What is AI design?

The first step of developing any RNA-based therapeutic is a successful RNA sequence design. Without the correct design, drug developers can experience issues during production and downstream chemistry, manufacturing, and control activities. In addition, suboptimal expression due to design issues can impact dosing for a therapeutic later down the line. By getting design right up front, drug developers can avoid these downstream issues, derisking development while saving both time and costs.

As AI modeling capabilities improve, drug developers can utilize these technologies to better our understanding of RNA biology, which enables more effective biology-based engineering of RNA therapeutics. This RNA-centric approach to drug development leads to already high-performing lead candidates that can be further improved with input data from downstream validation assays.

How does AI design work?

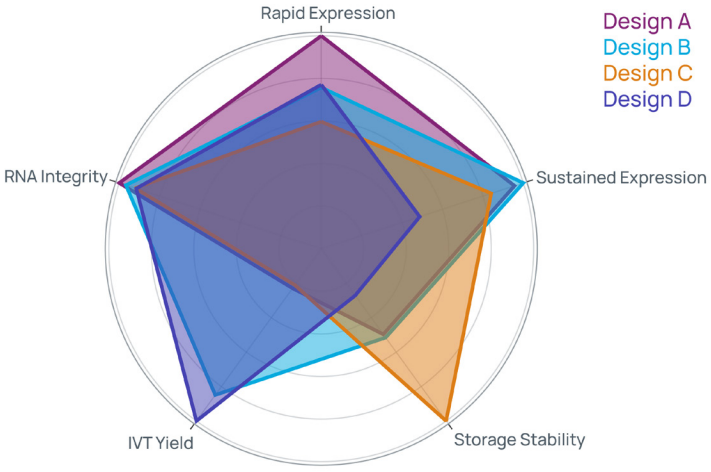
Drug developers use AI in design to predict how certain design features will impact key dimensions of RNA drug substance efficacy and quality, leading to therapeutics that are safer and more effective in the clinic.

To do this, drug developers first use a model to design potential sequence candidates within the desired codon region. They aim to optimize the candidates for both mRNA performance and manufacturability. Next, they prototype these constructs, validating manufacturability. These designed sequences are then tested against baseline controls or other sequences; typically, drug developers find that the AI-designed sequences perform significantly better in factors like stability and expression. Finally, the information gathered from the tests is used in design models to support future designs, closing the loop between designing, making, and testing RNA sequences.

AI design at Eclipsebio

At Eclipsebio, we design RNA through eNAVIGATE, our AI-optimized RNA design platform. It is a part of eCOMPASS, our lab-in-the-loop that integrates eNAVIGATE's design with sequencing-based analytics to create an integrated platform for RNA therapeutic drug development. Our multiobjective AI models take a holistic approach to therapeutic design, factoring in key dimensions of RNA performance and manufacturability.

After the initial design, we empirically validate candidates using our portfolio of traditional and sequencing-based analytics. The output of these assessments provides key insights into how specific features optimize stability, integrity, or purity. We then input this data back into our models to support upcoming designs, enabling optimization per Target Product Profile rather than a one-size-fits-all solution.



With AI design, we can compare how different designs perform on different goals. In this example, Design A has the highest rapid expression but a lower IVT yield. Design D has the highest IVT yield, but the lowest sustained expression of the four designs.

With this lab-in-the-loop process, we are continuously generating AI training data when designing RNA. This loop allows us to better predict how different design features will impact the RNA, helping us further optimize our designs to develop an effective therapeutic.

Ready to use paired AI and advanced validation to develop optimized RNA therapeutics? Contact Eclipsebio to get started.