Sistemas, minerales, y haciendo un lío: aventuras en la química de Orígenes.
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En su experimento famoso, publicado en 1953, Stanley Miller demostró la síntesis abiótica de aminoácidos a partir de gases simples y chispas de alta energía1 – junto con una mezcla horrible de otros compuestos, que frecuentemente se ignoran. Este experimento fundó el área de “Química Prebiótica”, y también lo estableció como una sub-disciplina de (retro)síntesis de productos naturales. Muchas investigaciones en el área han seguido este camino, concibiendo rutas sintéticas para obtener moléculas/estructuras específicas (productos naturales) en el mejor rendimiento y la más alta pureza posible (minimizando las mezclas no deseadas de otros compuestos).

Hablaré sobre un colección de trabajo del grupo de “Complex Chemical Systems” en Glasgow que plantea un enfoque distinto: intentando aprovechar de las mezclas horribles.² En lugar del planeamiento de rutas sintéticas hacia moléculas específicas, hemos estado construyendo redes complejas de reacciones (es decir, haciendo reacciones que producen un lío de miles de compuestos), y usando técnicas poco usadas en este campo para analizarlos.³ Ésta es nuestra base para explorar cómo los cambios ambientales en las reacciones (sales solubles, minerales, y la manera en que mezclan disoluciones – o la confluencia de los “warm little ponds” de Darwin) pueden dirigir no sólo a la distribución de productos en nuestras complejas redes de reacción, sino también a sus propiedades funcionales (a nivel de sistema).⁴


CV
Andrew obtained his first degree (MSci Chemistry) from King’s College, London. He enjoyed his final year research project in a supramolecular chemistry research lab so much, he decided to spend more time in the lab by pursuing a PhD. Under the guidance of Prof. Ramon Vilar, he worked on ‘smart’ contrast agents for medical imaging – responsive probes meant as tools to understand what is happening in complex biological systems – starting at the Catalan Institute of Chemical Research (ICIQ, Tarragona), before moving to Imperial College, London, to complete his thesis.
After this, he moved to Plaxica: a company set up to establish new industrial methods for producing ‘next generation’ recyclable plastics from renewable resources. After nearly three years – as Plaxica progressed from a concept to planning a pilot plant – and a lot of different research areas (biocatalytic chiral resolution, sugar/formose systems chemistry, separations science), he returned to academic research. After a brief period working on self-assembled nanostructures at the University of Puerto
Rico, he moved to the University of Glasgow, to work in Prof Lee Cronin’s ‘Complex Chemical Systems Group. In Glasgow he worked on a wide variety of projects, encompassing analytical, inorganic, and organic chemistry, and led a team looking into how life can emerge from simple chemistry. In late 2018, Andrew returned to the Department of Chemistry at King’s as a Lecturer.
Systems, minerals, making a mess: some adventures in Origins chemistry.
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In his classic 1953 experiment, Stanley Miller demonstrated the abiotic synthesis of amino acids – from simple gasses and high energy sparks – along with a horrible mess of other compounds, which are frequently ignored. Not only did this kickstart “Prebiotic Chemistry” as an effort to understand the Origin of Life, but to many established it as a subset of natural product (retro)synthesis. Much research in this area since has followed this path, designing syntheses to obtain particular molecules/structures (natural products) in the greatest yield and purity possible (minimising the horrible mess).

I will be talking about a body of work from my time in the “Complex Chemical Systems” group in Glasgow which takes a different approach: embracing the horrible mess, not avoiding it. Instead of planning synthetic routes, we have chosen to develop reactions which will make a mess, and unusual approaches to analysing them. We are using these as a basis to explore how environmental changes (salts, minerals, the confluence of Darwin’s “warm little ponds”) don’t just steer the distribution of components in our complex reaction networks, but also their functional properties as systems.


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