

Mass spectrometry

Literature: Jürgen H. Gross: Mass Spectrometry

Mass spectrometry

- ▶ One of the basic methods to characterize samples – „weighing“

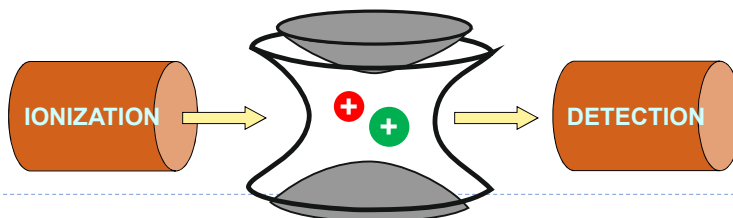
Mass of oxygen $\sim 5 \cdot 10^{-23}$ g



~~SCALES~~

SPECTROMETRIC WEIGHING

utilizes different field effects on charged particles



MASS SPECTROMETRY - HISTORY

1897 J. J. Thomson discovered electron and determined its m/z ratio

1898 Wilhelm Wien analyzed particles of anode rays by magnetic field and determined that the particles are positively charged

1912 First mass spectrometer (J. J. Thomson)

1942 First commercial mass spectrometer

1953 Quadrupole and ion traps (Paul and Dehmelt)

1956 First GC-MS



1968 First commercial quadrupole mass spectrometer

1974 FT-ICR

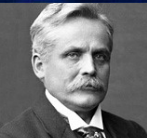
1975 First commercial GC-MS

1990- Mass spectrometry in biology (ESI a MALDI)
Development of TOF analyzers


2005 Orbitrap MS


J. J. Thomson
Physics, 1906




Wilhelm Wien
Physics, 1911



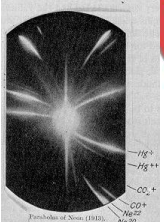
Paul Dehmelt
Physics, 1989



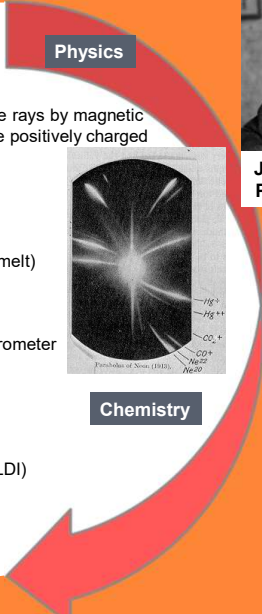
Fenn



Tanaka
Chemistry, 2002

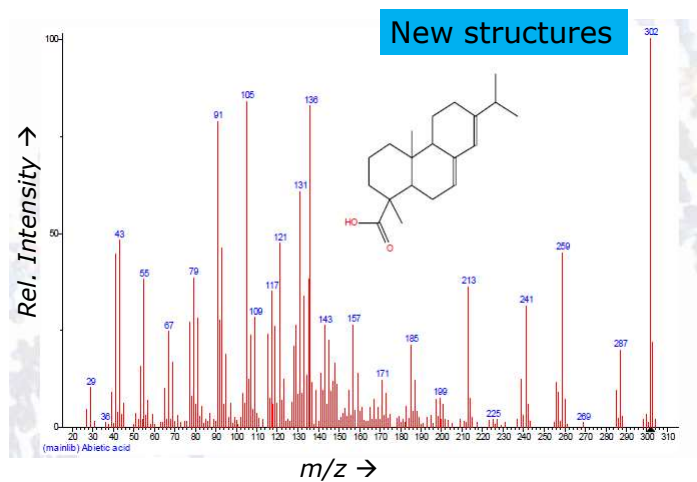


Chemistry

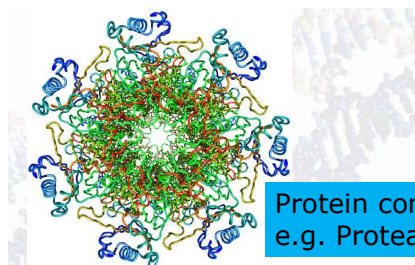


Biology

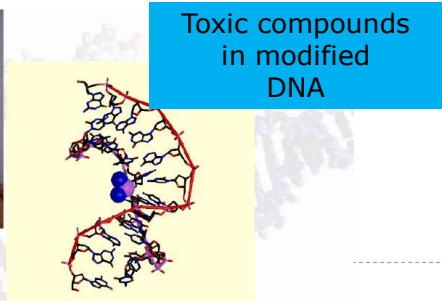
Examples: Chemistry



Biology

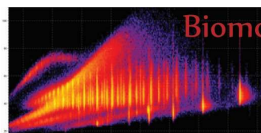
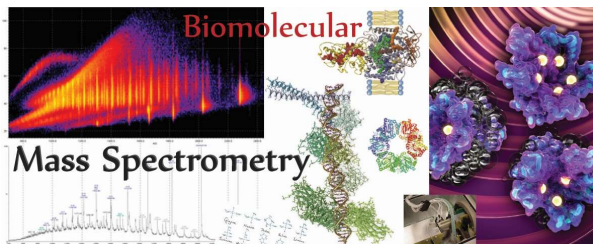


Protein complexes
e.g. Protease



Toxic compounds
in modified
DNA

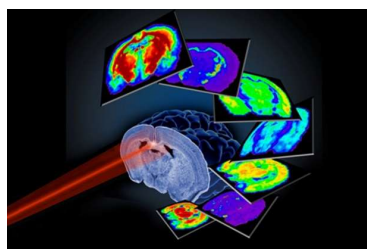
Biology



Mass Spectrometry

Biomolecular

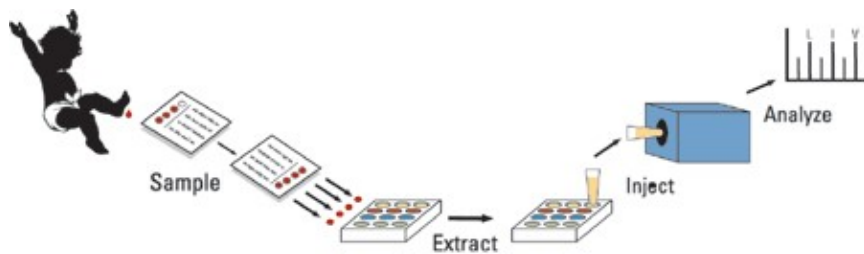
Credit: Prof Frank Sobott:
<http://www.astbury.leeds.ac.uk>



Credit: <https://medschool.vanderbilt.edu/ims/>

Medicine

Screening of metabolic diseases of newborns



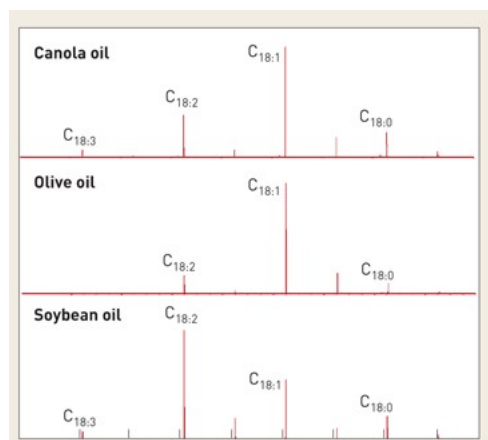
Credit: Randall C. Willis: *MDD* 2012, 5, 28. © ACS

Environment



Detection of pollutants, aerosol formation monitoring, monitoring of gene mutations, ...

Quality control



What is behind the ever growing importance of mass spectrometry?

- ▶ New ionization techniques (we can transfer more and more complex molecules to a mass spectrometer)
 - ▶ New analyzers with high resolution (we can weigh larger molecules with higher precision and accuracy)
 - ▶ Instruments are smaller, easier to operate and more robust
 - ▶ Progress in computer software and hardware simplifies data analysis
 - ▶ Coupling of new methods with MS (mobility, optical spectroscopy)
-

MS course – flip classes

