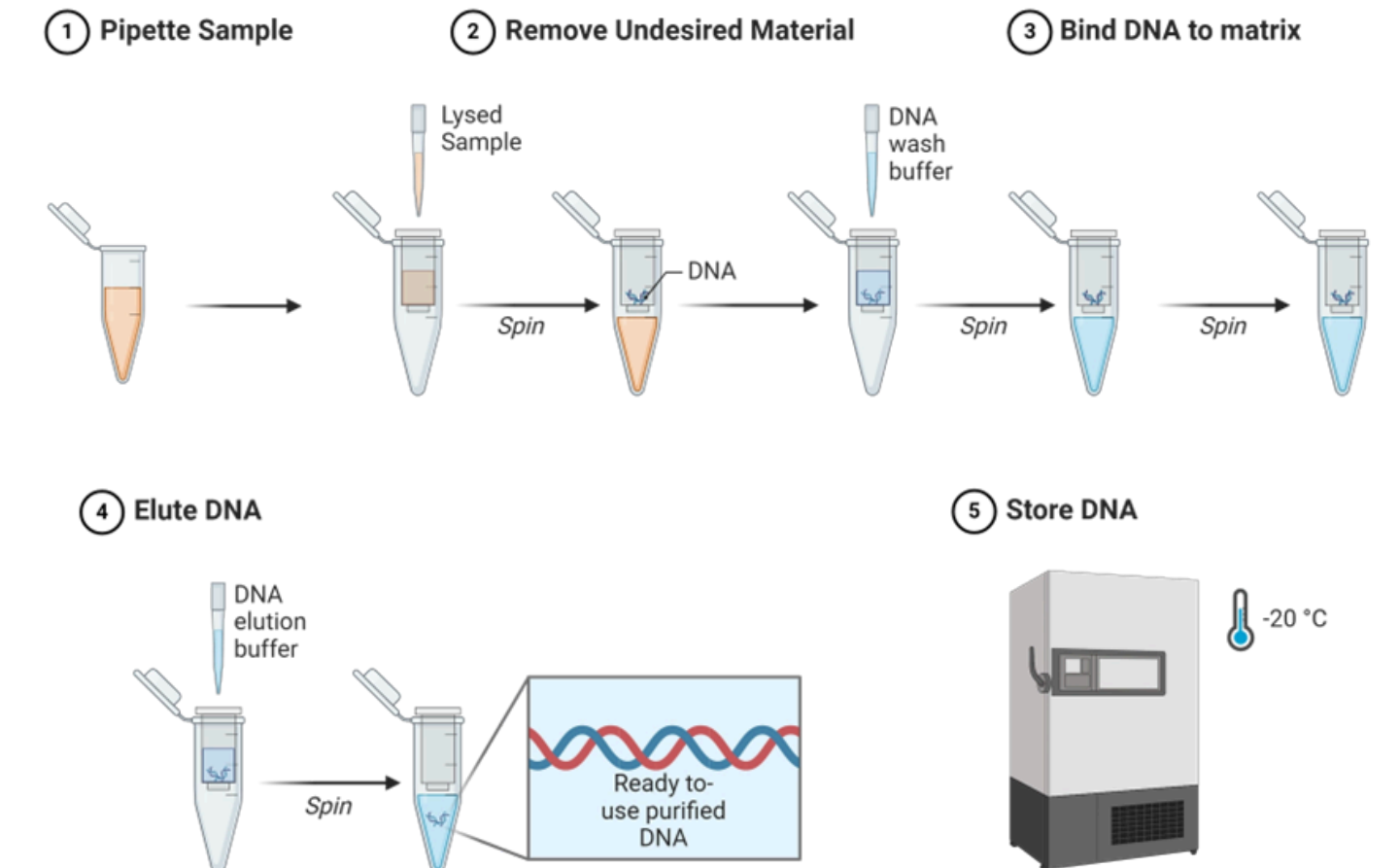
- Get rid of contaminants
- Humic substances inhibit PCR

3. Binding of the DNA to a purification matrix

- Binding depending on the affinity of the matrix

4. Washing processes

- Release DNA from the matrix
- Remove additional contaminants



Published Study

Research | [Open access](#) | Published: 27 December 2022

Global patterns of diversity and metabolism of microbial communities in deep-sea hydrothermal vent deposits

[Zhichao Zhou](#), [Emily St. John](#), [Karthik Anantharaman](#) ✉ & [Anna-Louise Reysenbach](#) ✉

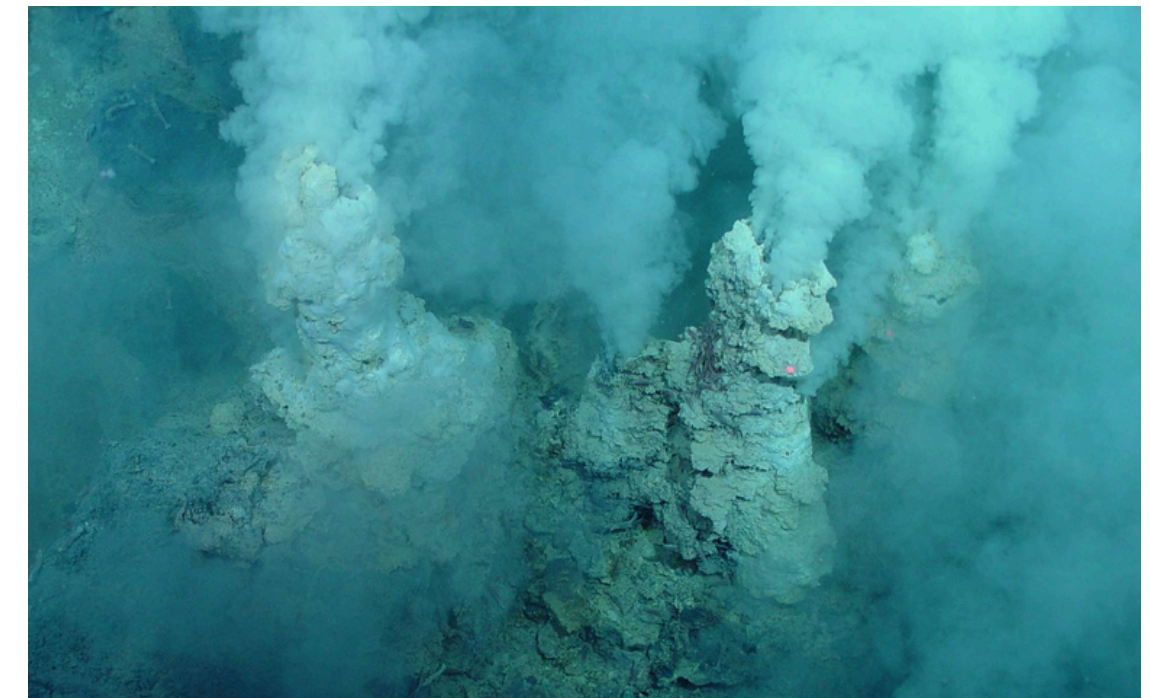
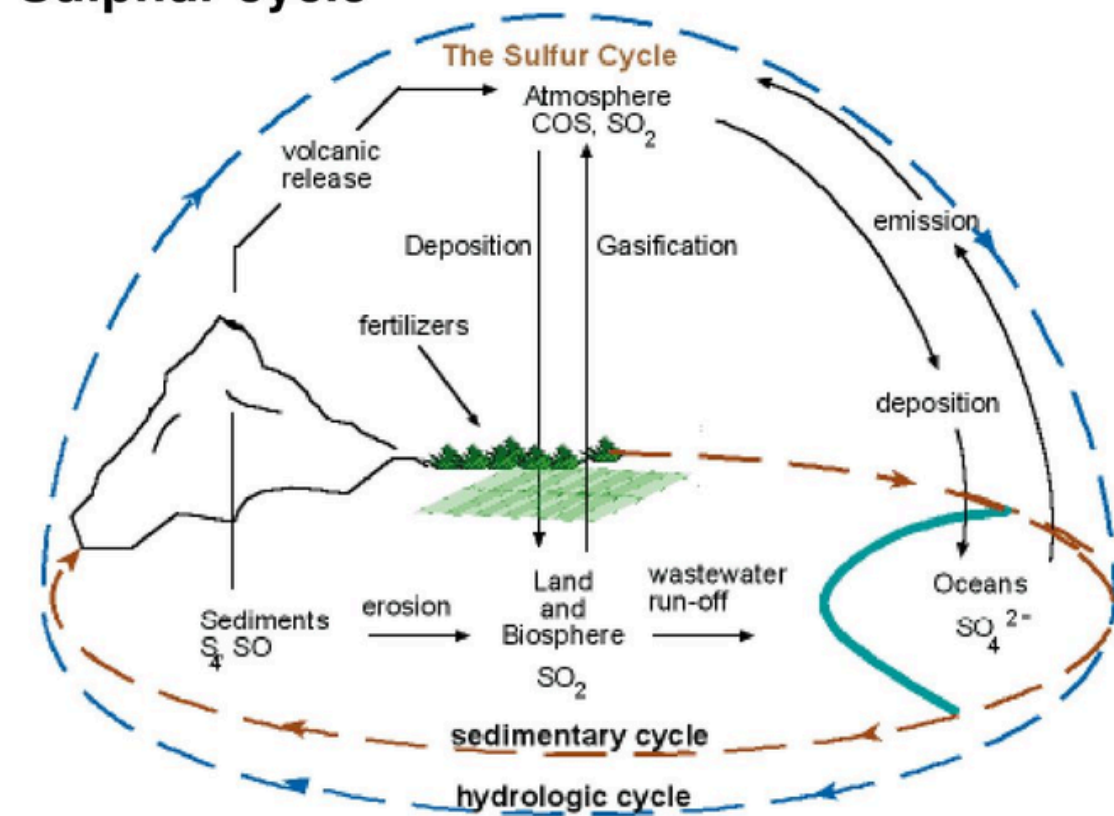
[Microbiome](#) **10**, Article number: 241 (2022) | [Cite this article](#)

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Goals

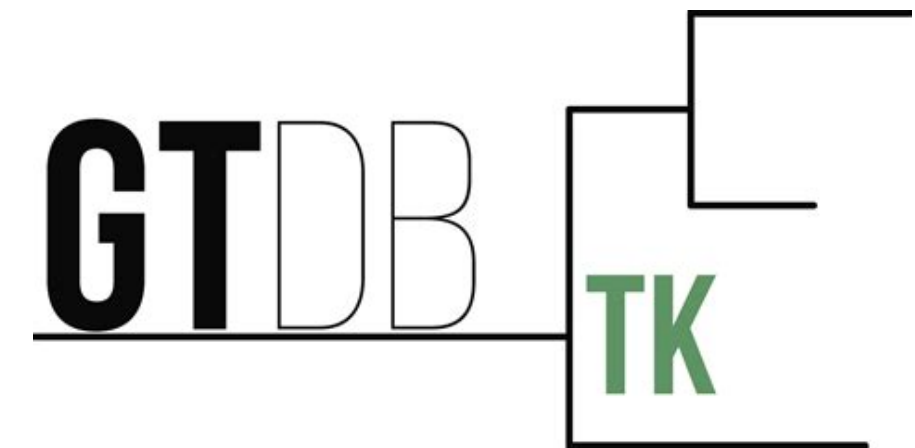
- Explore **genomic diversity** of thermophilic microorganisms living on the deep-sea hydrothermal deposits
- Learn about their possible **implications in biogeochemical cycles**

Sulphur cycle



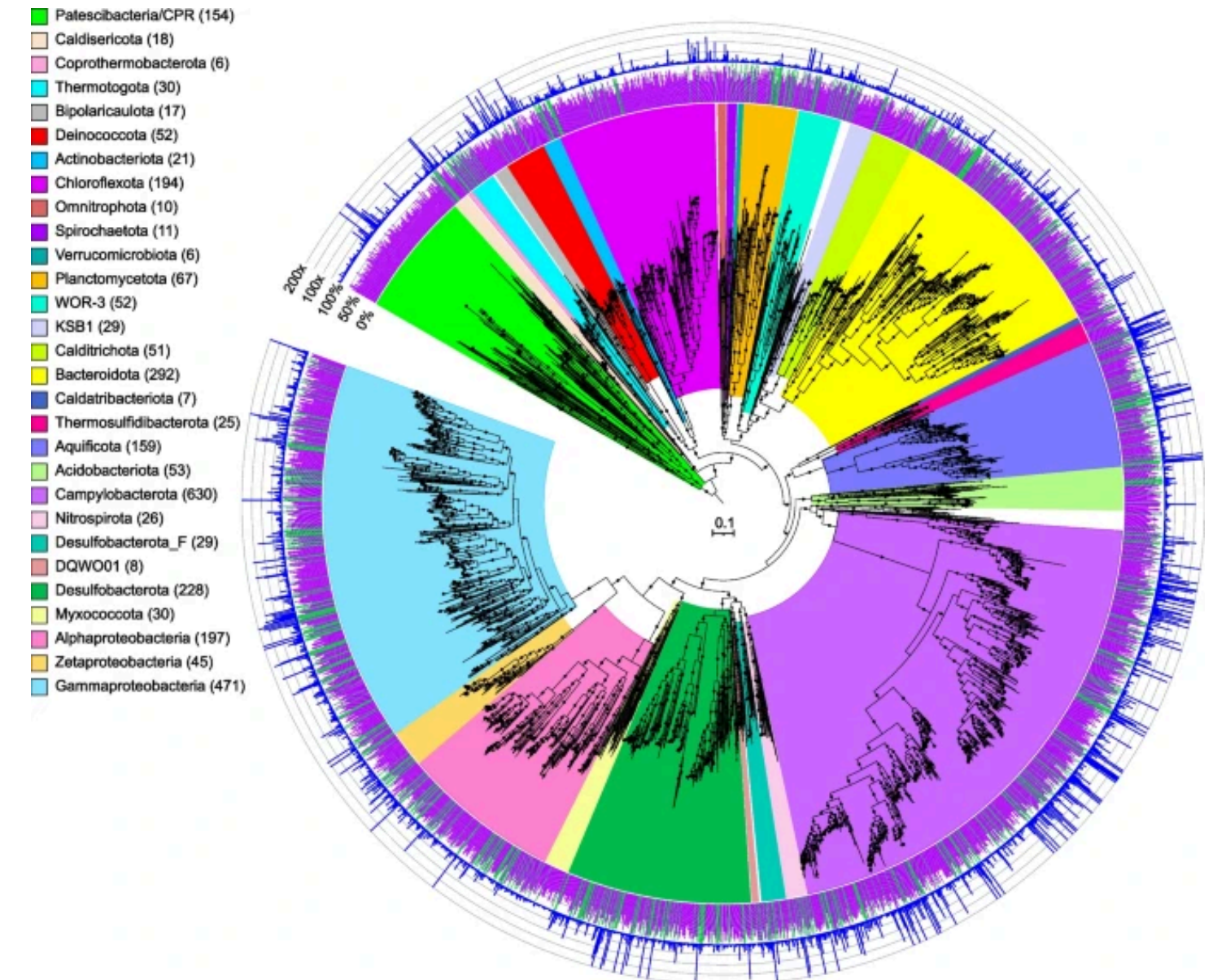
Methods

- Samples from 4 deep-sea hydrothermal vent fields + 1 deep sea volcano
- DNA extraction + sequencing
- Generation of **metagenome-assembled genomes** (MAG)
- **Phylogenetics inferences** : Genome Taxonomy Database Toolkit (GTDB-Tk)
- Trophic and energy **metabolism analysis**



Results & Findings

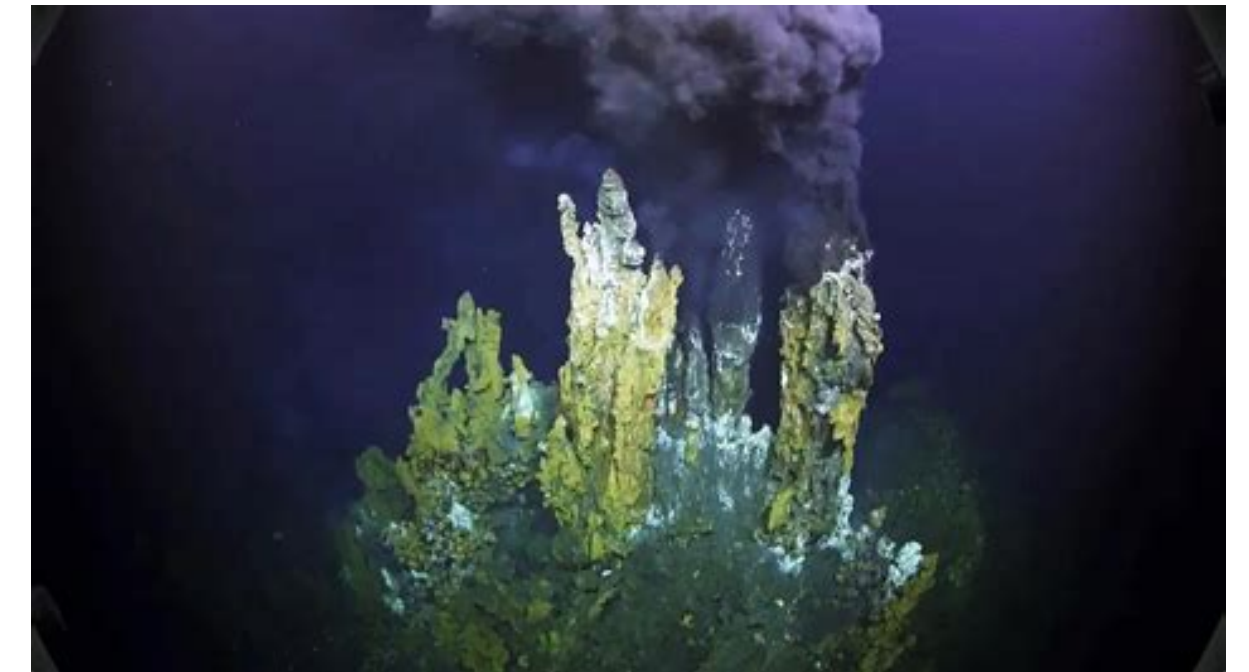
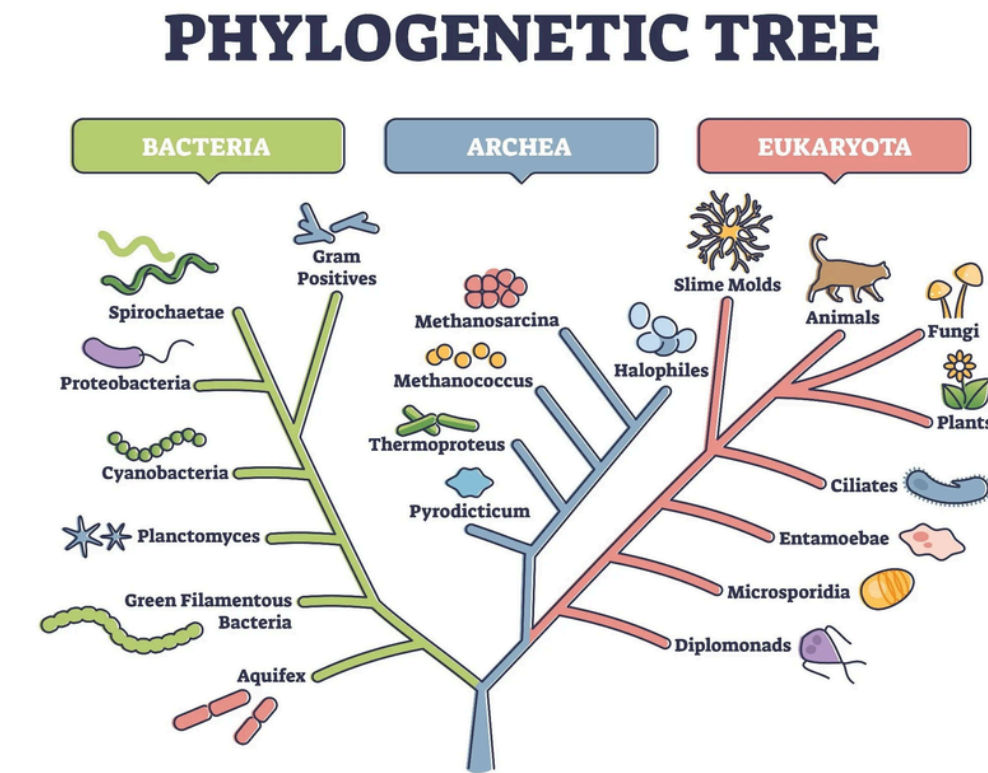
- 2983 bacterial and 652 archaeal draft MAGs
- **Discovered a large diversity** for Thermoproteia, Patescibacteria and Chloroflexota
- **2 potentially novel phyla:** JALSQH01 and JALWCF01
- **New assembled genomes**
- Ecology side : metabolic “handoffs”, functional redundancy & importance of geochemical characteristics of the site



Maximum-likelihood phylogenomic tree of bacterial metagenome-assembled genomes, constructed using 120 bacterial marker genes in GTDB-Tk

Conclusion

- DNA extraction methods have become more effective
- ZymoBIOMICS™ (cell extraction method) is divided into 4 consecutive steps
- Used to explore the genomic diversity in harsh environments
- Helps understanding their implications in geochemical cycles & interactions with other organisms



Sources

- [1] https://fr.wikipedia.org/wiki/Friedrich_Miescher
- [2] <https://zymoresearch.eu/products/zymobiomics-dna-miniprep-kit>
- [3] <https://www.sciencing.com/uses-dna-extraction-5344428/>
- Gahlon, H. L. A Brief History and Practical Applications in DNA Extraction: Chemical Education. https://www.chimia.ch/chimia/article/view/2020_907 (accessed 12/09/2024).
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- Mahalanabis, M. et al. Cell lysis and DNA extraction of gram-positive and gram-negative bacteria from whole blood in a disposable microfluidic chip. Lab on a Chip 2009, 9, Publisher: The Royal Society of Chemistry, <https://pubs.rsc.org/en/content/articlelanding/2009/lc/b905065p>.
- DNAPurification|DNAExtractionMethods|Promega <https://ch.promega.com/resources/guides/nucleic-acid-analysis/dna-purification>.

Study Article :

- Zhou, Z., St. John, E., Anantharaman, K. et al. Global patterns of diversity and metabolism of microbial communities in deep-sea hydrothermal vent deposits. Microbiome 10, 241 (2022). <https://doi.org/10.1186/s40168-022-01424-7>