

Nellie Sibaeva

My PhD project is broadly focused on exploring the origin of DNA during the early evolution of life. It is widely accepted that life originated with RNA, as it is capable of acting both as genetic material and a catalyst. However, in modern life, all cellular organisms possess DNA genomes. Despite its centrality to life, when DNA first arose remains uncertain. The chemical complexity of the sole pathway for the *de novo* production of DNA building blocks (deoxyribonucleotides) through ribonucleotide reduction has led some to argue that DNA evolved relatively late, perhaps after the primary lineages of modern life began to diverge. However, synthesis of deoxyribonucleotides could be possible through a chemically simpler pathway in which production of deoxyribose is catalysed by the enzyme deoxyriboaldolase (DERA). This alternative pathway could provide an earlier route for the transition to DNA. However, the DERA pathway naturally runs in the direction of degradation. For my project, we are working to reverse this pathway in a living cell, i.e. push it towards the direction of deoxyribonucleotide synthesis. We aim to establish whether complete functional replacement of the universal ribonucleotide reduction pathway by the reverse DERA pathway is possible for the synthesis of deoxyribonucleotides. This research explores the plausibility of an earlier evolution of DNA by simpler chemistry and highlights the value of synthetic biology for experimentally testing hypotheses on the origin of life.

I hope that the completion of my PhD will be the first step towards a career in academia. I am particularly interested in the origin and early evolution of life and the field of synthetic biology. My career goal in pursuing postgraduate study is to transition to a postdoc overseas and to eventually become an independent researcher and lecturer at a New Zealand university.