



## DEVELOPMENT OF THE GC-MS STARTED RIGHT HERE IN MIDLAND

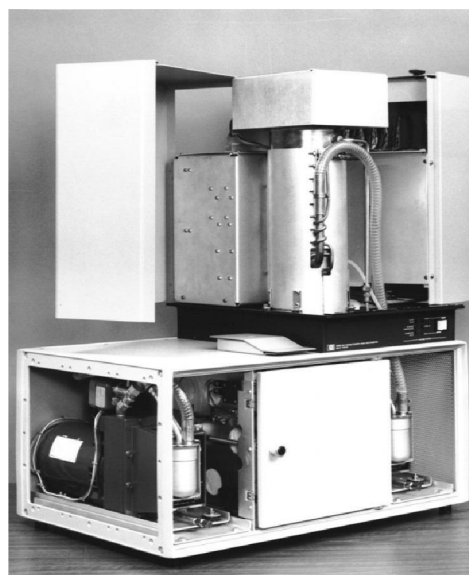
MARK JONES

*EXECUTIVE EXTERNAL STRATEGY AND COMMUNICATIONS FELLOW*  
THE DOW CHEMICAL COMPANY

7 June 2019



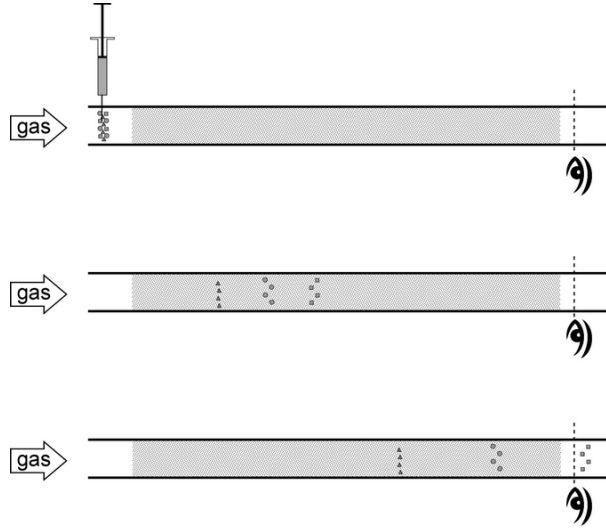
HP 1000 Computer c.1983



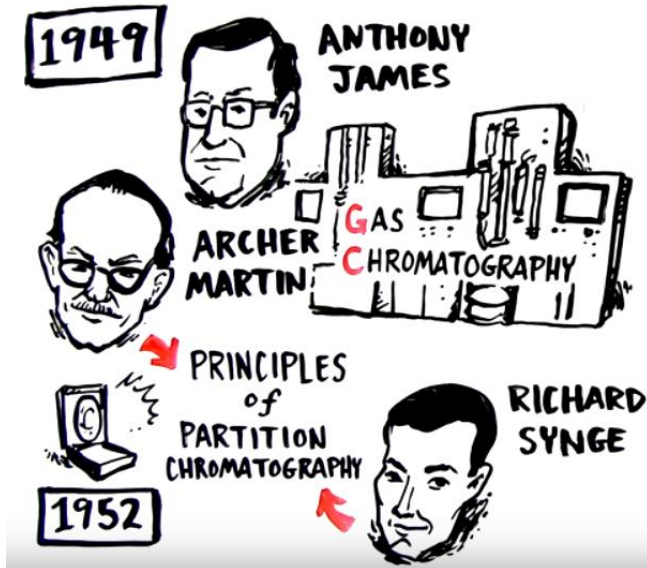
HP 5992 GC/MS c.1983



## GAS CHROMATOGRAPHY



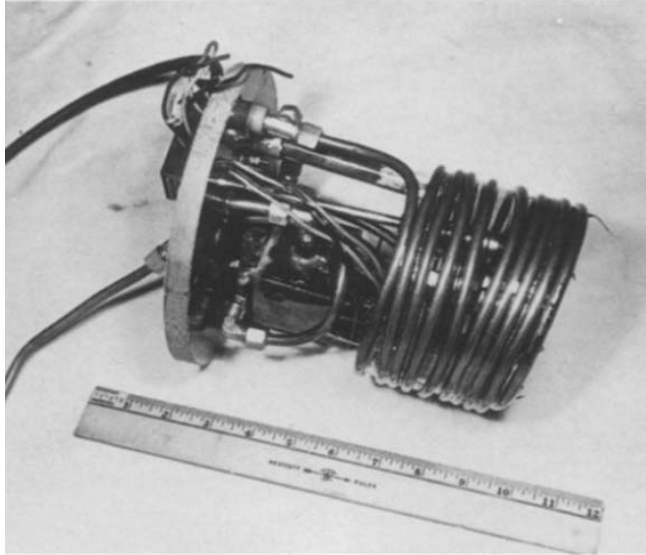
## DEVELOPMENT OF GAS CHROMATOGRAPHY



YouTube: An Illustrated History of Gas Chromatography



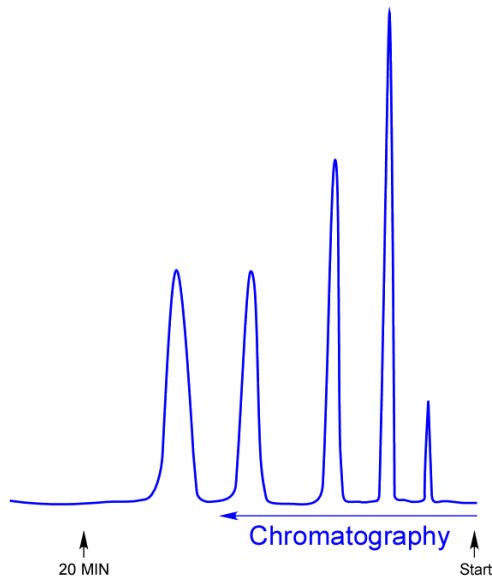
# CHROMATOGRAPHY IN 1955



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

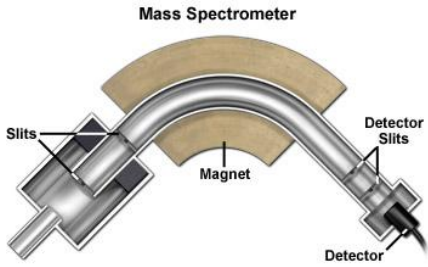


# CHROMATOGRAPH



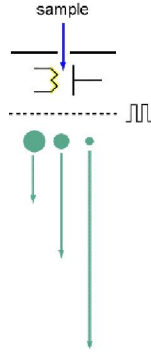
# MASS SPECTROMETERS

sector instruments



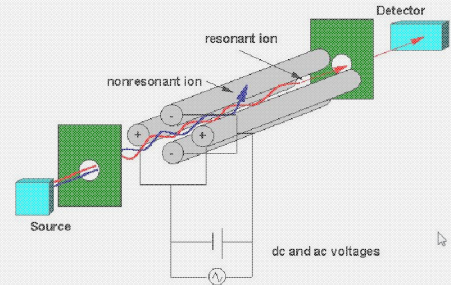
[nationalmaglab.org/education/magnet-academy/learn-the-basics/stories/mass-spectrometry](http://nationalmaglab.org/education/magnet-academy/learn-the-basics/stories/mass-spectrometry)

time-of-flight

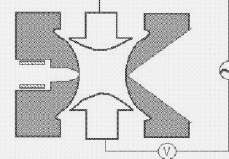


detector  
**Dow**

quadrupole

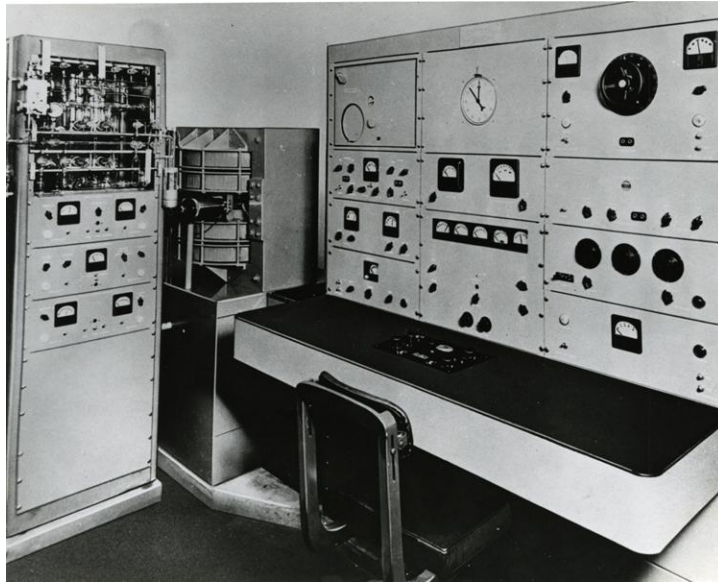


ion trap



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

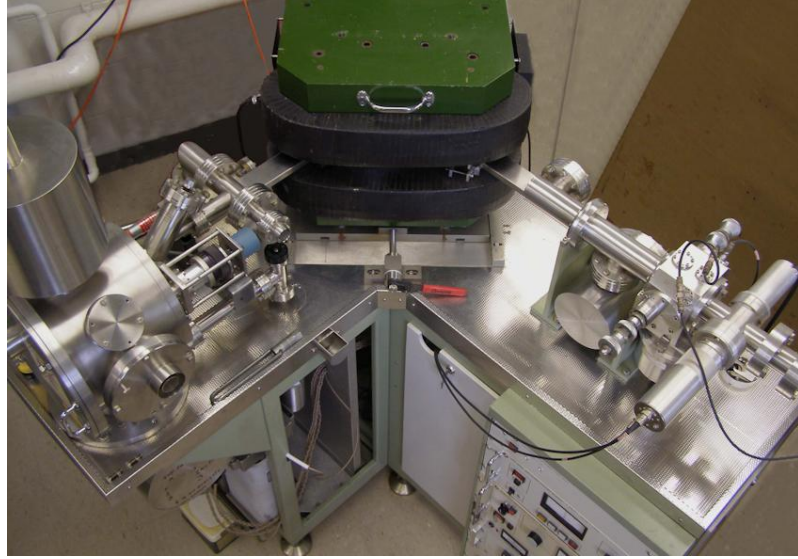
# COMMERCIAL MASS SPECTROMETERS



wikipedia.

**Dow**

## SECTOR INSTRUMENT

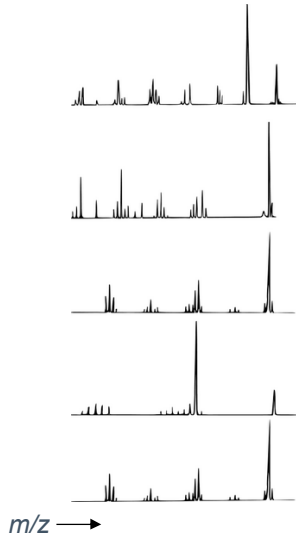


wikipedia.

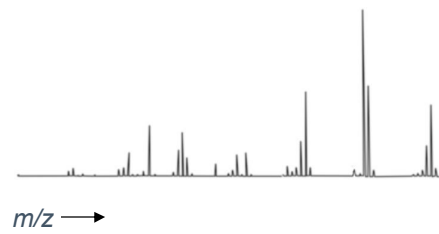


## MASS SPECTRUM

*Pure Components*



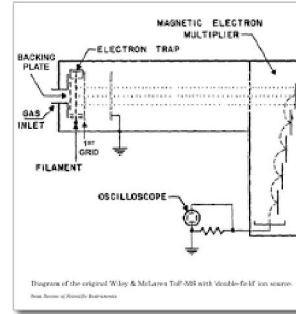
*Mixture*



## BENDIX TIME-OF-FLIGHT



Science Heritage Institute



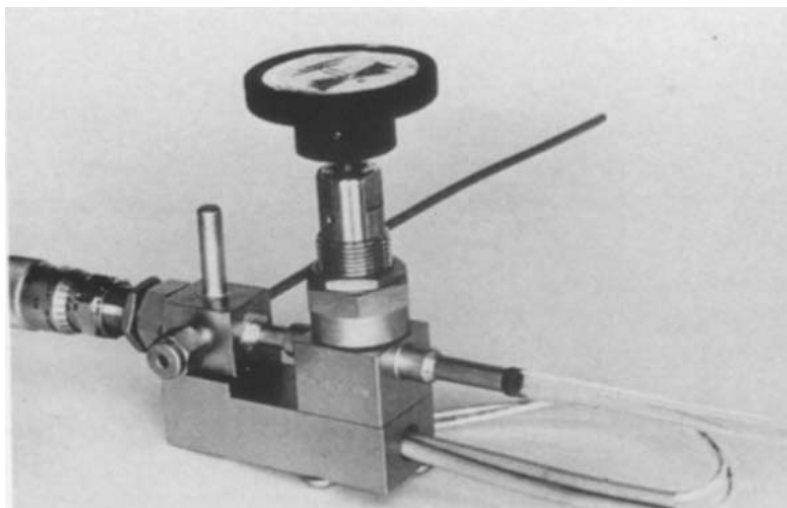
## BENDIX TIME-OF-FLIGHT MASS SPECTROMETER



Science Heritage Institute



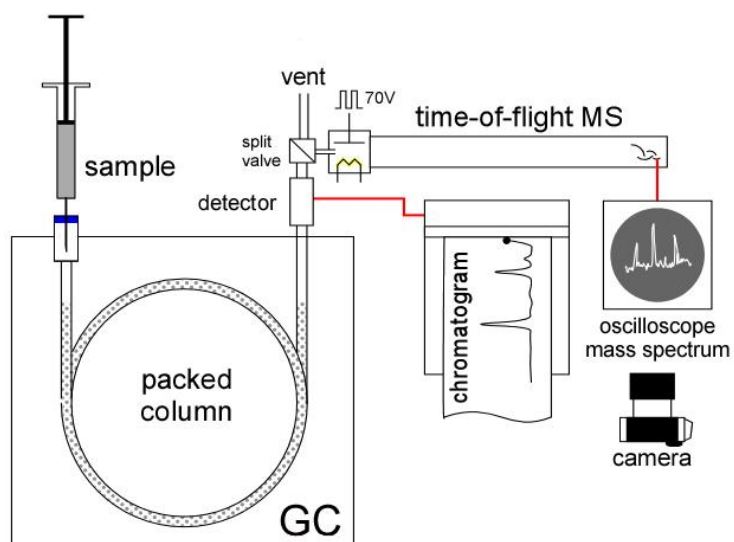
## INTERFACE



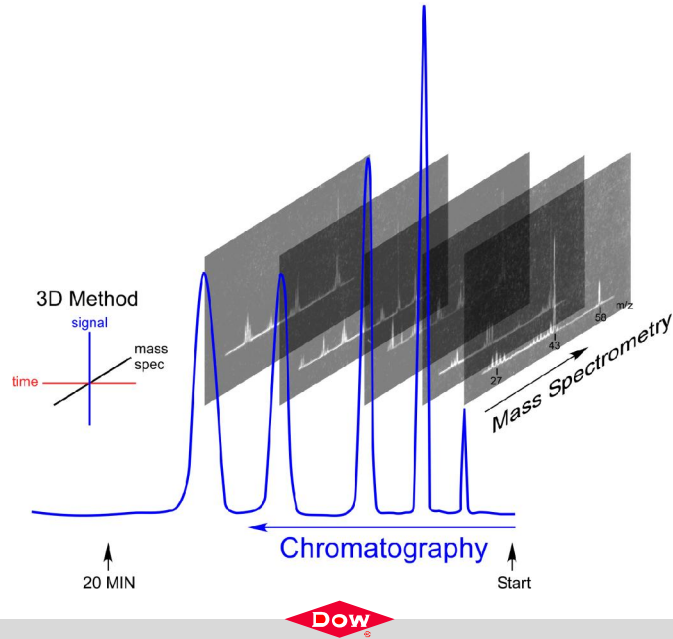
Gohlke RS, McLafferty FW. Early gas chromatography/mass spectrometry. *Journal of the American Society for Mass Spectrometry*. 1993 May 1;4(5):367-71.



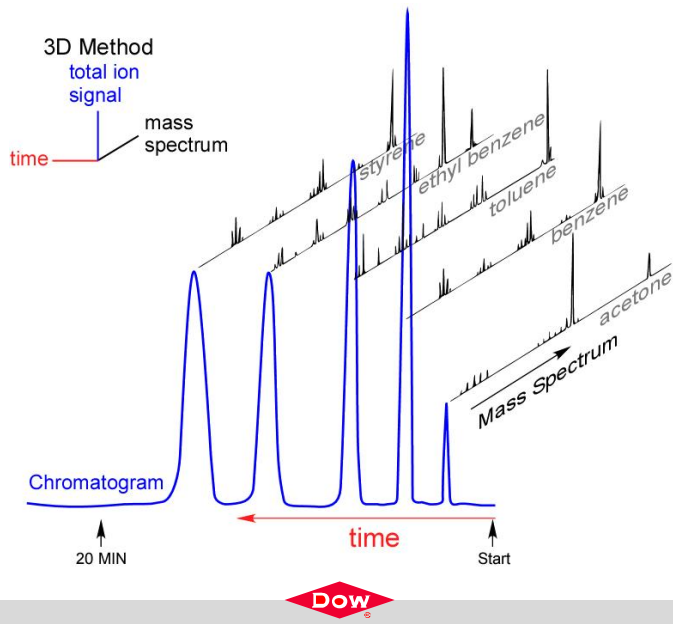
## ORIGINAL GC-MS



## DATA CAPTURE BY CAMERA

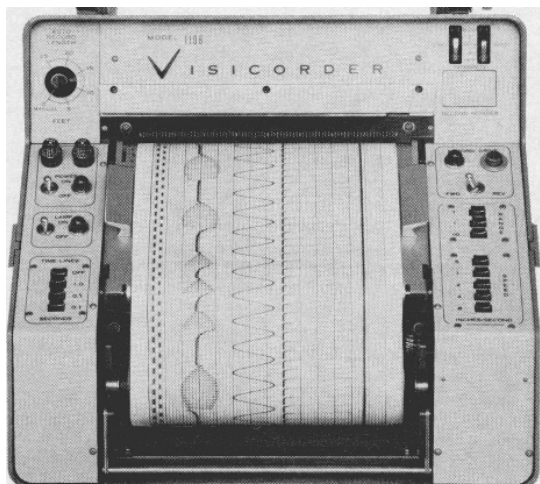


## 3D DATA

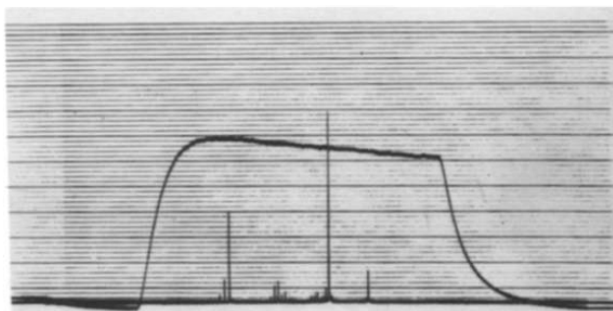




## VISICORDER



science.sciencemag.org

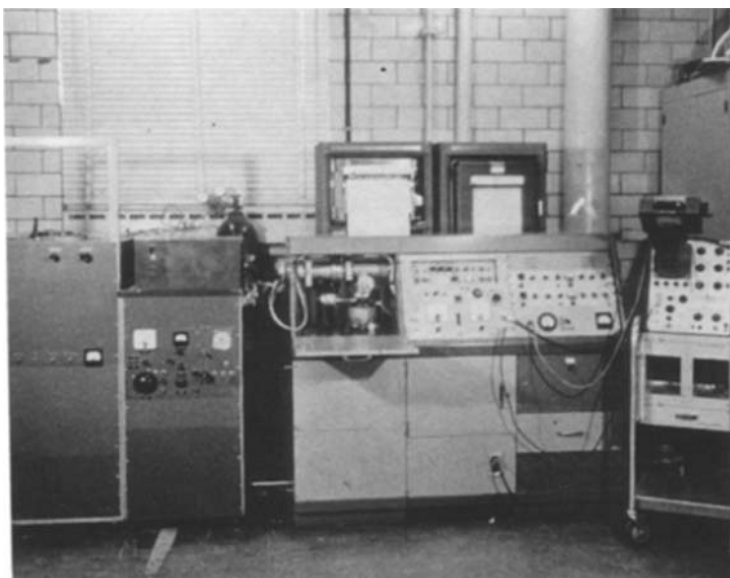


**Figure 6.** Visicorder mass spectrum of GC-eluted acetone fraction recorded simultaneously with the total ion current from corresponding GC peak, with  $\sim 2$  s.

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

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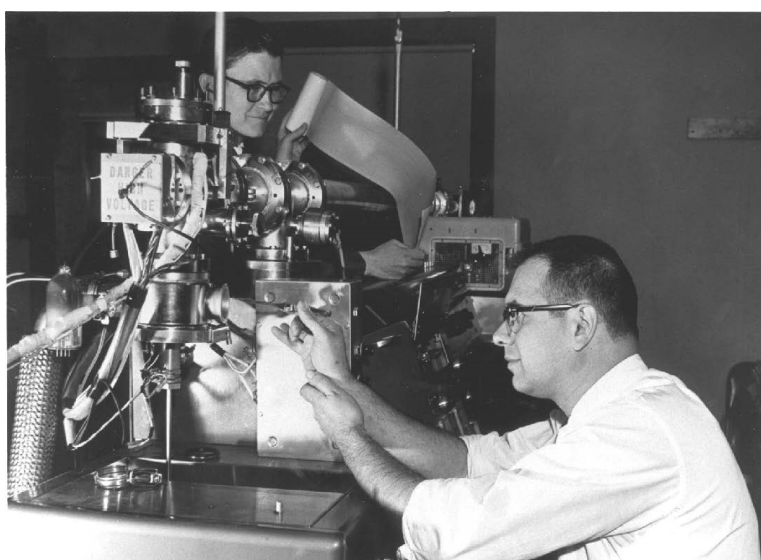


*Dow chemical*



## GOHLKE AND McLAFFERTY

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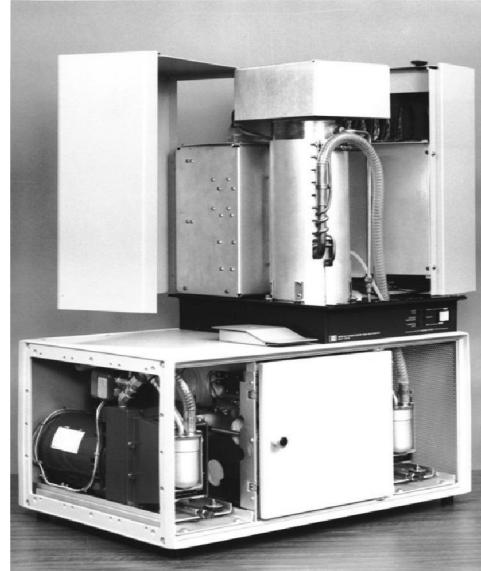


*Dow chemical*





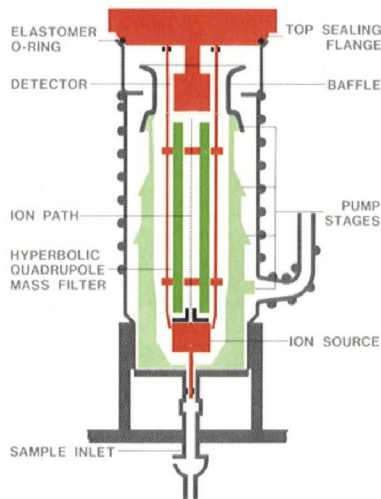
HP 1000 Computer c.1983



HP 5992 GC/MS c.1983



## EVOLUTIONARY DEADENDS



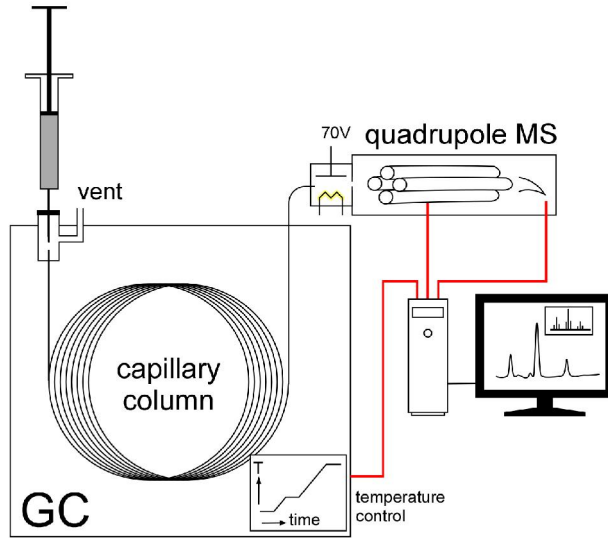
History of GC-MS at HP/Agilent



History of GC-MS at HP/Agilent

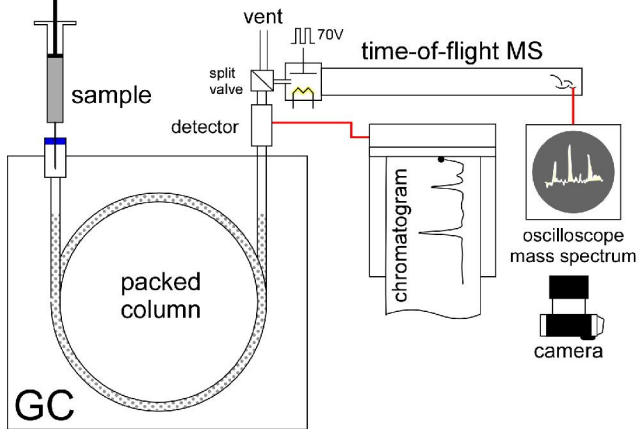


### MODERN GC-MS

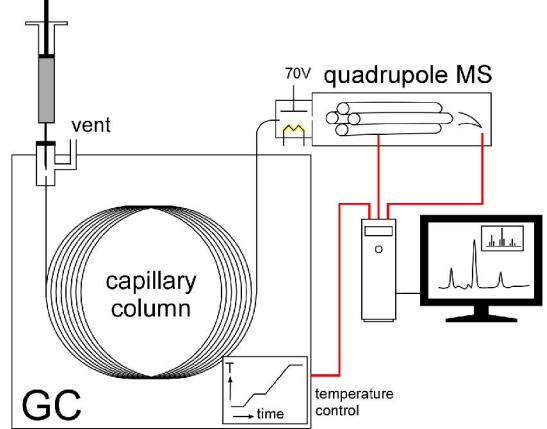


### COMPARISON

#### Original GC-MS



#### Modern GC-MS



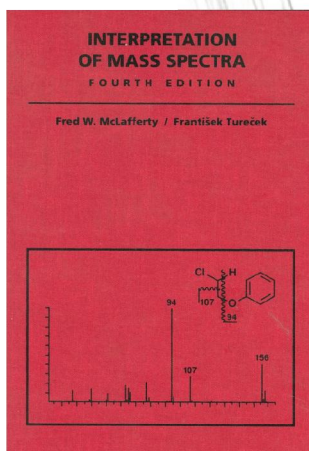
## PERSON PORTABLE GC-MS



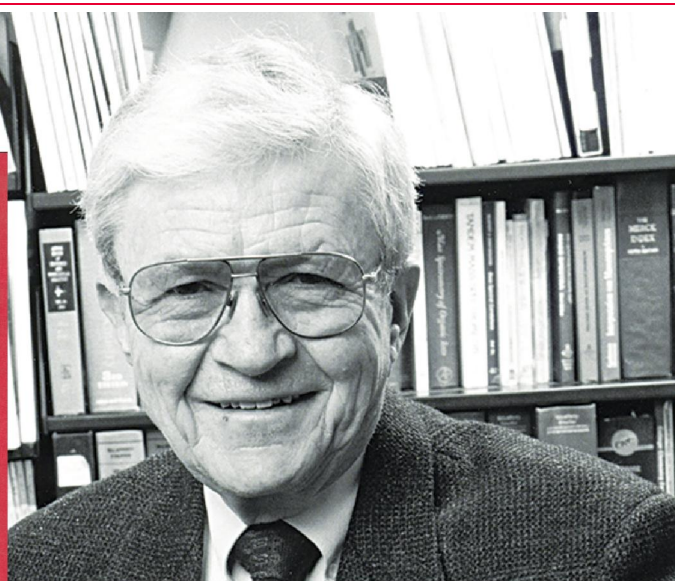
FLIR Systems



## FRED MCLAFFERTY



amazon.com

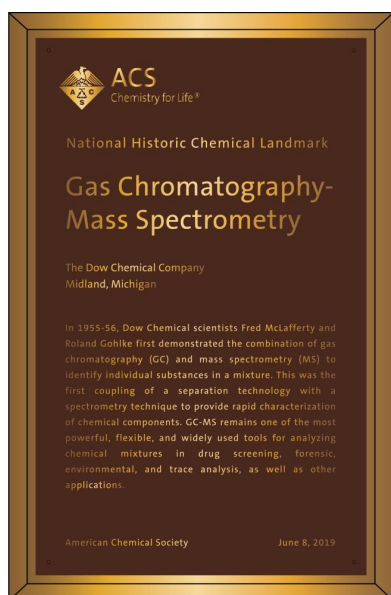


theanalyticalscientist.com



## NATIONAL CHEMICAL HERITAGE LANDMARK

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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.

