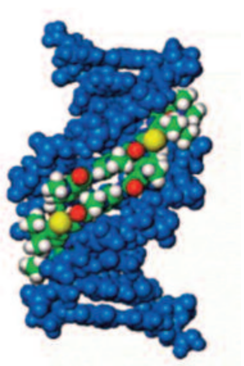
It's all around us – Heterocyclic chemistry

No surprise that the public interest is readily attracted through the media to the latest fashions in science and it's good that there is a continual stimulus of discoveries and inventions to whet the practical and intellectual appetites. Behind all the innovations the basic rules of the chemical and physical sciences still apply governing what will work and what won't. It's the skill and imagination of the scientist and technologist that brings things together to create innovation. Or in the case of biology, it's time and evolution that work together. When I look out of my office window I see objects from both nature and technology: trees, flowers, painted objects, dyed banners, for example. I've picked or implied colours because colour is the visible manifestation of one of the most important branches of chemistry; scientists call it heterocyclic chemistry. Basically, it's defined as the chemistry of compounds containing atoms joined in rings, mostly with 5 or 6 atoms, most of which are carbon but others are nitrogen especially, oxygen, sulfur, or phosphorus and sometimes metals and other elements. I've worked in heterocyclic chemistry all of my research career from PhD onwards and for me, *heterocyclic compounds make things happen*. I can argue this both from the point of heterocyclic compounds that occur in nature and heterocyclic compounds that we have made in the laboratory.

Let's start with nature. Everyone has heard of DNA and knows that this is the molecule that codes the information that makes us, and all living things, what we are. Some people will know about the 'double helix' structure of DNA. Only a few will know DNA contains a heterocyclic component as the major part of its backbone (the sugar, ribose) and that four specific heterocyclic rings are responsible for carrying the information (the so-called bases, adenine, guanosine, thymidine, and cytidine). When DNA is active, its information is converted in a series of steps of copying and editing into the proteins of the organism, plant, animal, or microorganism.



Now let's jump into the laboratory to make some new heterocyclic compounds. One of our major projects at Strathclyde concerns designing and synthesizing small compounds that bind selectively to DNA and in this way can control its operation; this class of compound is known as a minor groove binder (MGB). The picture shows DNA in blue with one of our MGBs bound (green, red, white, yellow; the yellow atoms represent sulfur which is part of a heterocyclic ring, the other atoms being carbon, nitrogen and hydrogen). We've been able to obtain MGBs that act highly selectively to kill disease-causing bacteria and one of these has been taken forward by our partner company, MGB Biopharma, to clinical trials for *Clostridium difficile* infections. Because we can target DNA in different ways using MGBs we think that there are many diseases that will be susceptible to treatment with medicines containing MGBs. Indeed we have some early information that viruses such as hepatitis C virus can be attacked. This leads to the thought that even the infamous Ebola virus might be treatable with the right MGB. We're trying hard to set up the right teams with partners who can handle Ebola virus safely so that we can put heterocyclic chemistry to work challenging this global health problem.

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