Unlocking the hidden potential of RNA

RNA is one of the most important molecules of life. It helps carry genetic information, but it also does much more: it can act as a catalyst, a regulator, and even a building block inside cells. Because of this versatility, scientists believe RNA could become a powerful tool for developing new medicines, sensors, and diagnostic technologies.

One big challenge, however, is understanding how RNA molecules interact with small molecules. Proteins have been studied extensively with the help of advanced AI systems such as AlphaFold, but RNA research has been slower because there is much less structural data available. This project aims to change that.

The idea is to combine artificial intelligence with new experiments to teach computers how RNA behaves and how it can be designed to recognize and bind specific molecules. A technique called SELEX will be used to generate large amounts of experimental data by testing billions of RNA molecules and identifying those that can bind to chosen targets. This information will then train deep learning models that can not only predict the structure of RNA, but also design new ones with tailored properties.

The project builds on earlier work creating databases and computer tools for RNA research, and it will now push the field further with three goals: improving RNA structure prediction, developing a system to design RNAs for binding specific molecules, and combining computer models with experimental data to discover general rules of RNA–molecule interactions.

In the long term, this research could enable the creation of “designer RNAs” with custom functions. Such RNAs might serve as new types of drugs, smart biosensors, or tools for understanding disease. Beyond practical applications, this work will also deepen our knowledge of how life operates at the molecular level, opening new doors in both science and medicine.