

"Nitrogen and Humanity: A Perpetual Crisis"

Prof. Philip Poole, Oxford University

Professor Poole's lecture began by explaining that, although Nitrogen is an inert gas in the atmosphere, it is essential to life. Biological productivity is mainly constrained by access to nitrogen in a reactive form, and until relatively recently nitrogen-fixing bacteria provided the major input to the biosphere. Humans discovered how to exploit this by including legumes, which host nitrogen-fixing bacteria in root nodules, into crop rotations and some historians claim that the surplus agricultural productivity led to rapid population growth and eventually the current cultural dominance of western civilisation. Further growth in food production (and population) followed the exploitation of "guano" bird droppings as a major source of fertilisers - to the extent that its rapid exhaustion of guano and nitrate supplies from Chile could have caused a major gap between supply and demand for food. Fortunately, or unfortunately, Haber and Bosch invented and commercialised a process for turning inorganic nitrogen into ammonia, which is then easy to turn into fertiliser - or explosives. So, Haber was both a hero and villain: people got fed - but the carnage of major wars could not have been sustained without his chemistry.

Today, about half the nitrogen atoms in our bodies have been through the Haber-Bosch process - and without this process a large part of the World's population would not have food to eat. (The "Green Revolution" of the 1960s can be regarded as the development of plant varieties that could handle much larger inputs of artificial fertiliser.) Unfortunately, organic nitrogen also leaks out of the agricultural system into the water courses and eventually into the sea, where it produces algal blooms which consume all available oxygen and kill other forms of life. Directly or indirectly it contributes to the sixth great mass extinction of biological species that we are currently living through (and causing).

So, how do we fix these problems without also having to choose who eats and who does not? One solution, pursued for many years, but perhaps now becoming feasible with modern techniques, is to persuade non-legume food species to give house-room to nitrogen-fixing bacteria, so producing their own fertiliser. Or else, we can all learn to like beans: we get fifteen times as much protein from eating them directly as we do by first feeding them to ruminants.

We need to be reminded from time to time that the World is facing some really big problems: they are at the moment easy to ignore and push to one side as being "Too difficult!" but they do not go away, and one day will have to be faced. Professor Poole's lecture highlighted the importance of the research work being undertaken to ameliorate the problems with existing artificial Nitrogen cycle.