BIOGENIC AMINES IN THE HEALTH CHALLENGE CAUSED BY THE CHANGING ARCTIC CLIMATE

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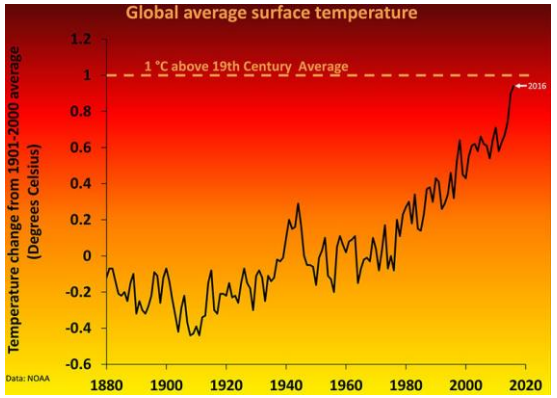
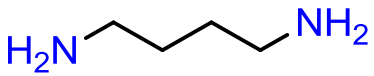
Polyamines & arctic climate change

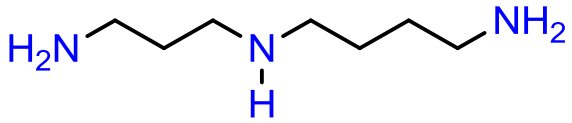
* The temperature in the Arctic Circle is rising faster than in the rest of the world
* Due to the climate change, Arctic ecosystems are challenged by new pathogens and fluctuating environmental conditions causing abiotic (i.e. heat/cold, drought/flooding, salinity, sunlight) and biotic (i.e. microbes, viruses, fungi, parasites, introduced invasive species) stress
* Spreading of Arctic microbes to the south - southern microbes to the Arctic
* Permafrost is a very good preserver of microbes - as it melts, infectious agents may be released
* Polyamines are a class of important biogenic amines, acting as universal molecules protecting against abiotic and biotic stress

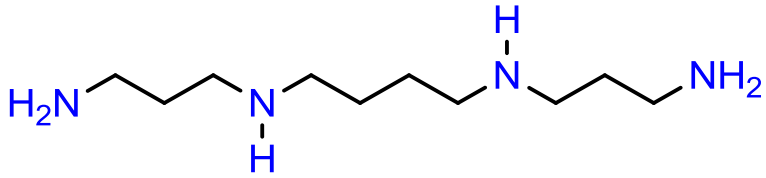


Polyamines in living cells

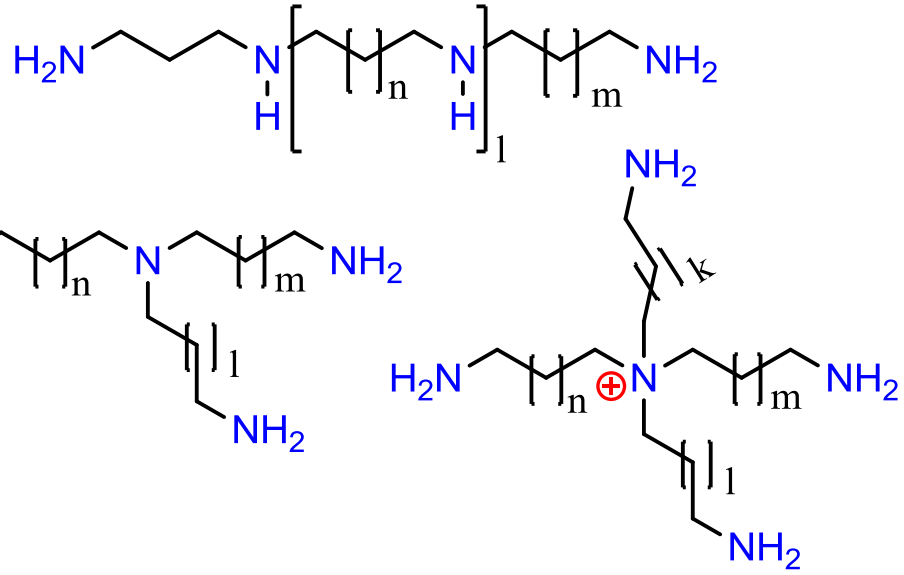
* The most common polyamines in living systems are putrescine, spermidine and spermine





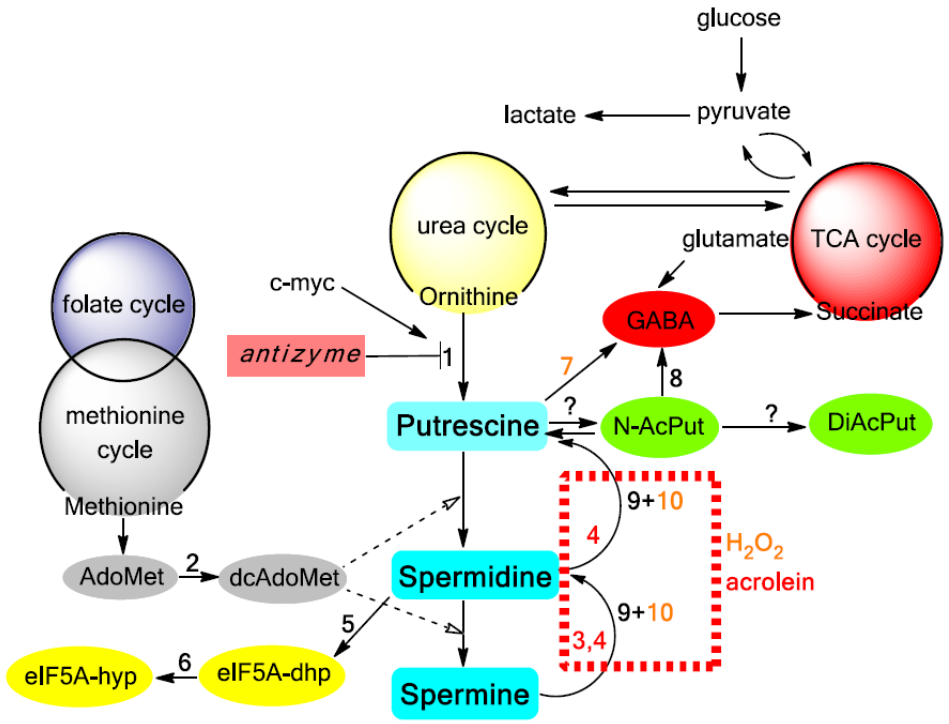


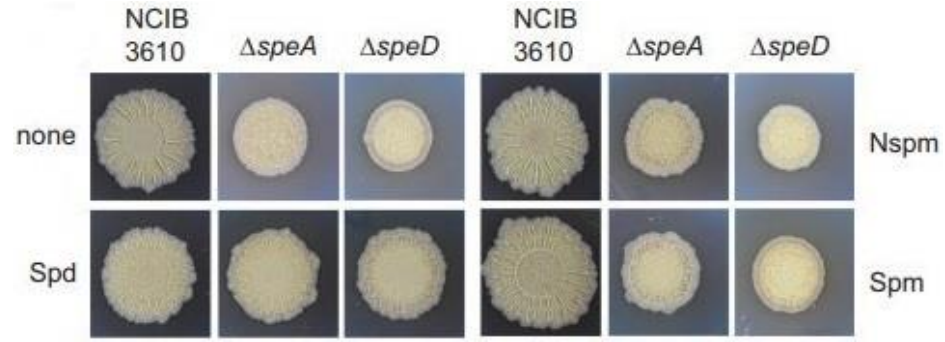
* Long-chain and branched polyamines allow extreme thermophile bacteria live at high temperature
* Spermine protects plants from salinity and drought
* Many viruses require polyamines for replication



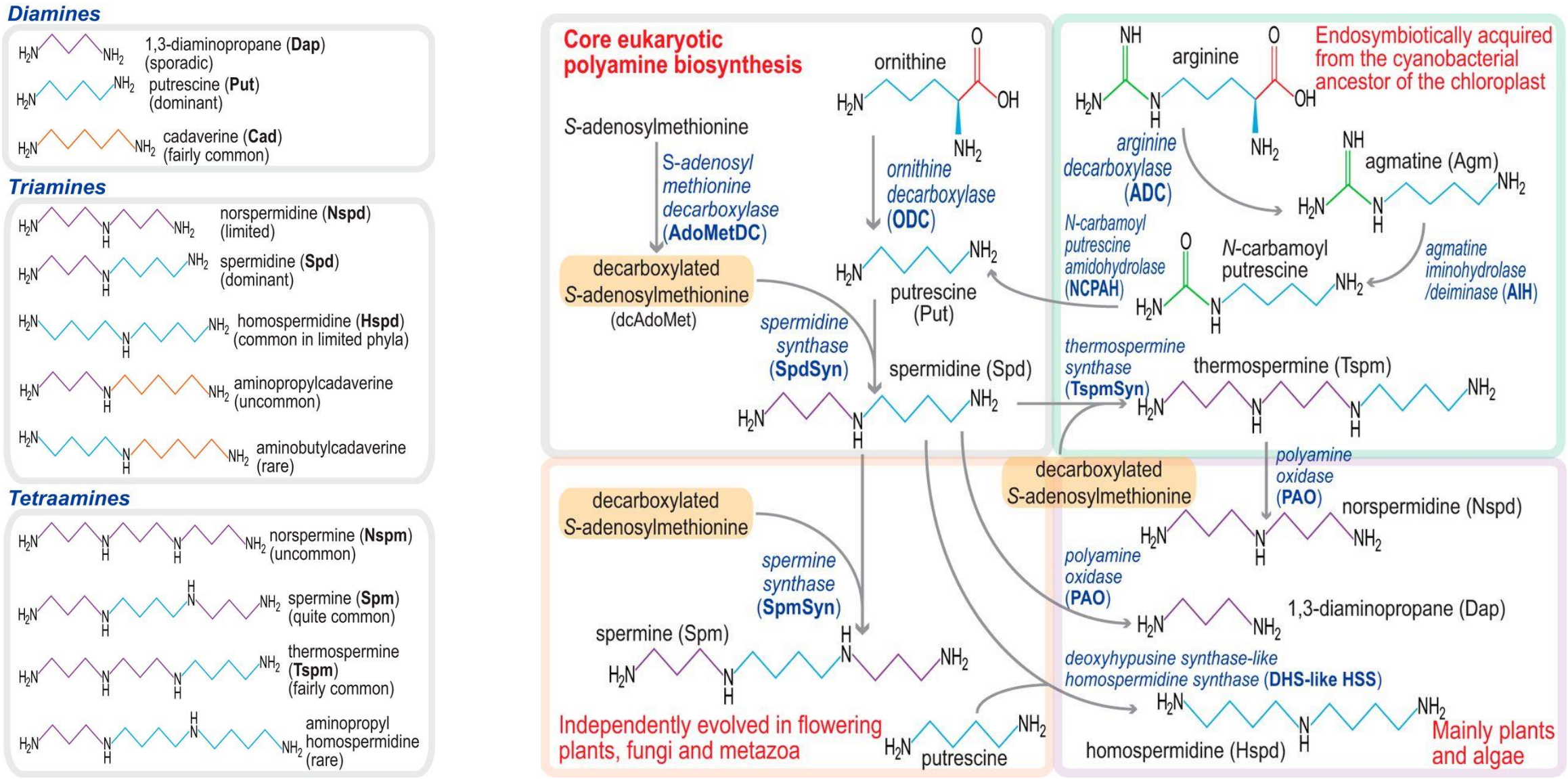
Polyamines protect against abiotic and biotic stress

* Polyamine metabolism is linked to central metabolic pathways in all three kingdoms of life
* Polyamines are an alternative energy source (via conversion to succinate)
* Spermidine is essential for the proliferation and differentiation of many cell types
* Spermidine protects humans against cardiovascular diseases
* Spermidine is necessary for bacterial biofilm formation, which increases antibiotic resistance (even up to 1000-fold)





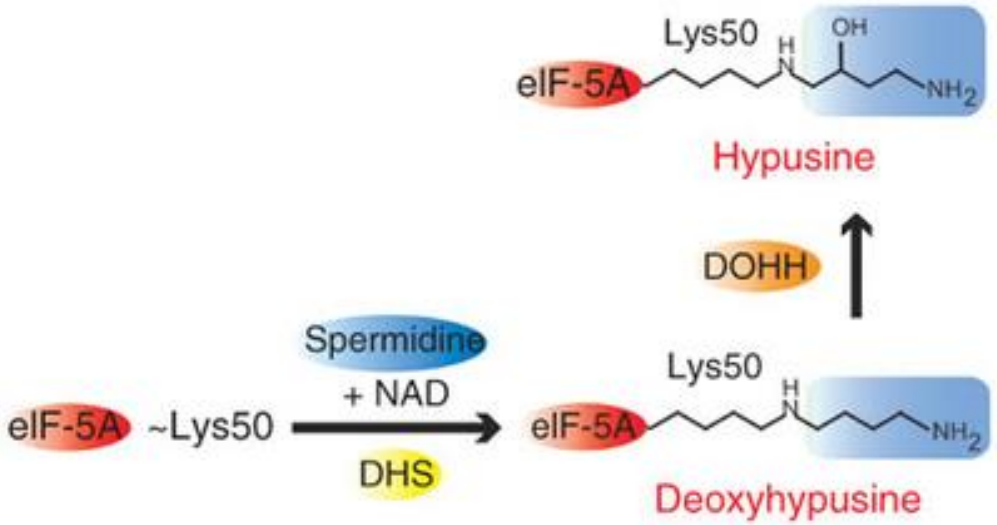
Polyamine metabolism differencies



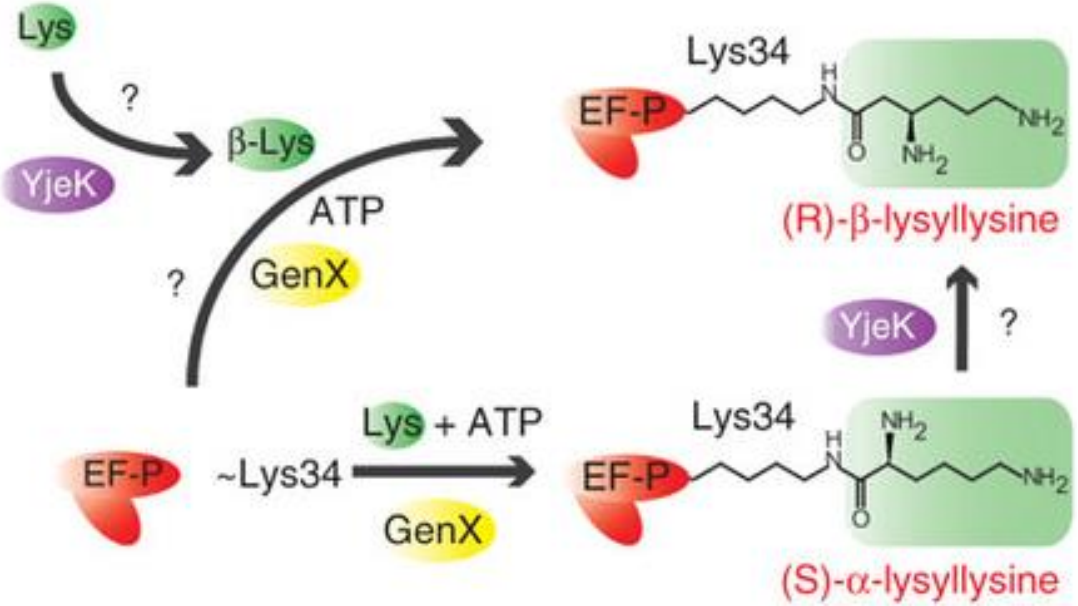
Eukaryotic vs bacteria cell metabolism

* Translation of poly-proline containing proteins

Eukaryotic cells

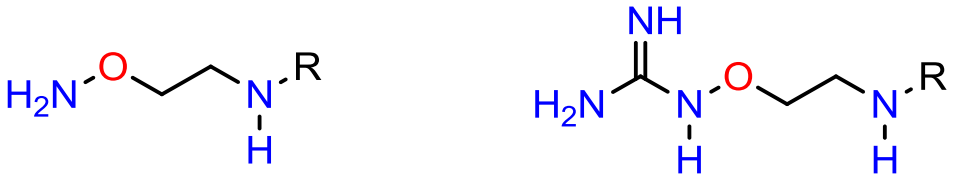


Bacteria

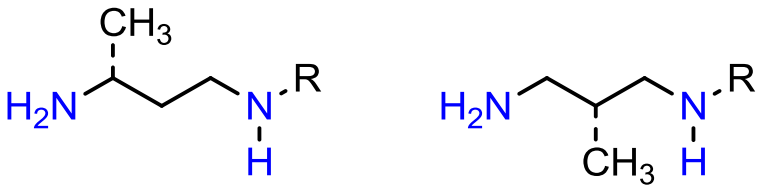


Aims and methods of the project

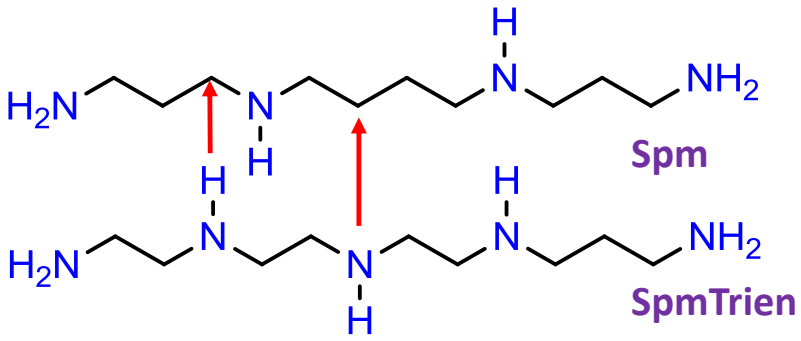
* Find differences in polyamine metabolism between host and microbe, healthy and diseased cell
* Synthesize novel polyamine analogs in order to develop therapeutics for human/animal/plant diseases associated with the changing Arctic climate
* HPLC, NMR, MS analysis of analog purity, concentration, and cellular content and metabolism of the compounds
* Investigation of the biological properties of the compounds with recombinant enzymes, microbes, cell/organ cultures and in mice
* Distribution of the compounds to our collaborators for testing in specific applications/disease models



Enzyme inhibitors



Modifying biological properties

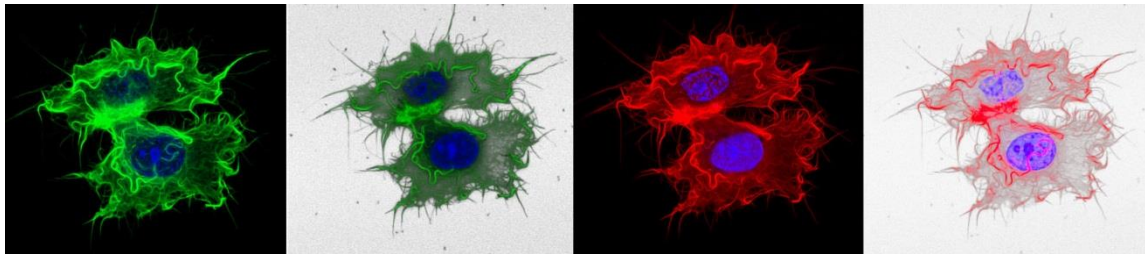


Stable precursors

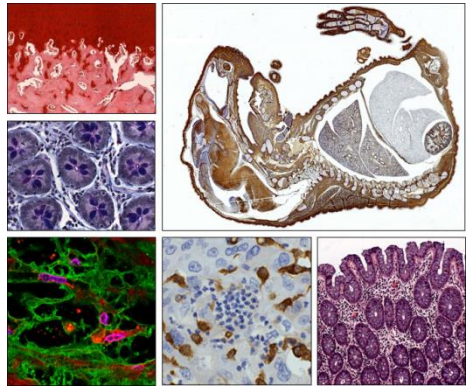
Instrumentation

NMR Spectroscopy

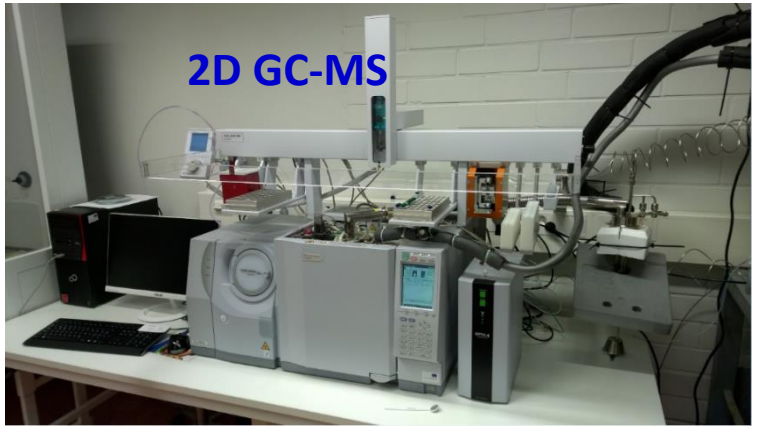
Biological imaging



Histology



2D GC-MS

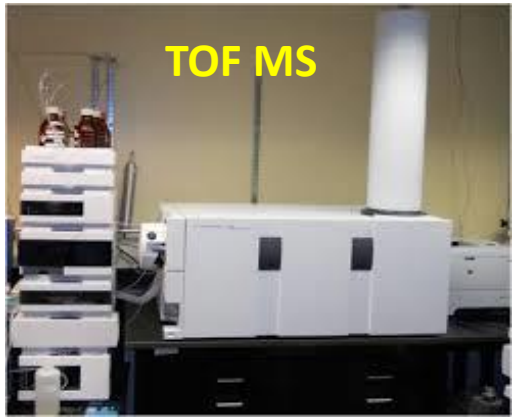


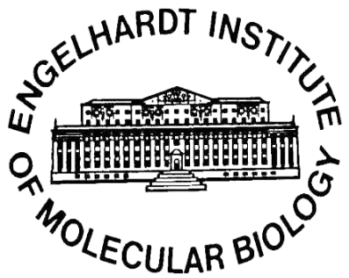
ESI MS

ICP MS

TXRF

TOF MS





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