Australian National University

TECHNICAL SUMMARY

Artificial Intelligence for designing mRNAs with high translational power

The translation of mRNA into proteins is the most important indicator of a cell's response to environmental stressors, infections and diseases. Current methods attempt at quantifying translational dynamics of mRNAs by investigating ribosome attachments to mRNAs but fail to provide strong correlations to absolute protein synthesis measurements and cannot be reproduced.

ANU has developed a machine learning ensemble that acquires multiple bio-signals related to protein synthesis to provide a strong correlation between the "translating power" of mRNAs with its absolute protein synthesis. Insights from this process can be used to design mRNA vaccines and plasmids with high protein expression rates.

Potential benefits

> Measure absolute translational power of mRNAs without protein measurement
> Measure changes in translational rates corresponding to cell stress, infections, disease
> Train the model for various cell types to generate a database of mRNA untranslated regions (UTRs)
> Design mRNAs with high translational power

Potential applications

> Plasmid design for optimising protein expression rates
> mRNA vaccine design
> Gene replacement therapy
> Pathway targeting and drug design
> Ultra-precise disease state diagnostics and real-time monitoring
> Ageing research

Opportunity

ANU is seeking investment into the technology to develop a multi-species UTR database atlas that can be utilised to provide custom mRNA design services/products. ANU is also open to collaborative projects that utilise the technology to develop high expression plasmids in synthetic biology or in mRNA vaccine and gene therapy development

IP status

The know-how and database of *S.* cerevisiae (yeast) mRNA translational power are owned by The Australian National University, and the process is being patented.

Key research team

> Dr Nikolay Shirokikh – Group leader at Division of Genome Sciences and Cancer at John Curtin School of Medical Research.
> Prof Thomas Preiss – Director, Shine-Dalgarno Centre for RNA Innovation, John Curtin School of Medical Reseach
> Prof Eduardo Eyras –EMBL Professor and Group Leader at the Division of Genome Sciences and Cancer, John Curtin School of Medical Research

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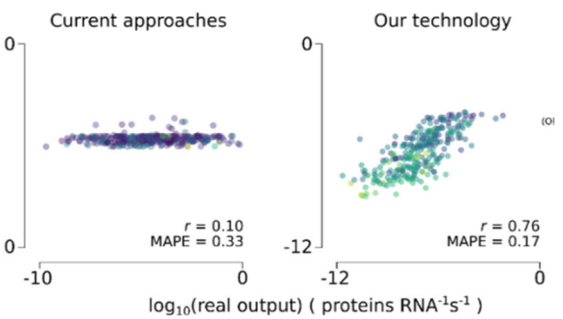

Figure 1: Predicted vs measured protein synthesis rate comparison between current approaches and ANU technology.