“Colour writing” – Chromatography’s role in studying molecular fossils

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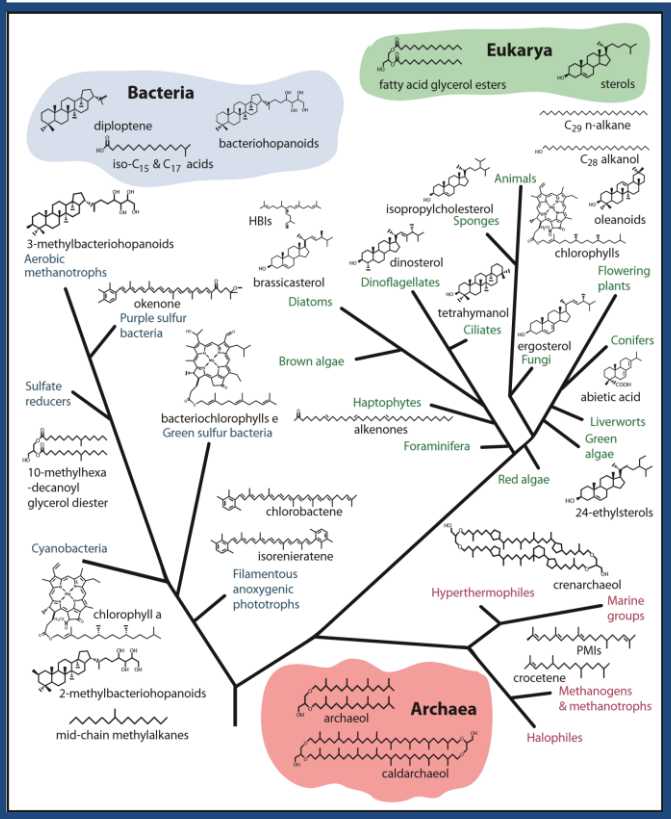


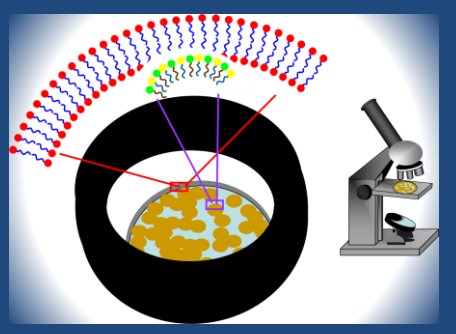
The Biomarker Tree of Life. Briggs and Summons, 2014

Chromatography derives from the Greek words χρῶμα chroma “color” and γράφειν graphein “to write”. Organic geochemists use chromatography to separate mixtures of lipids (fat molecules found in all forms of life, including Bacteria, Archaea, and humans). Some lipids are specific to particular groups of organisms, and are used as *biomarkers*.

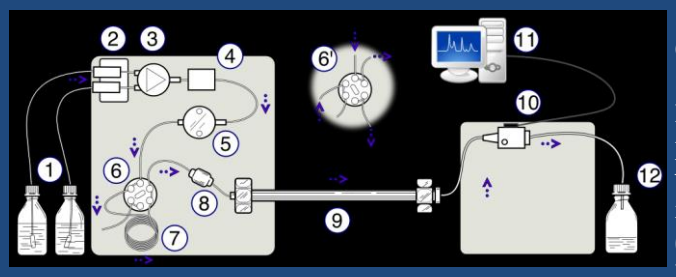

Kemp et al., 2000

At Newcastle University, we study molecular fossils, or *biomarkers*, in order to extrapolate present and past environmental conditions.

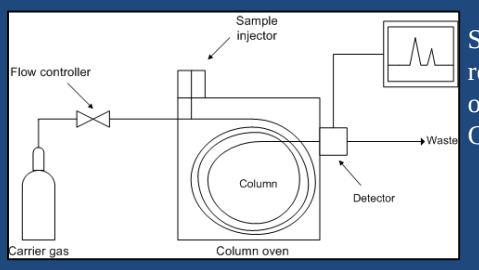
For example, the detection of a particular *biomarker*, *aminopentol*, in a 2.5 million year old sediment sample, taken from underneath the ocean floor, indicates aerobic methane oxidising bacteria were living at the time of sample deposition. We can use this information to extrapolate past environmental conditions.



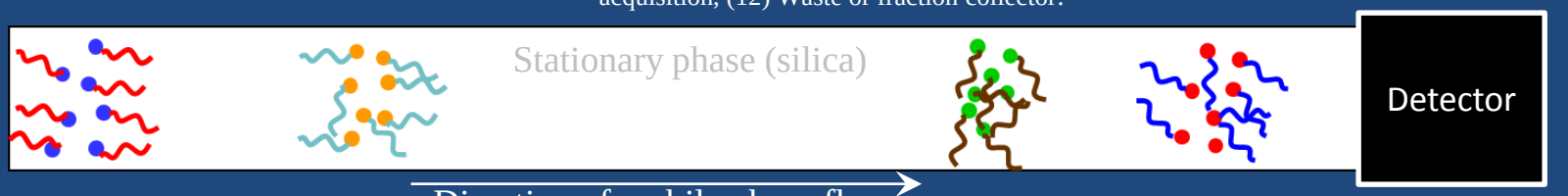
Traditionally, either liquid (solvents such as acetone, methanol, water) or gas (such as helium or nitrogen) is used as the *mobile phase* that carries the dissolved or vaporised lipids through a *stationary phase* (such as a column of silica). This separates the different *biomarkers* from each other based on their *size*, *charge*, or *polarity*.



Schematic representation of an Liquid Chrmatograph (1) Solvent reservoirs, (2) Solvent degasser, (3) Gradient valve, (4) Mixing vessel for delivery of the mobile phase, (5) High-pressure pump, (6) Switching valve in "inject position", (6') Switching valve in "load position", (7) Sample injection loop, (8) Pre-column, (9) Analytical column, (10) Detector (i.e. MS, IR, UV), (11) Data acquisition, (12) Waste or fraction collector.



Schematic representation of a Gas Chromatograph



http://en.wikipedia.org/wiki/Chromatography

A simple example of chromatography is the analysis of pigments in a felt marker. A beaker filled with water (or better yet, vodka) is used as the *mobile phase* to the paper *stationary phase*, on which a drop of marker ink is applied. The capillary action of the water up the paper carries the pigments at different speeds, separating them out from each other. The pigments below were separated for 10 minutes using water as the *mobile phase*.

Direction of solvent flow

Pen #