MJPhD

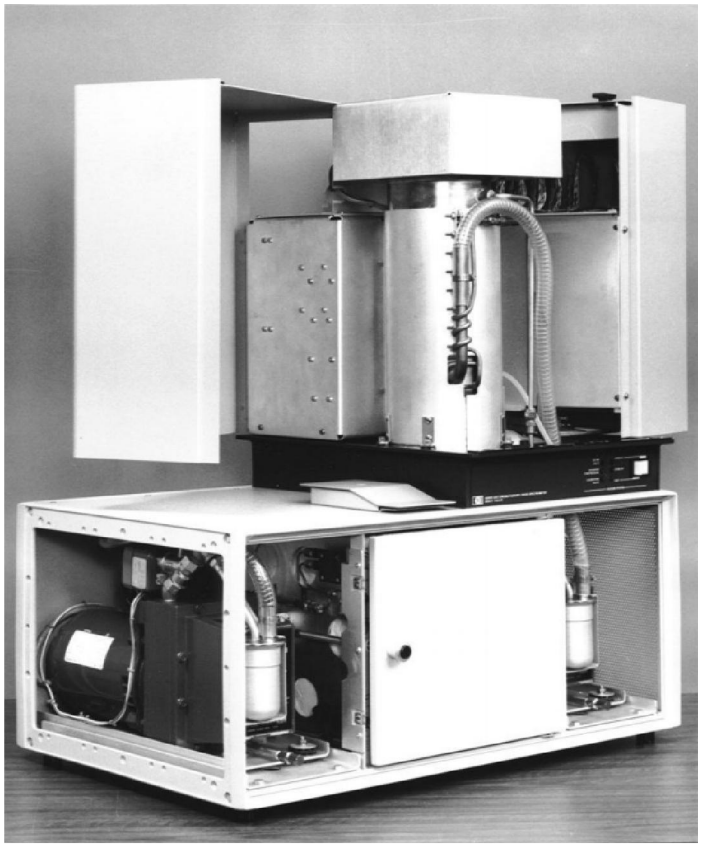
Invention of Gas Chromatography-Mass Spectrometry

Mark Jones
Creative Director
MJPhD, LLC

23 August 2021

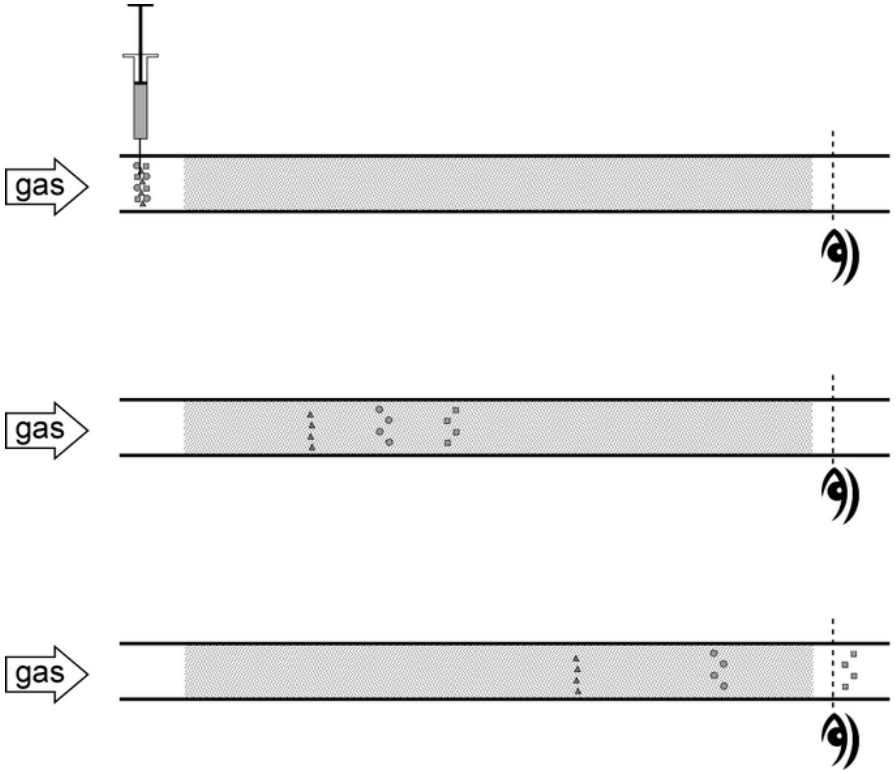
Atlanta National Mtg

HP 1000 Computer c.1983

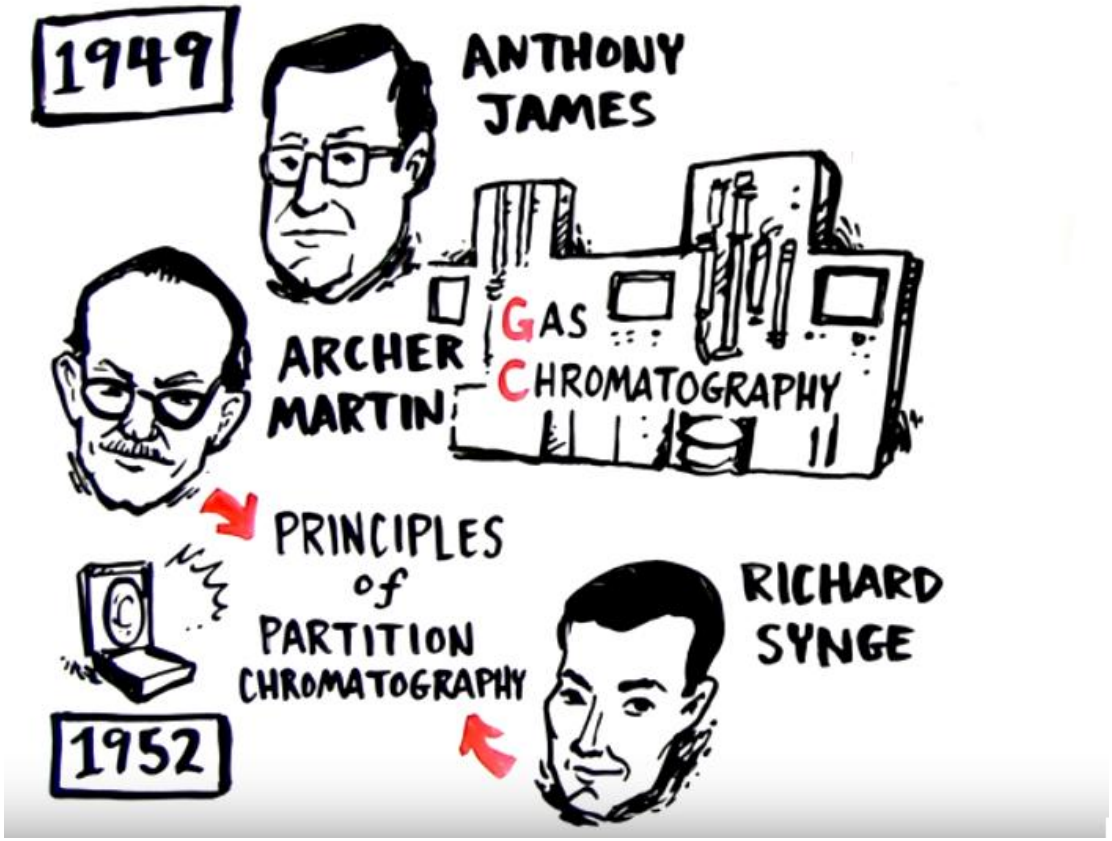


HP 5992 GC/MS c.1983

GAS CHROMATOGRAPHY

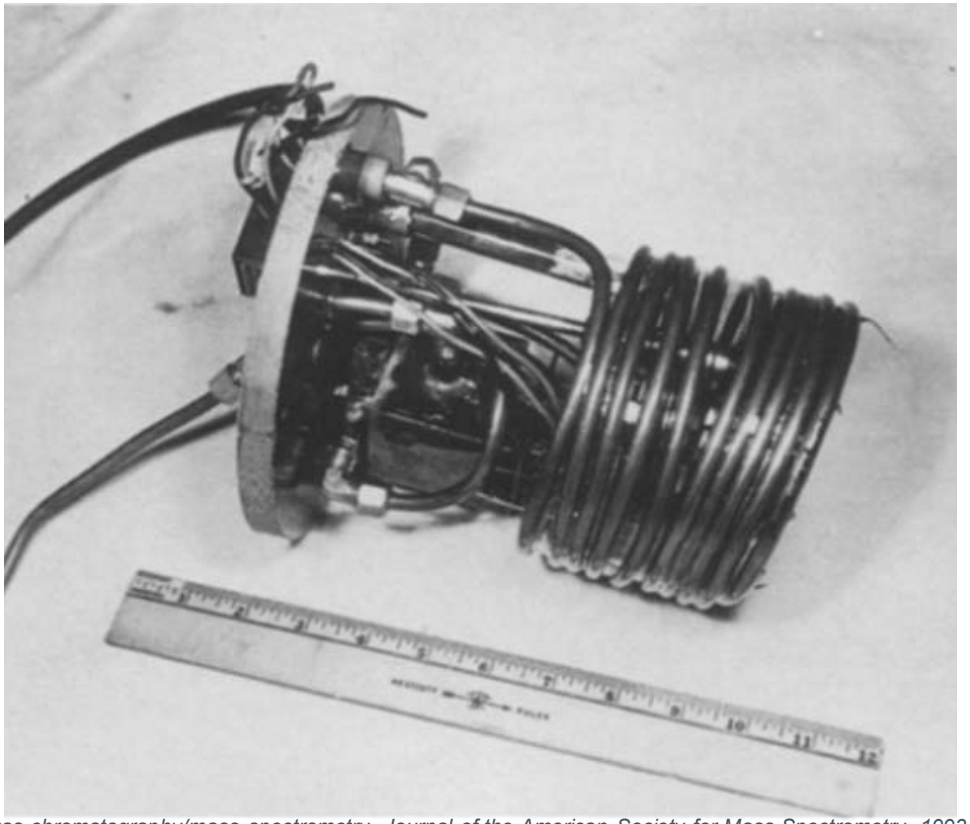


DEVELOPMENT OF GAS CHROMATOGRAPHY



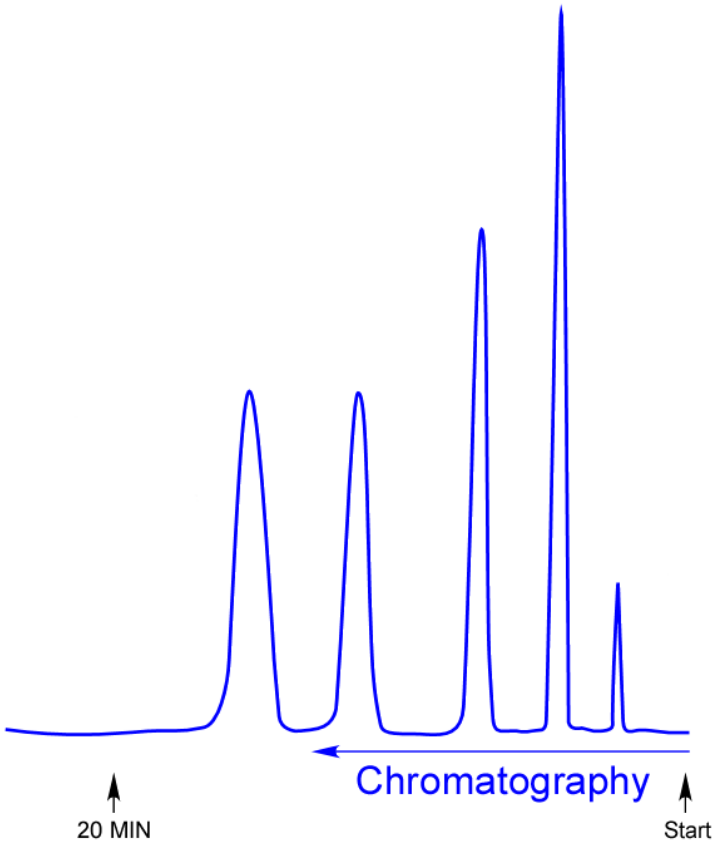
YouTube: An Illustrated History of Gas Chromatography

CHROMATOGRAPHY IN 1955



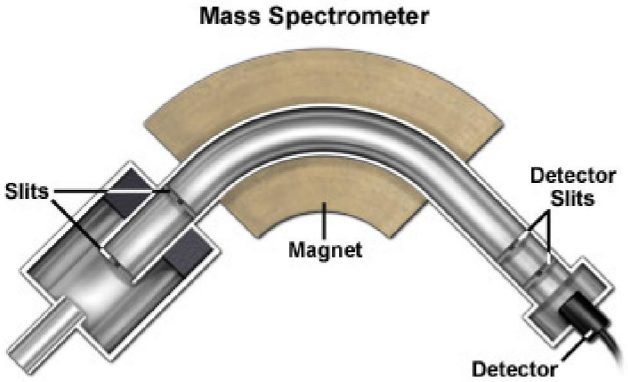
Gohlke RS, McLafferty FW. Early gas chromatography/mass spectrometry. Journal of the American Society for Mass Spectrometry. 1993 May 1;4(5):367-71.

CHROMATOGRAPH



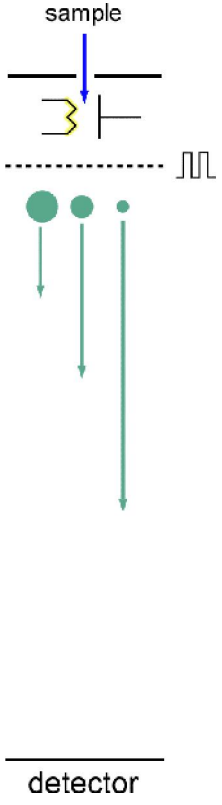
MASS SPECTROMETERS

sector instruments

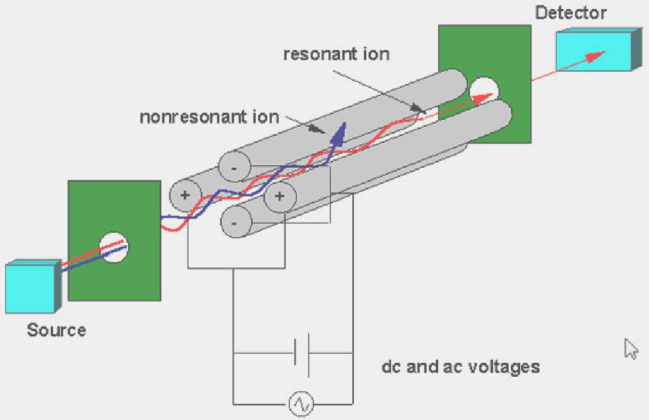


nationalmaglab.org/education/magnet-academy/learn-the-basics/stories/mass-spectrometry

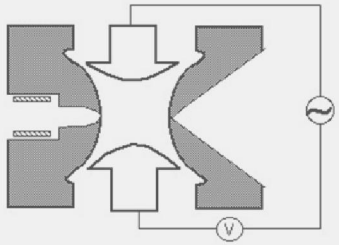
time-of-flight



quadrupole

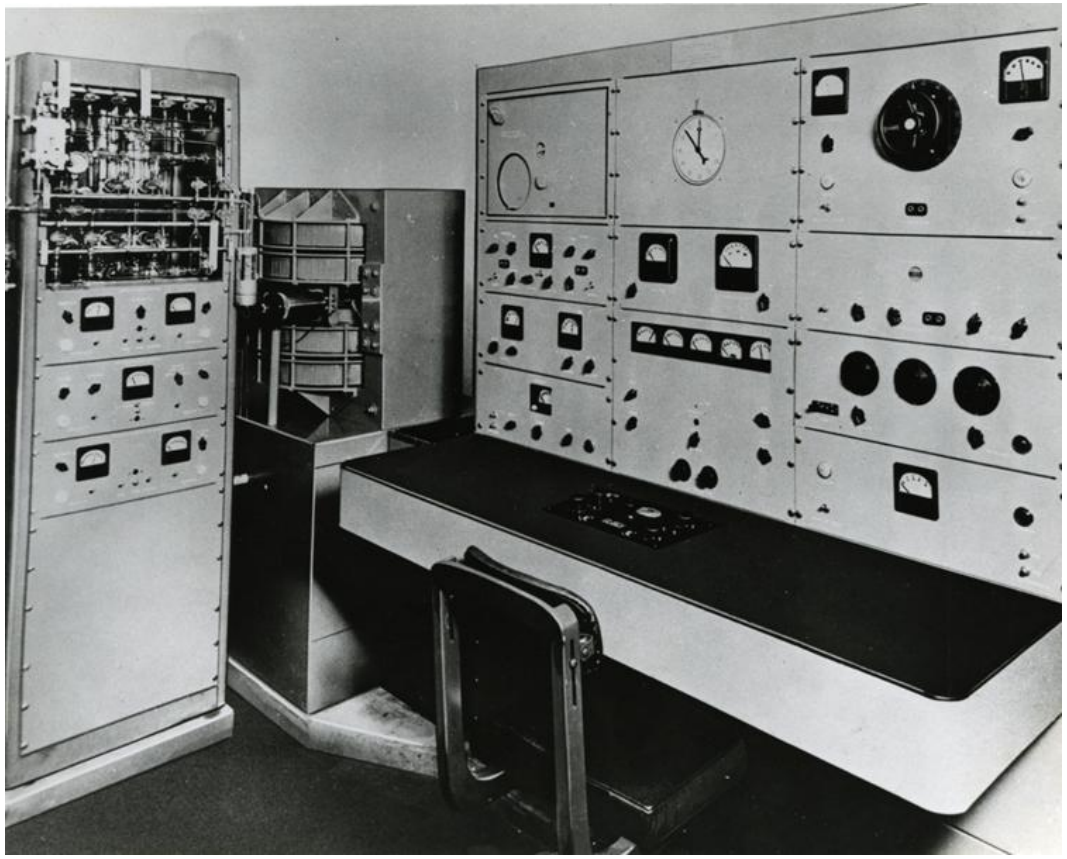


ion trap



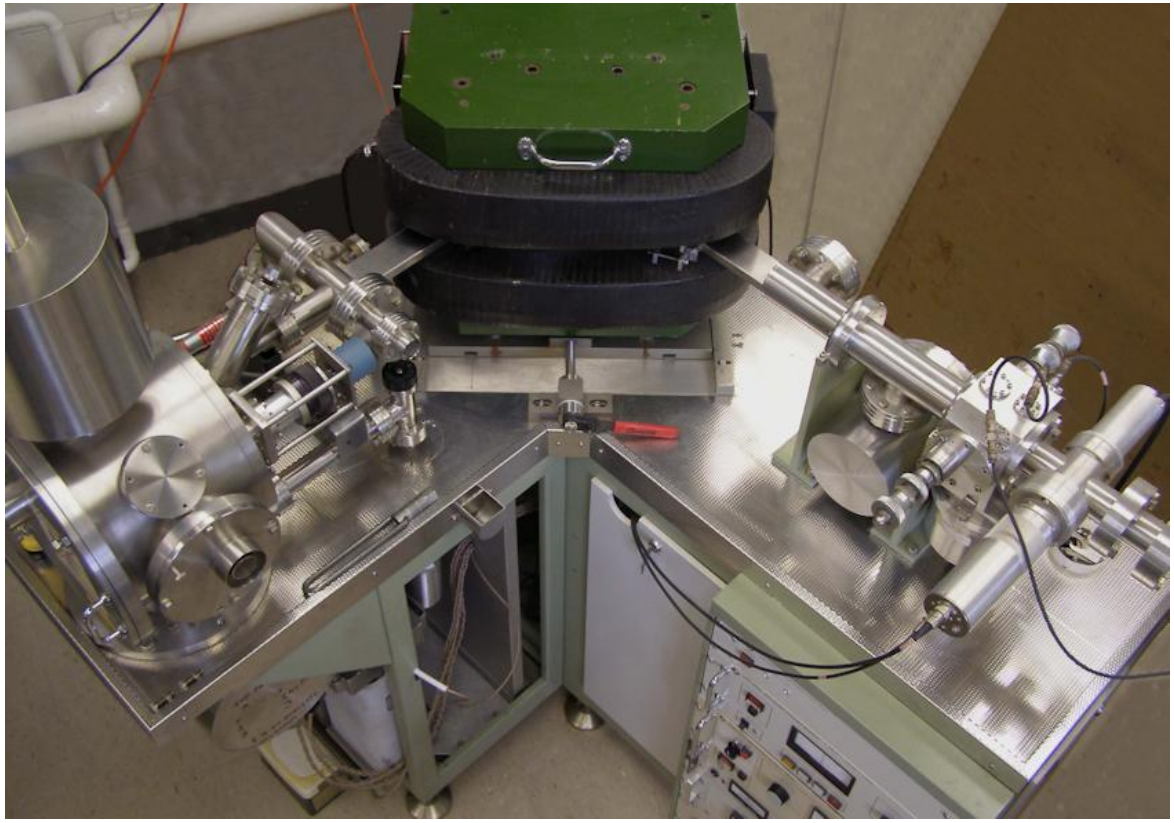
https://www.cif.iastate.edu/mass-spec/ms-tutorial

COMMERCIAL MASS SPECTROMETERS



wikipedia.

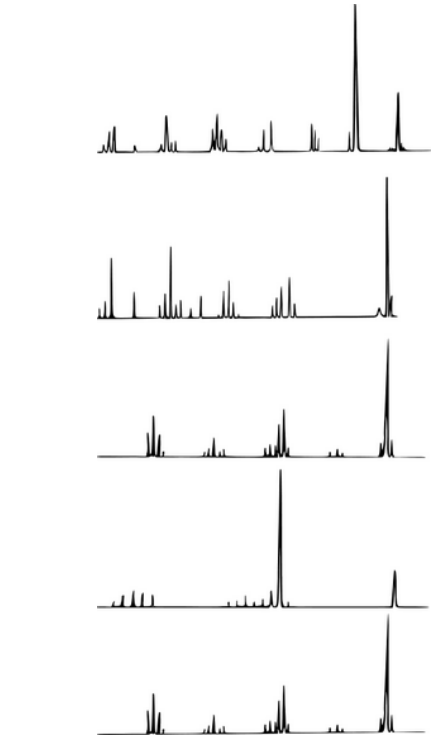
SECTOR INSTRUMENT



wikipedia.

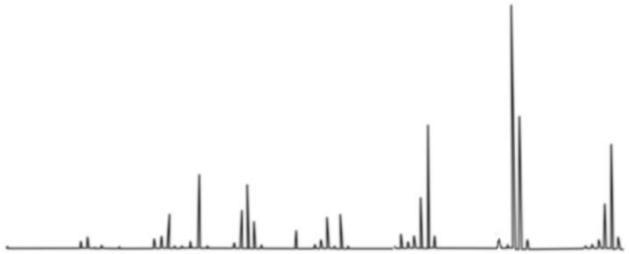
MASS SPECTRUM

Pure Components



m/z →

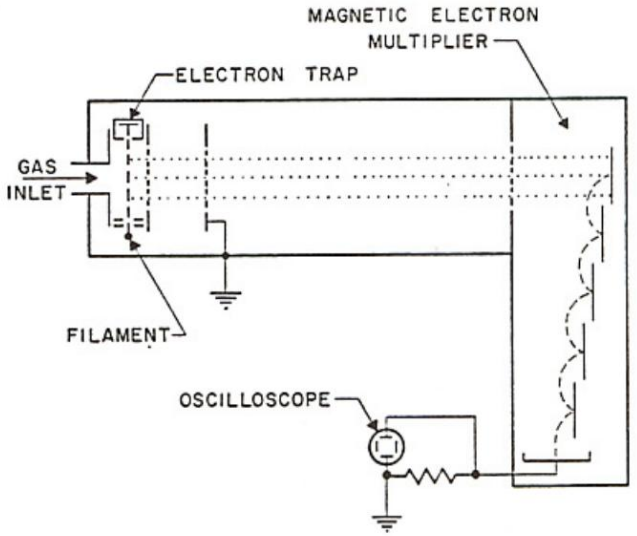
Mixture



m/z →

BENDIX TIME-OF-FLIGHT

Science Heritage Institute

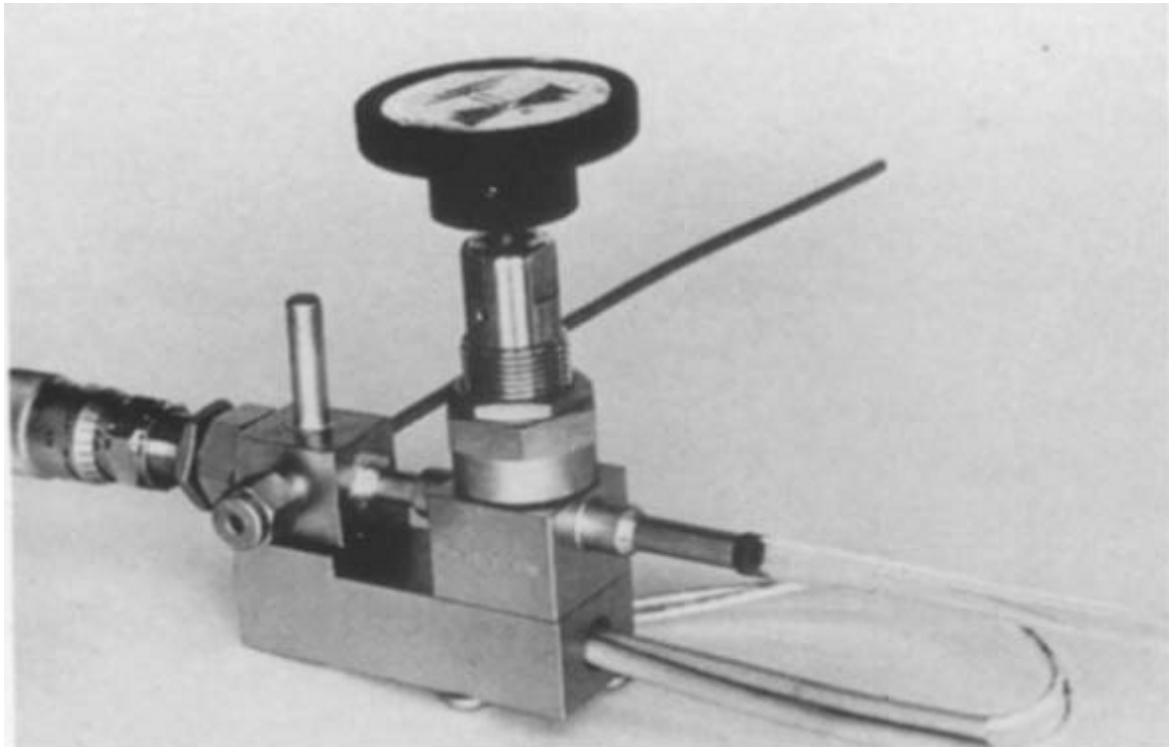


From Wiley and McLaren, The Review of Scientific Instruments, Dec 1955.

BENDIX TIME-OF-FLIGHT MASS SPECTROMETER

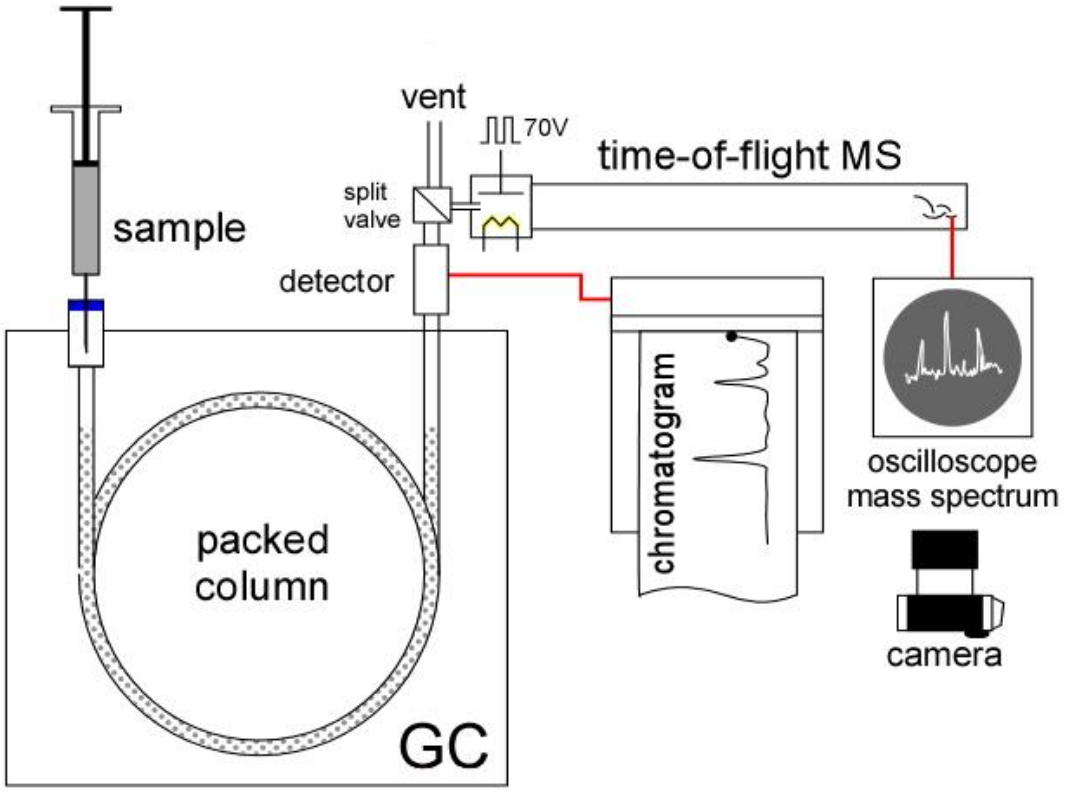
Science Heritage Institute

INTERFACE

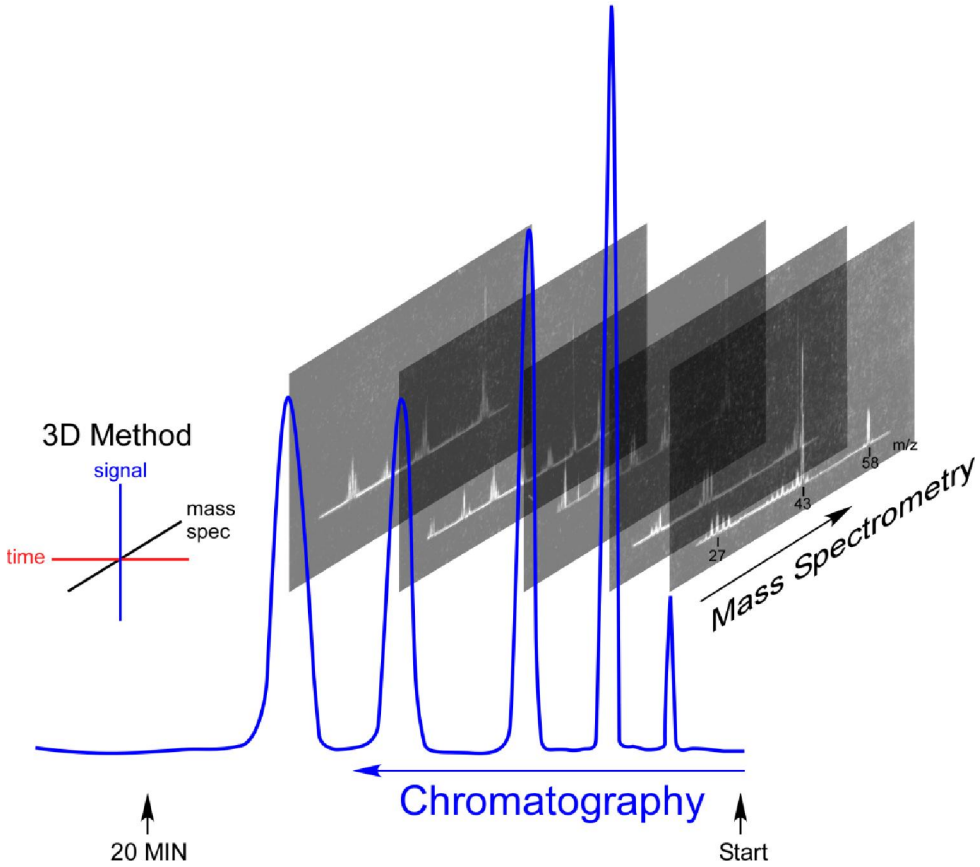


Gohlke RS, McLafferty FW. Early gas chromatography/mass spectrometry. Journal of the American Society for Mass Spectrometry. 1993 May 1;4(5):367-71.

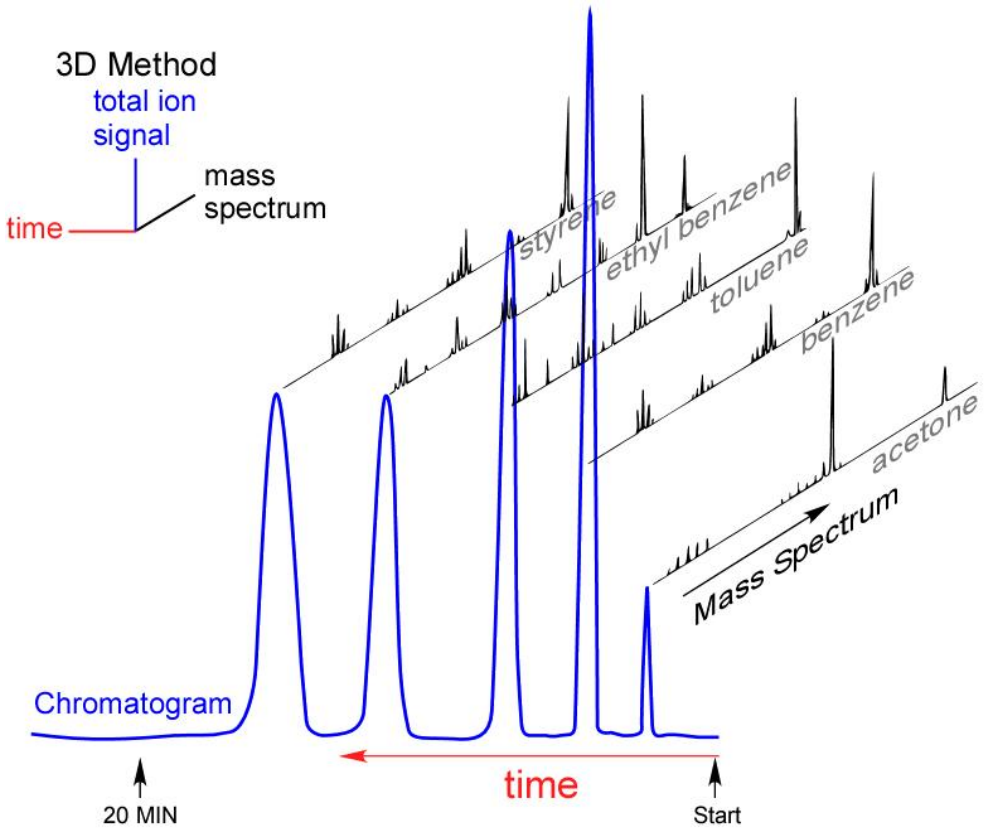
ORIGINAL GC-MS



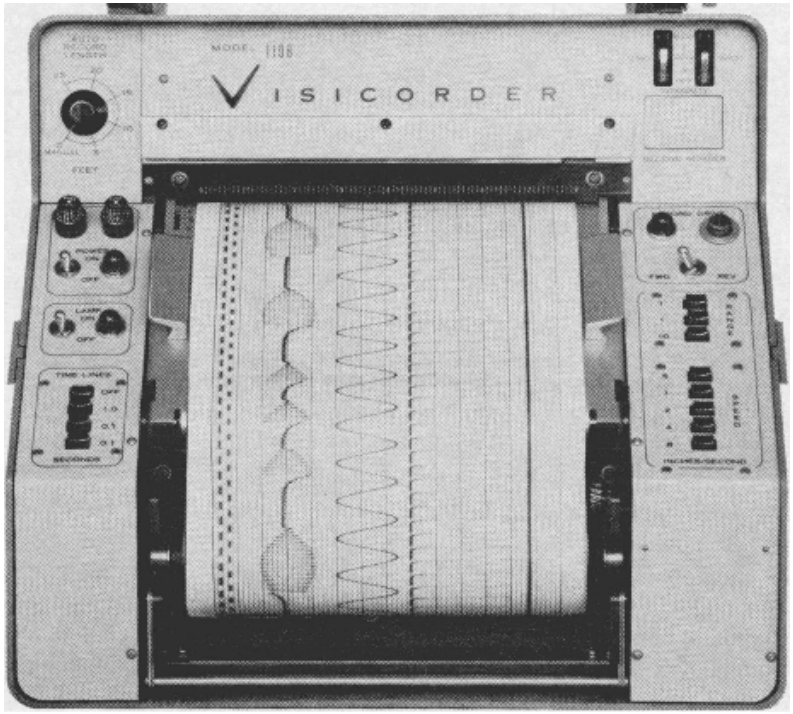
DATA CAPTURE BY CAMERA



3D DATA


3D Method
total ion
signal
mass
spectrum
time
styrene
ethyl benzene
toluene
benzene
acetone
Mass Spectrum
Chromatogram
time
20 MIN
Start

VISICORDER



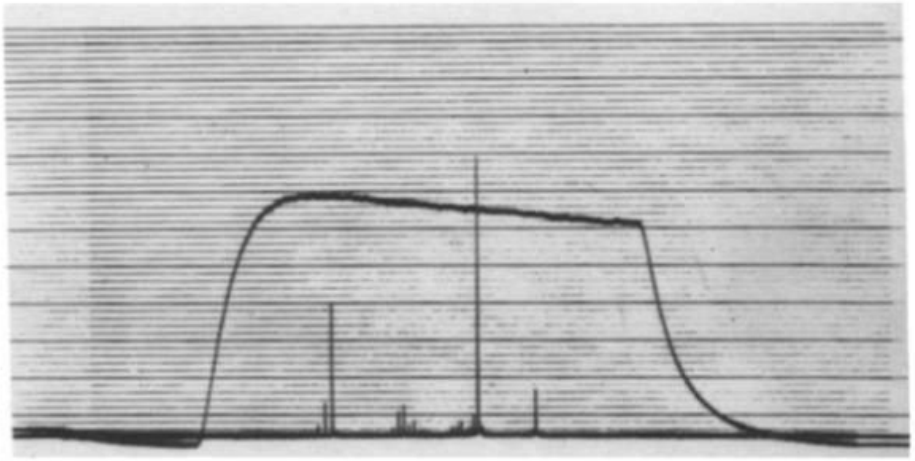
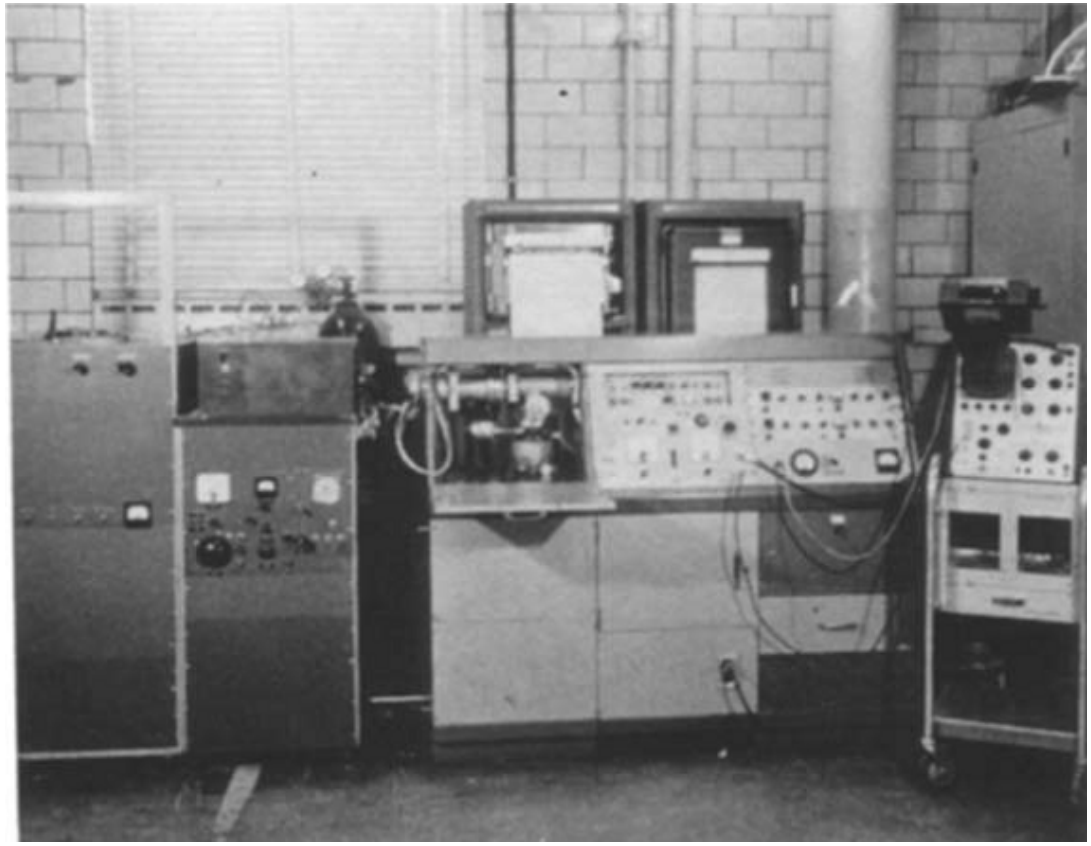


Figure 6. Visicorder mass spectrum of GC-eluted acetone fraction recorded simultaneously with the total ion current from corresponding GC peak, with ~ 2 s.

science.sciencemag.org.

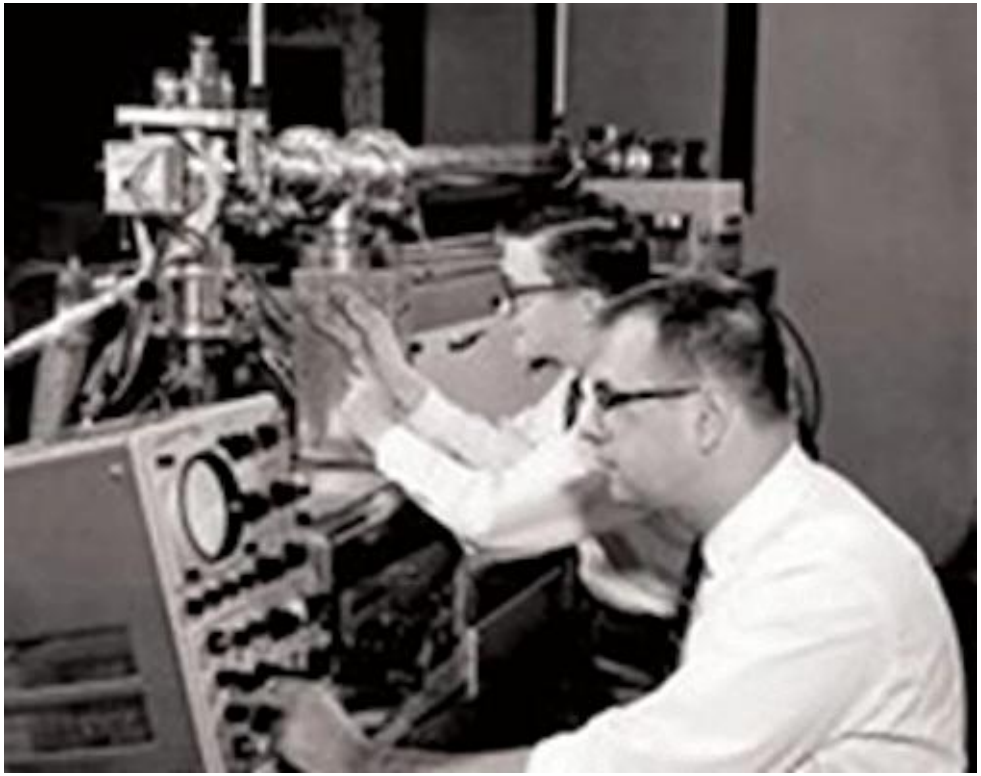
Gohlke RS, McLafferty FW. Early gas chromatography/mass spectrometry. Journal of the American Society for Mass Spectrometry. 1993 May 1;4(5):367-71.

Dow GC-MS 1957



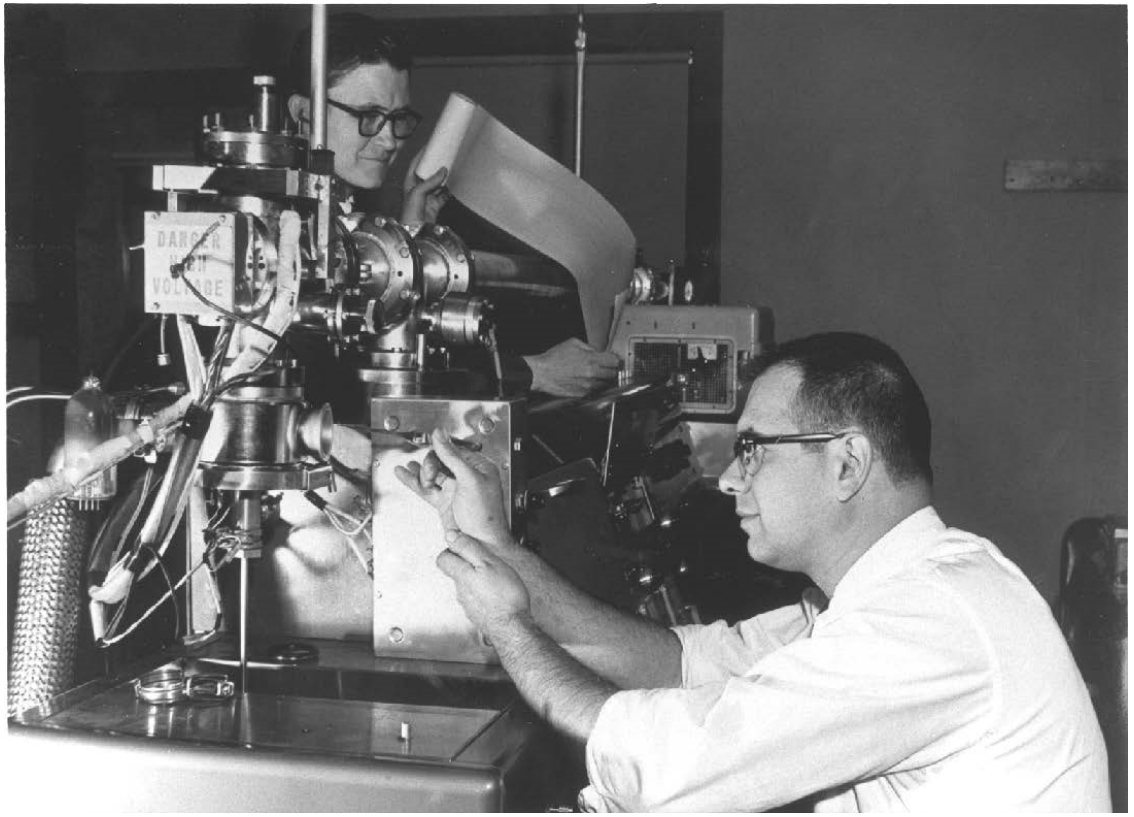
Gohlke RS, McLafferty FW. Early gas chromatography/mass spectrometry. Journal of the American Society for Mass Spectrometry. 1993 May 1;4(5):367-71.

Gohlke and McLafferty



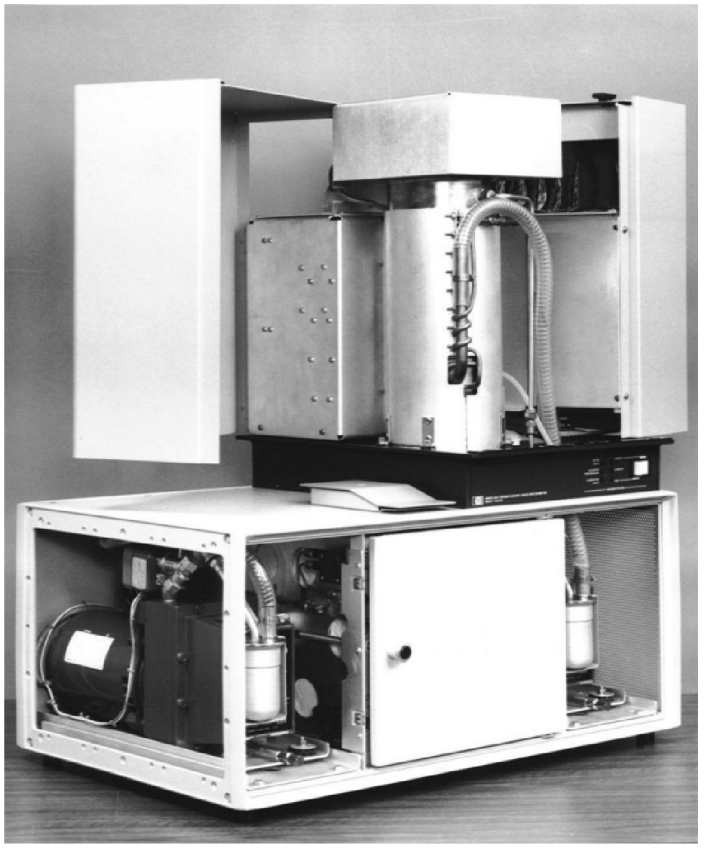
Dow Chemical

GOHLKE AND MCLAFFERTY



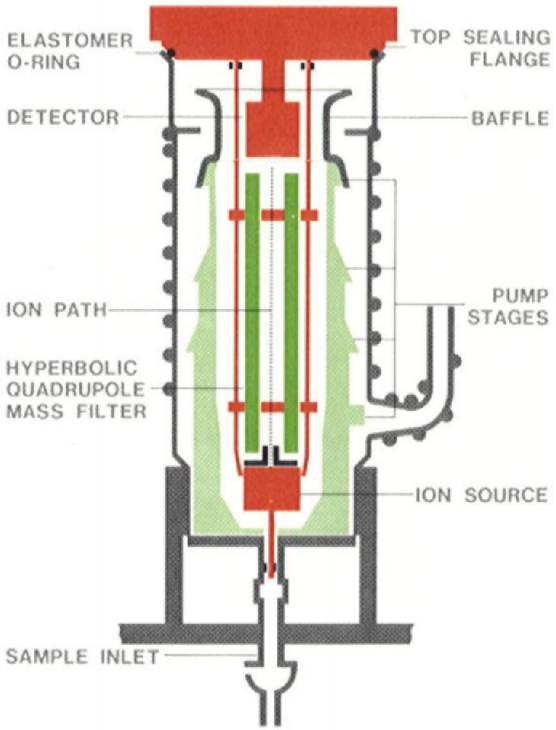
Dow Chemical

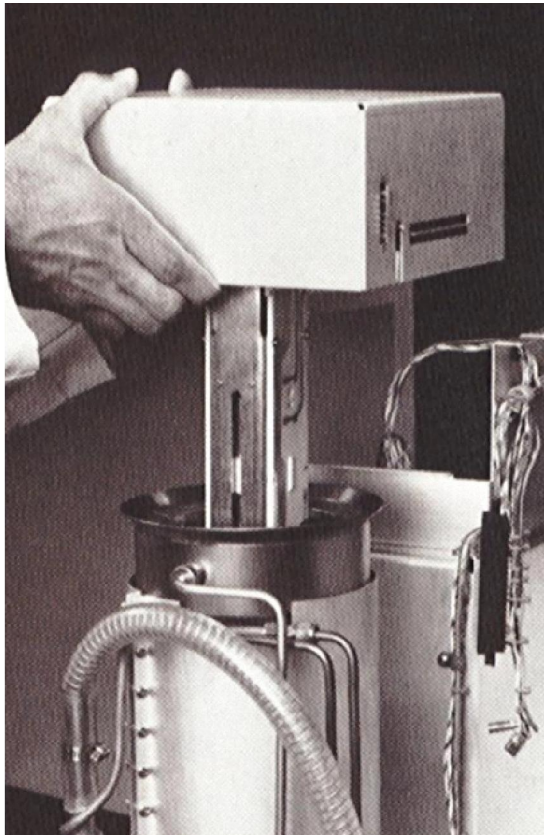
HP 1000 Computer c.1983



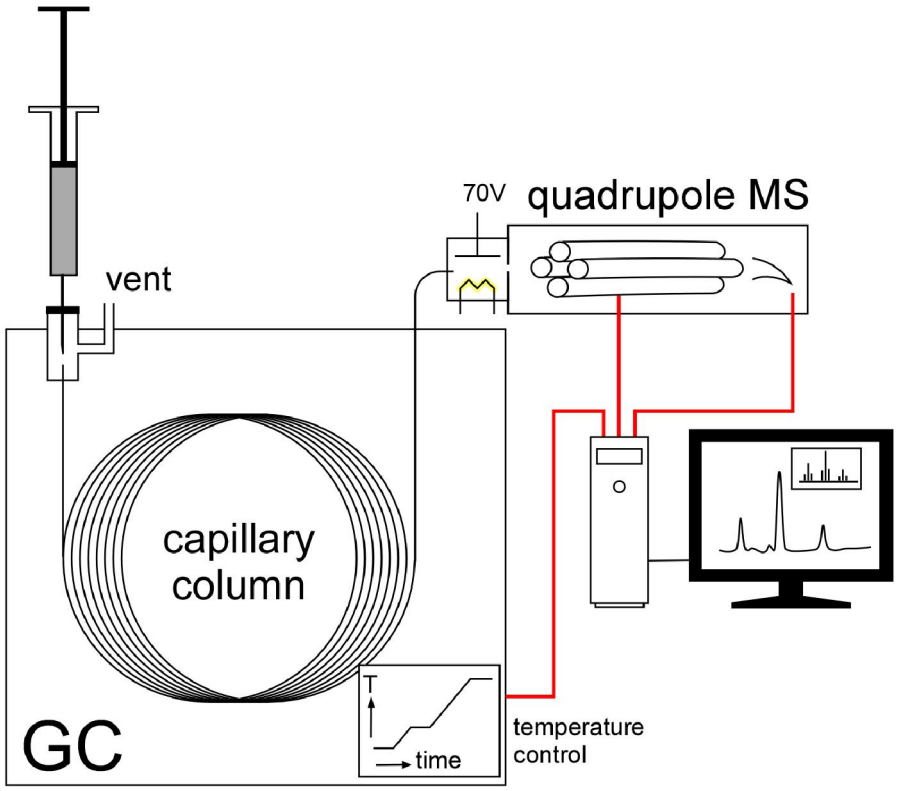
HP 5992 GC/MS c.1983

EVOLUTIONARY DEADENDS

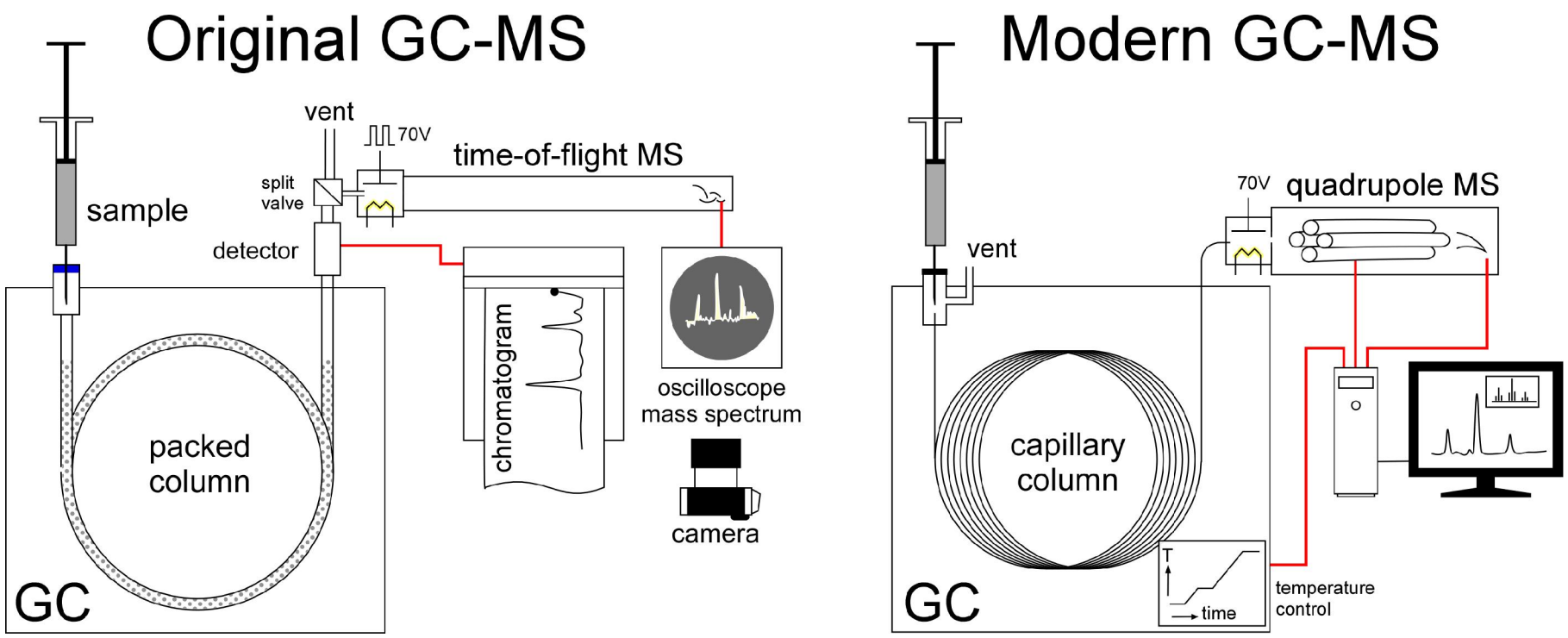




MODERN GC-MS


70V
quadrupole MS
vent
capillary
column
GC
T
time
temperature
control

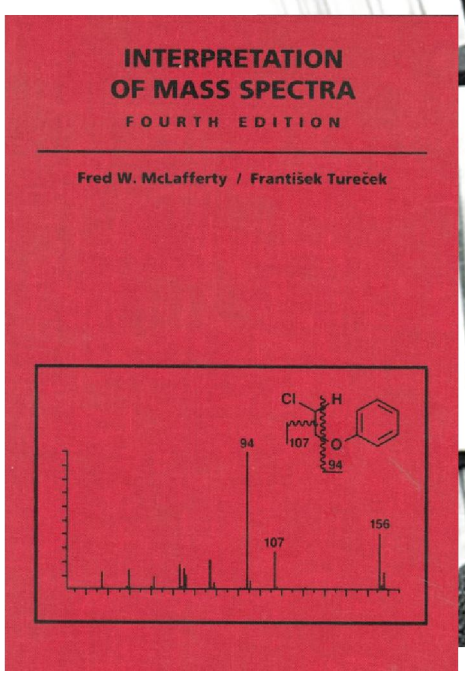
COMPARISON


Original GC-MS
vent
70V
time-of-flight MS
split
valve
sample
detector
chromatogram
oscilloscope
mass spectrum
camera
packed
column
GC
Modern GC-MS
70V
quadrupole MS
vent
capillary
column
T
time
temperature
control
GC

PERSON PORTABLE GC-MS

FLIR Systems

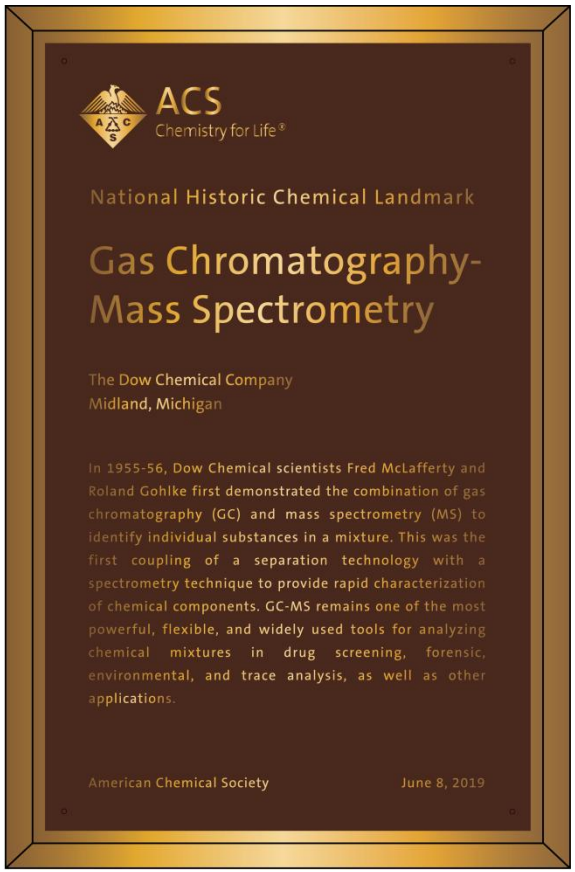
FRED MCLAFFERTY



amazon.com

theanalyticalscientist.com

National Chemical Heritage Landmark



In 1955-56, Dow Chemical scientists Fred McLafferty and Roland Gohlke first demonstrated the combination of gas chromatography (GC) and mass spectrometry (MS) to identify individual substances in a mixture. This was the first coupling of a separation technology with a spectrometry technique to provide rapid characterization of chemical components. GC-MS remains one of the most powerful, flexible and widely used tools for analyzing chemical mixtures in drug screening, forensic, environmental, and trace analysis, as well as other applications.

https://www.acs.org/content/acs/en/education/whatischemistry/landmarks/gas-chromatography-mass-spectrometry.html

MOUNTED IN FOUNDER'S PARK