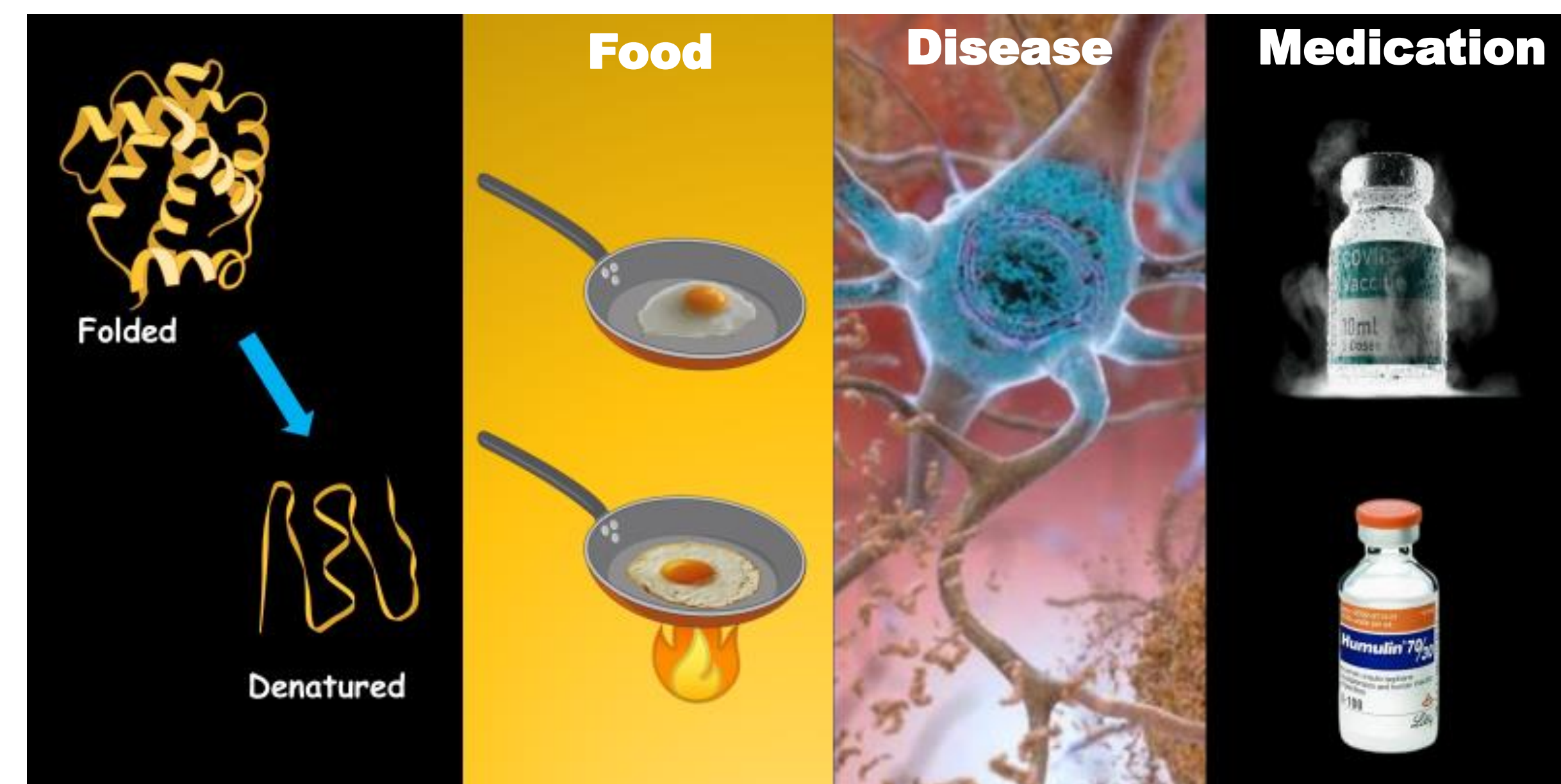




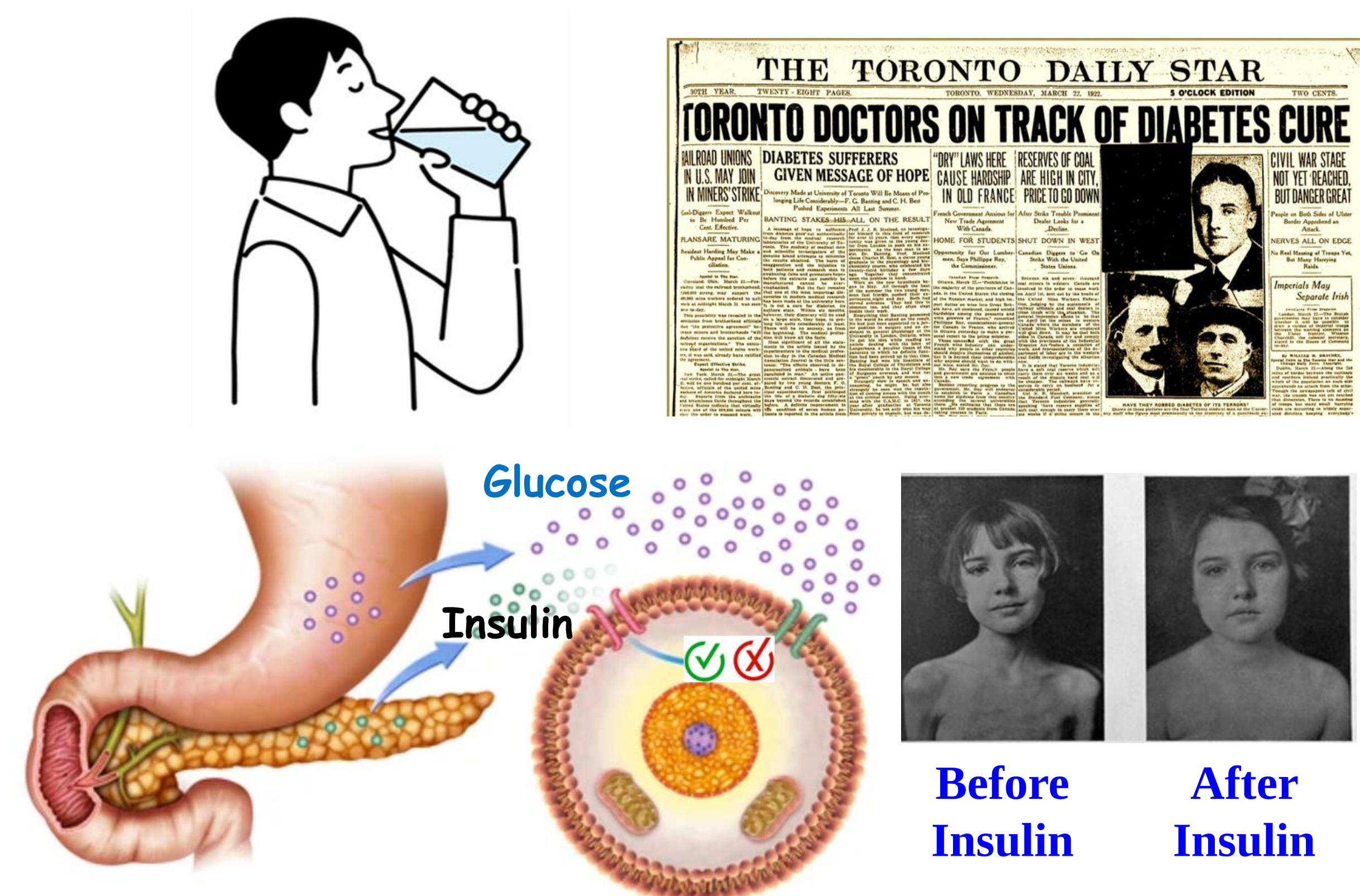
Introduction

Insulin often forms toxic fibrils during production transportation and storage, which are deposited as amyloids at repeated injection sites in diabetic patients. Distinguishing early fibrils from non-fibrillated insulin is difficult. Herein, we introduce a chemically modified human insulin derivative with a distinct visual colour transition upon aggregation, facilitating insulin quality assessment.

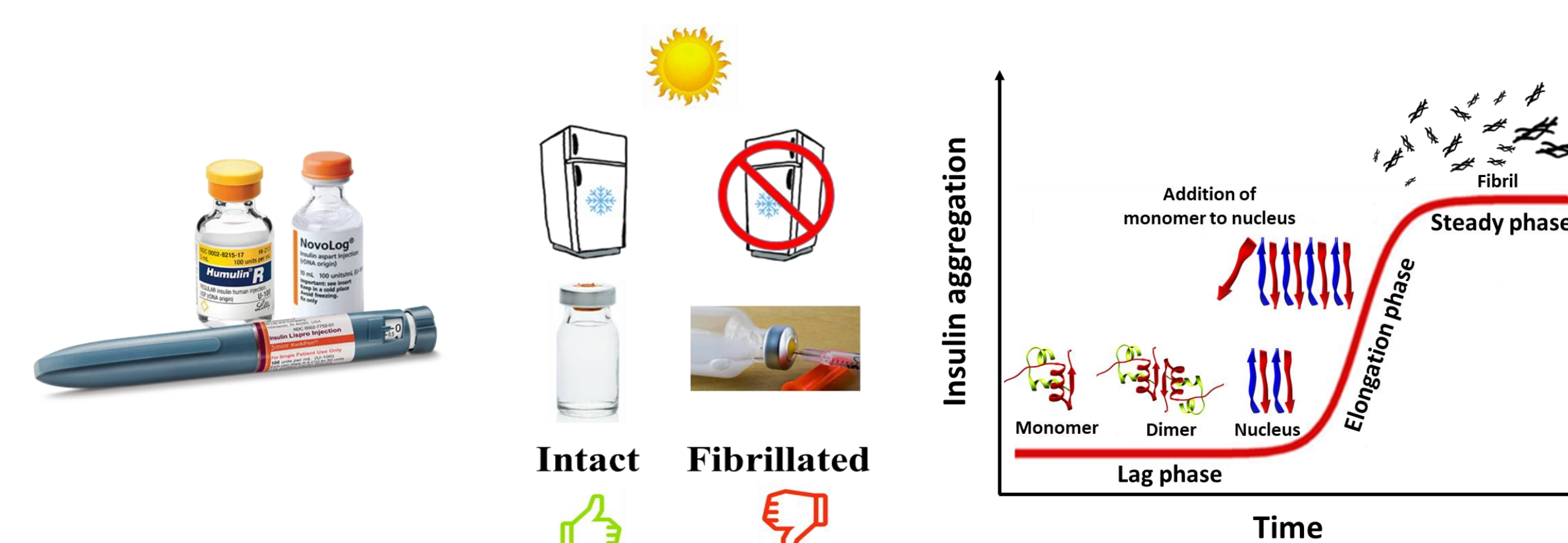
Protein denaturation



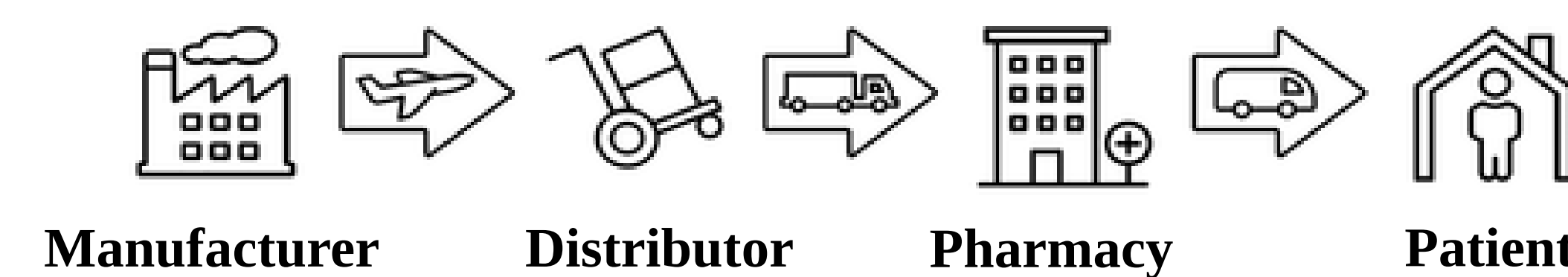
Insulin



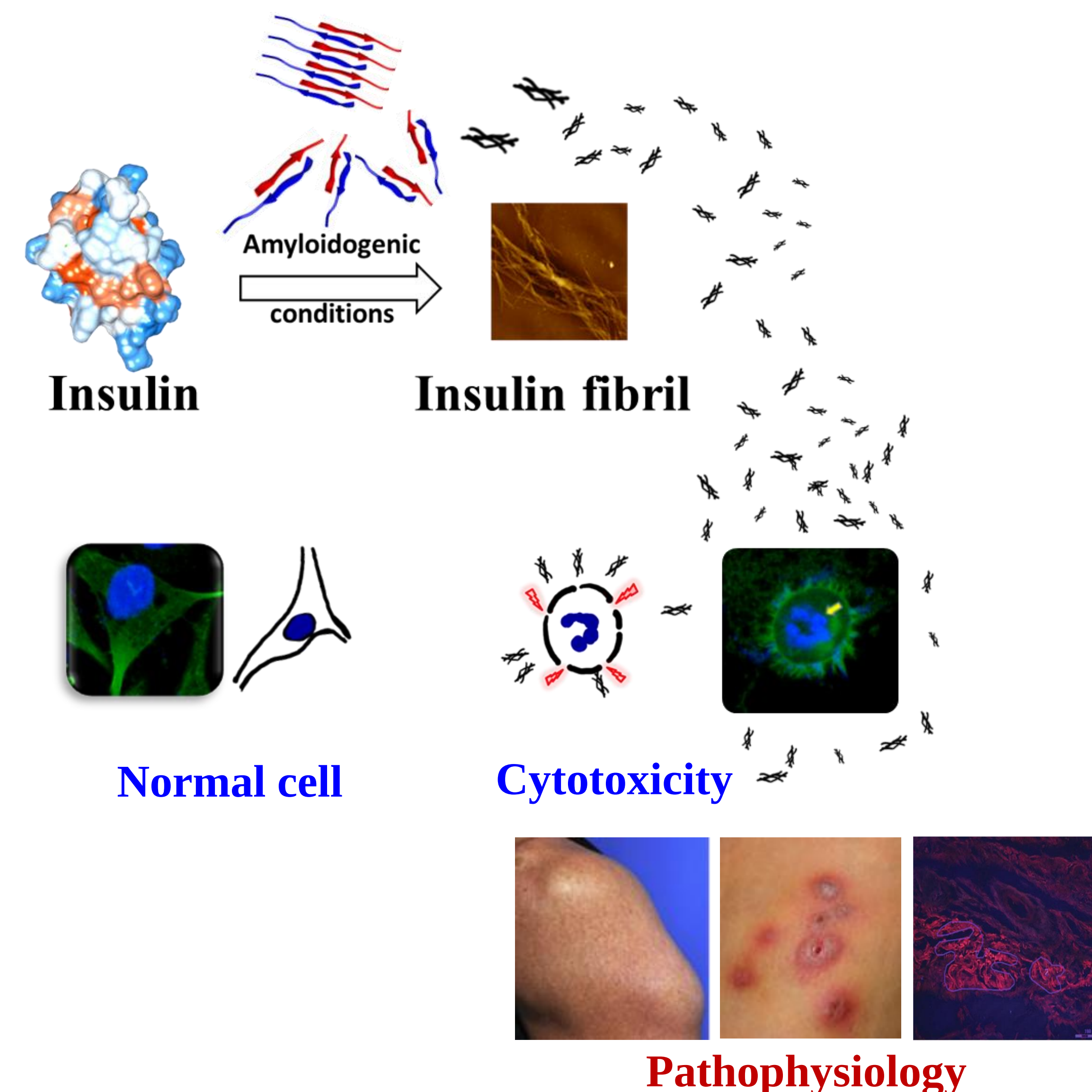
Insulin thermolability



Continuous cold chain dependance



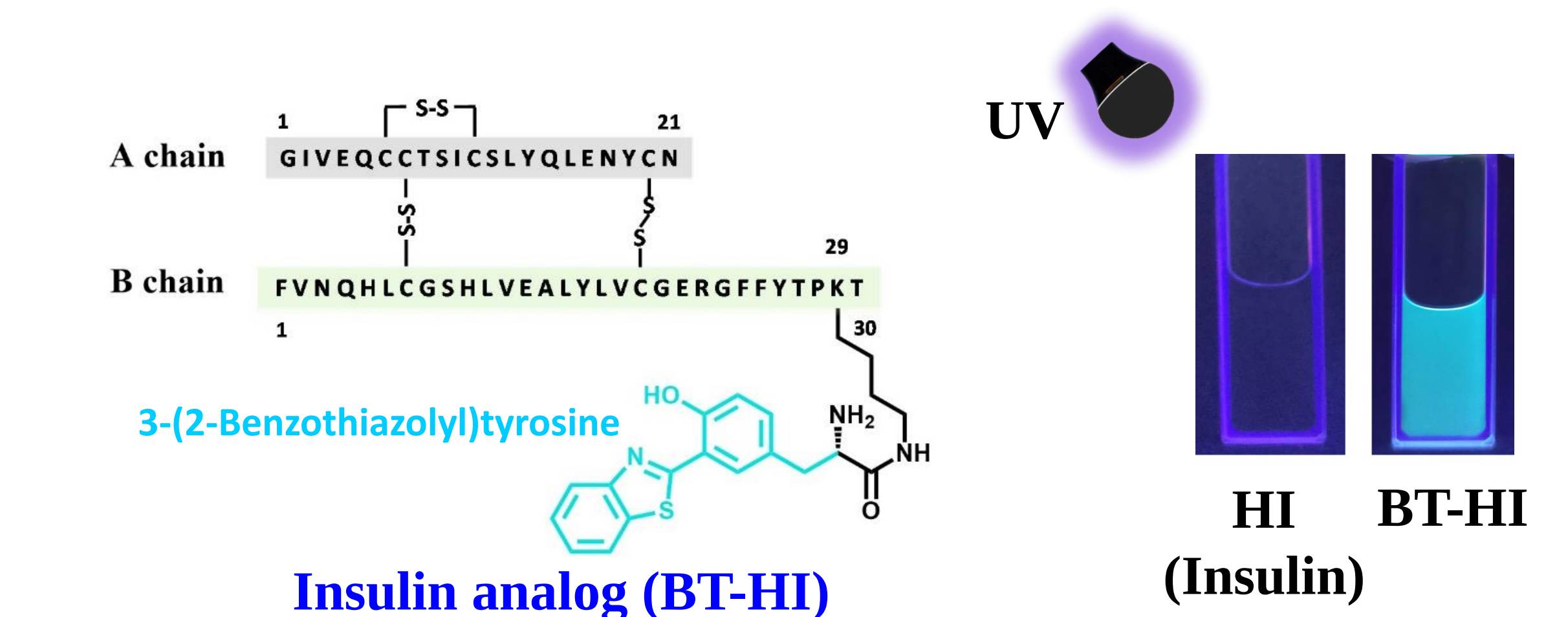
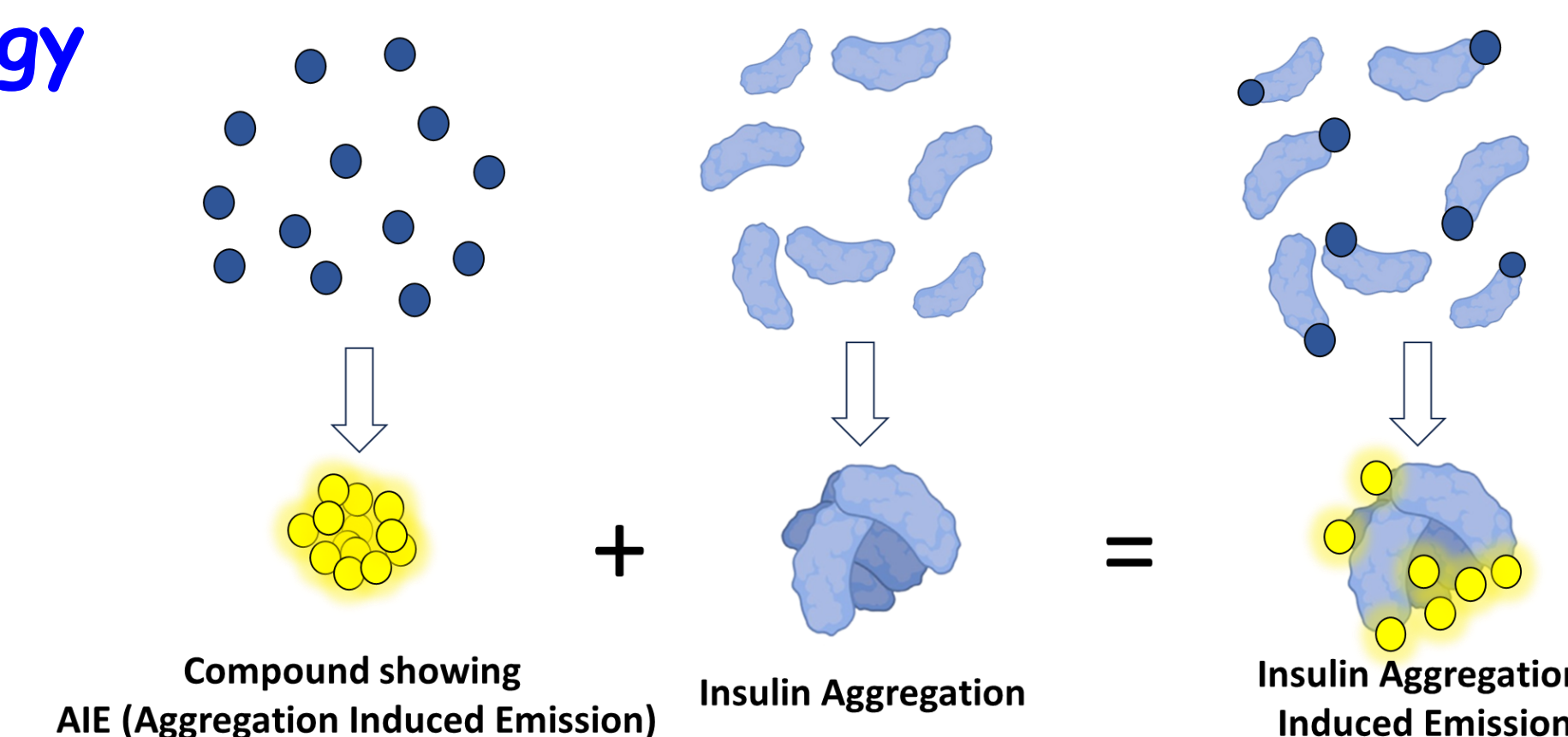
Insulin fibril: Cytotoxicity



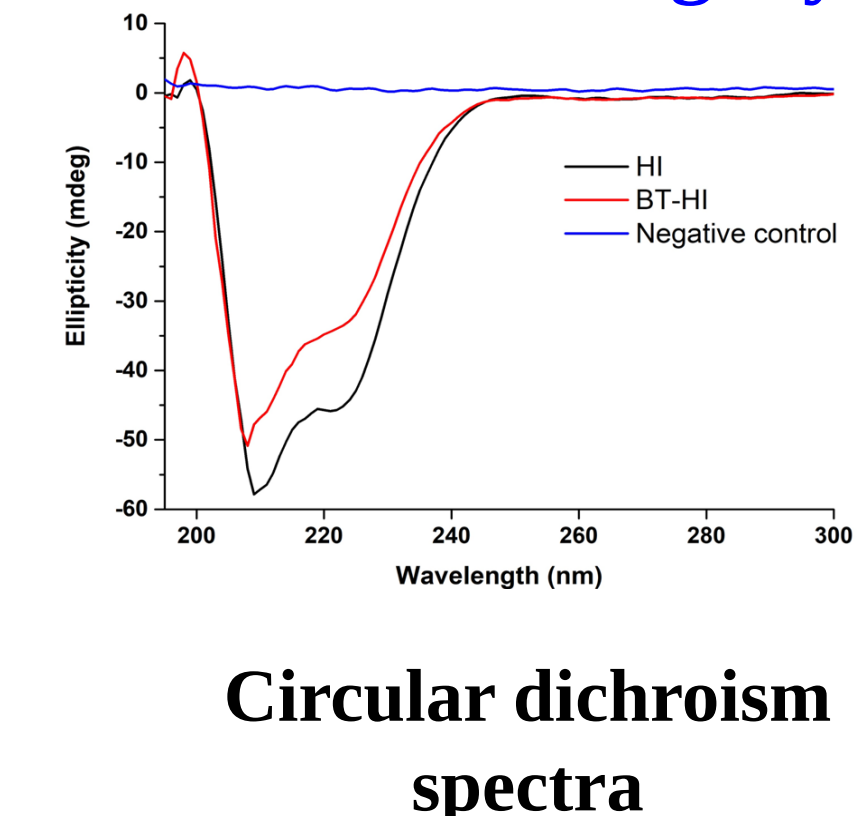
Insulin quality



Strategy

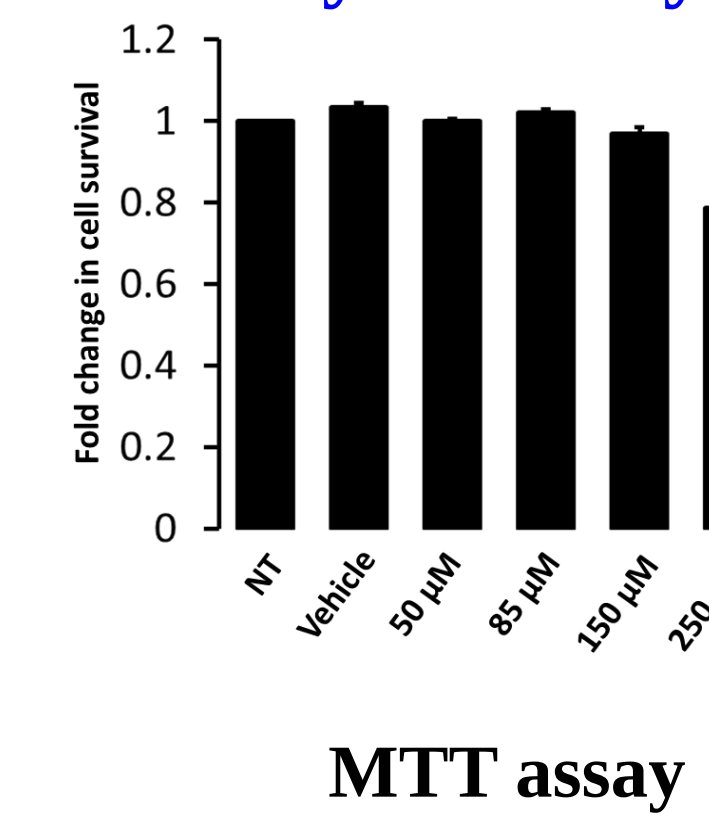


Structural integrity



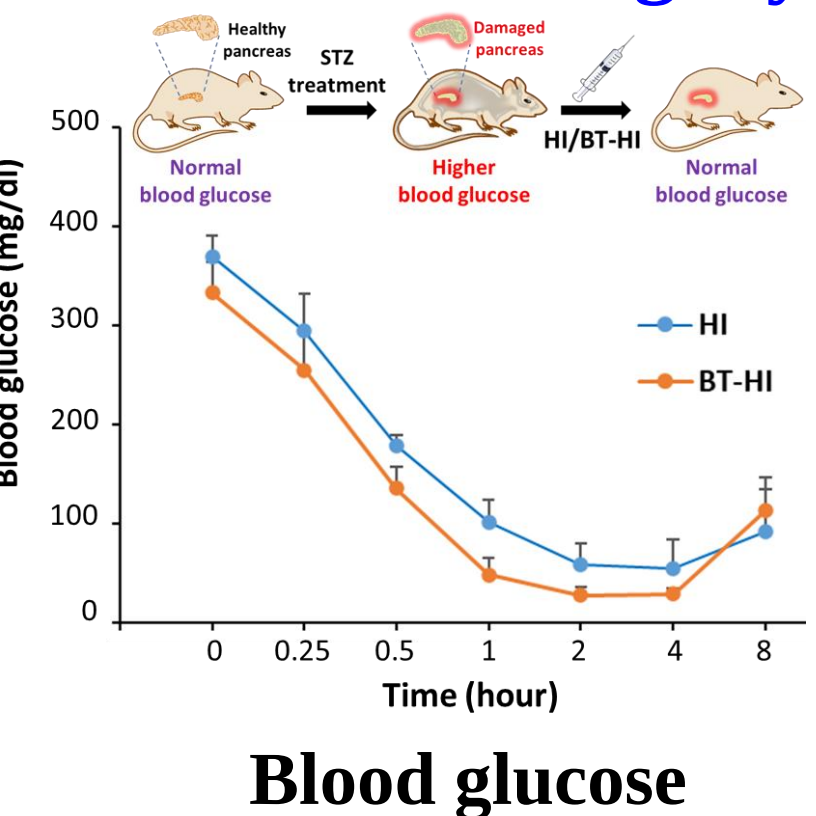
Circular dichroism spectra

Cytotoxicity



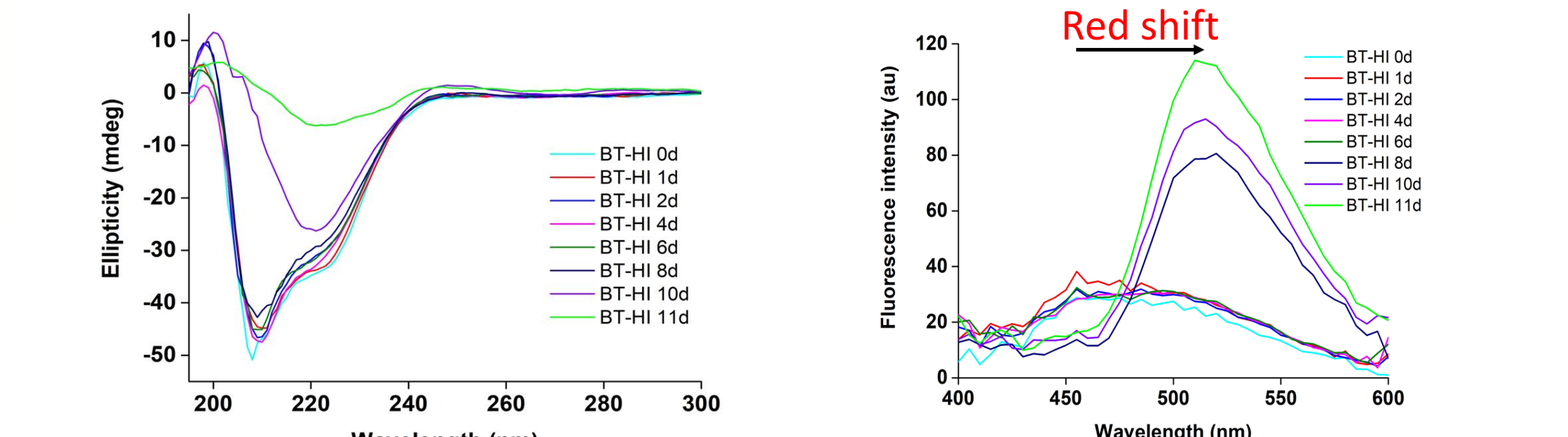
MTT assay

Functional integrity



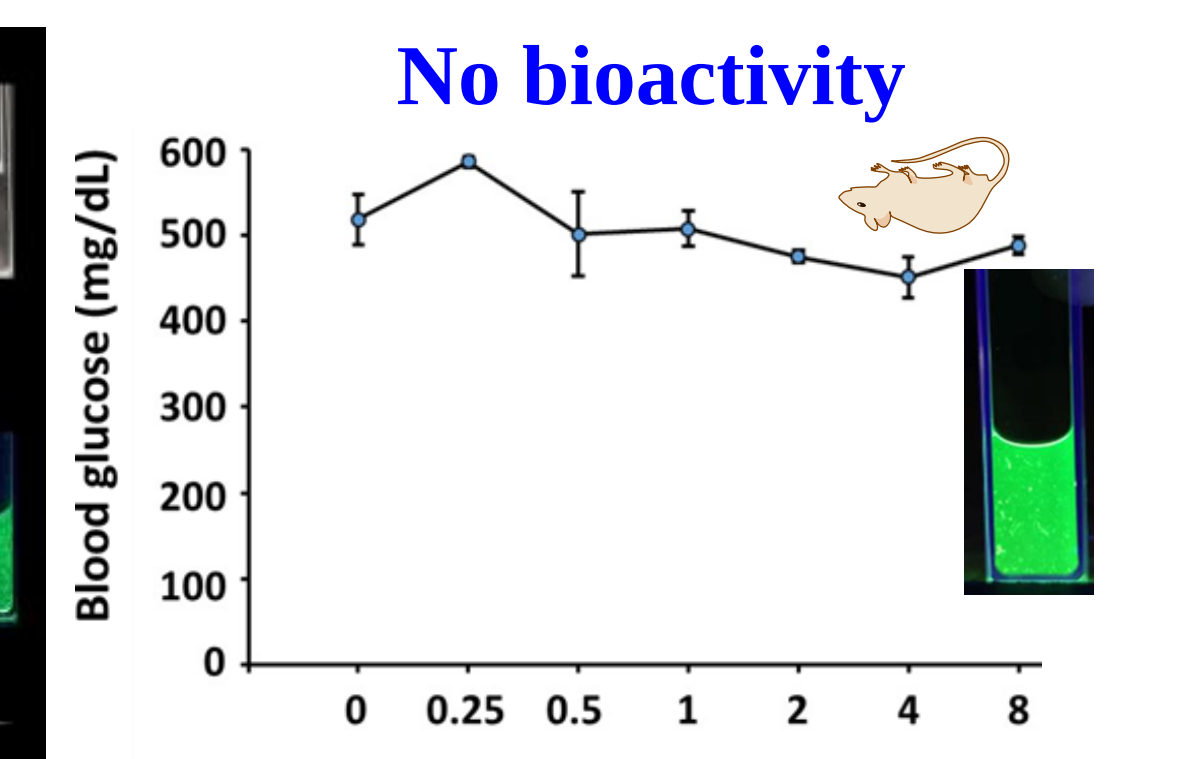
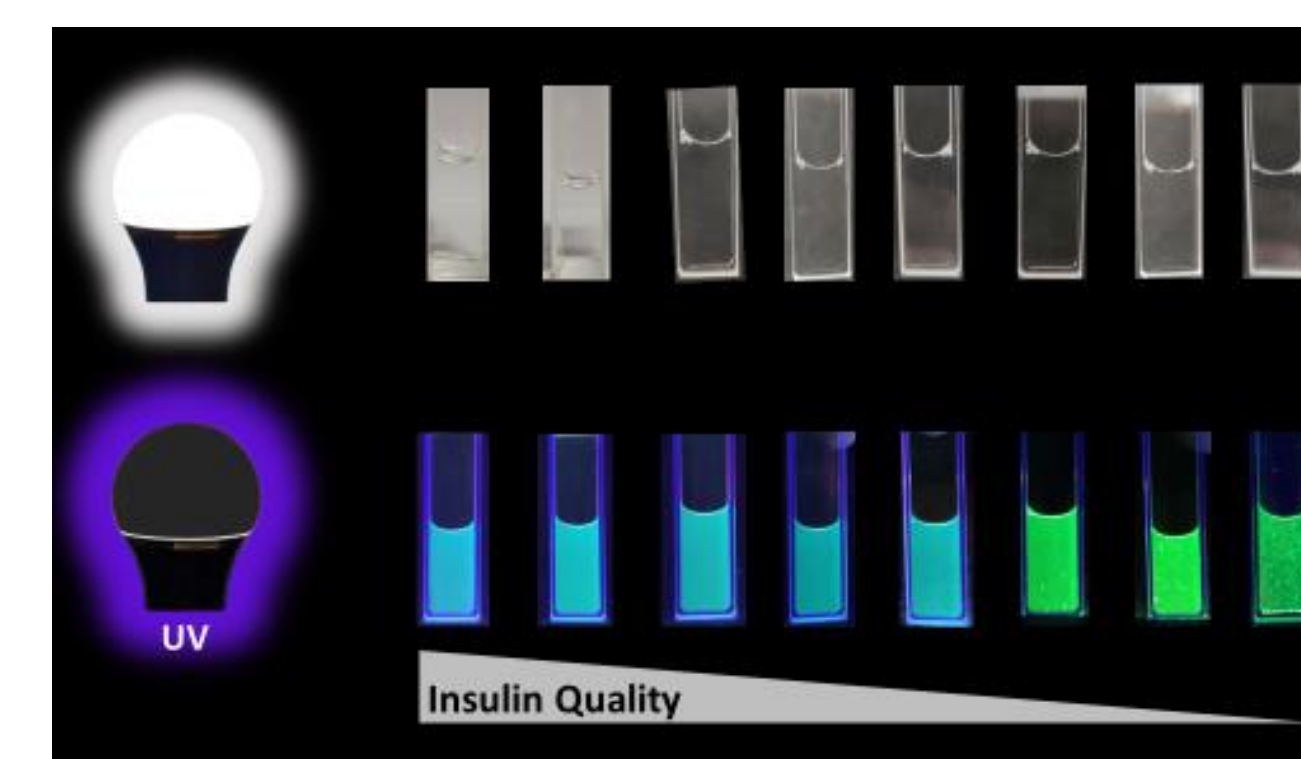
Blood glucose

Fibrillation vs Fluorescence



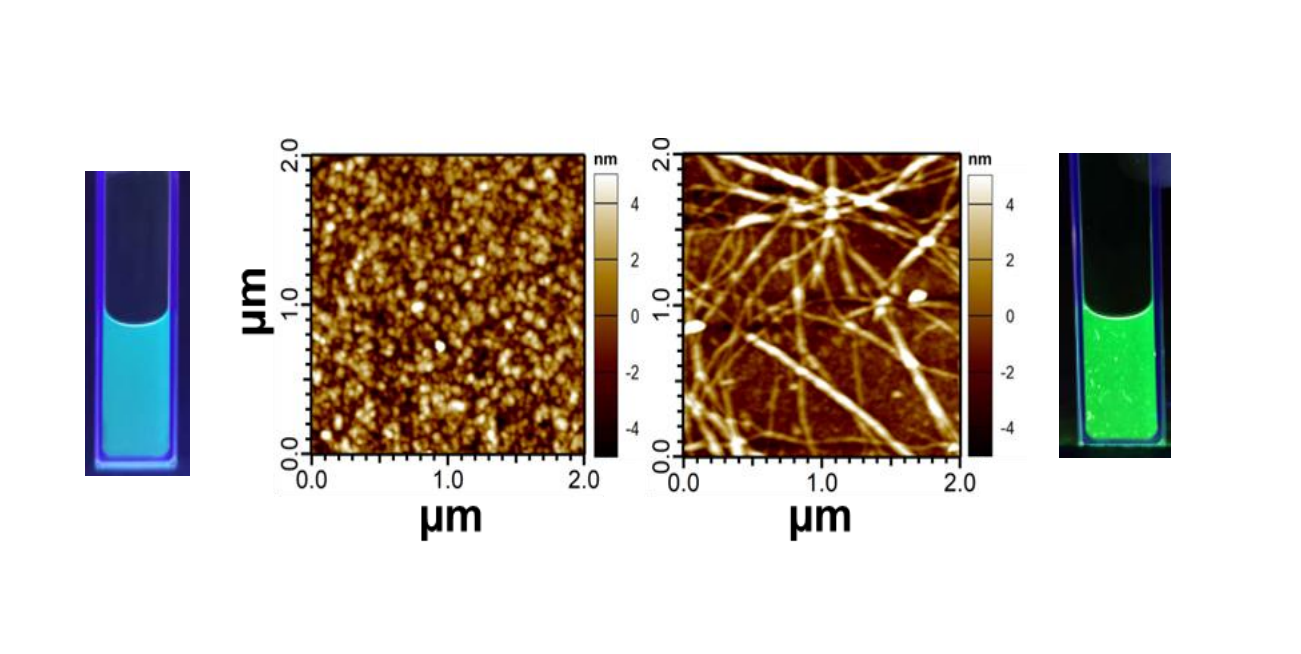
Time dependent Circular dichroism spectra

Fluorescence spectra (λ_{ex} = 254 nm)



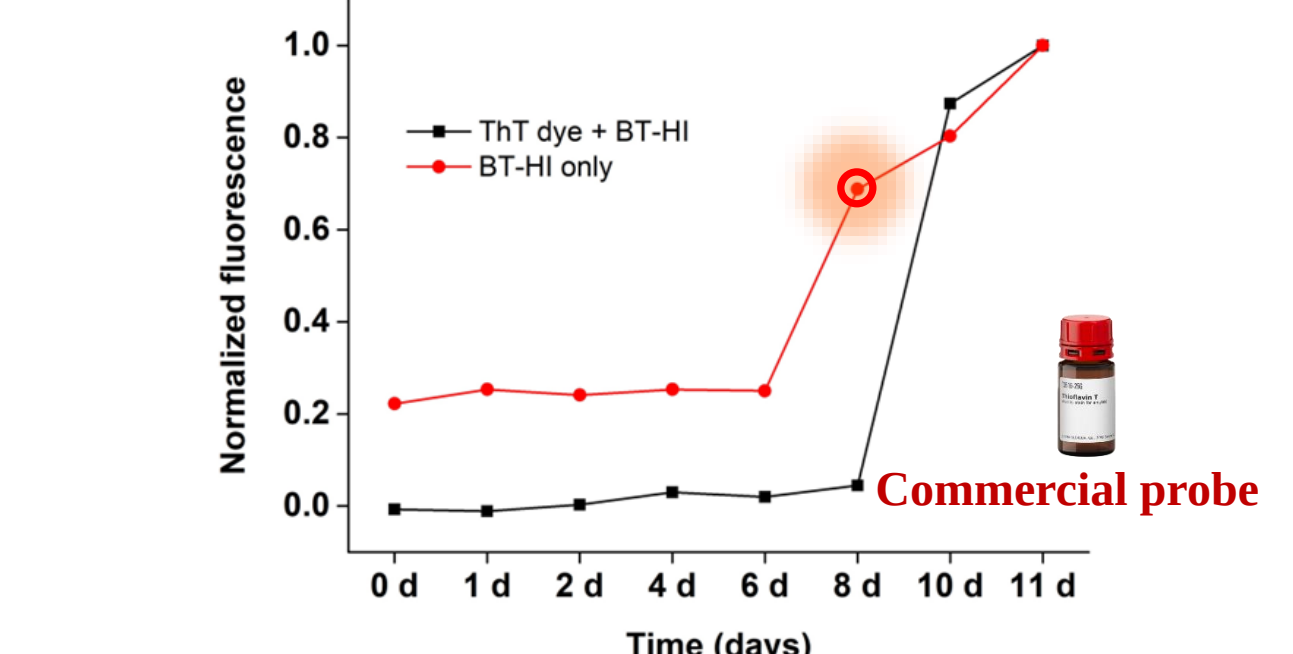
No bioactivity

Fibrillation status



Atomic Force Microscopy (AFM)

Early detection

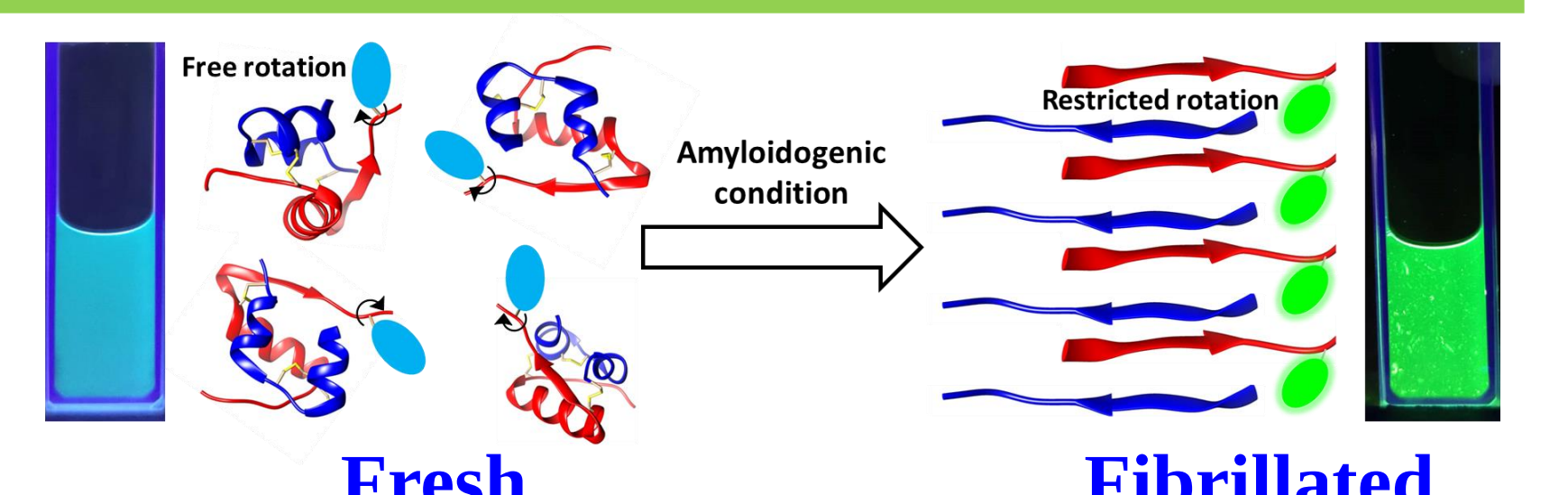


Commercial probe vs BT-HI Autofluorescence

- Conversion of helical content of insulin into β -sheet during aggregation.
- Change in **colour** from cyan to green under UV-irradiation.
- Higher sensitivity** of fibril detection as compared to existing gold-standard commercial probe (Thioflavin T dye).

Conclusion

We have developed an innovative approach which offers **visual self-monitoring** of insulin dosage quality right before usage



Reference

- Indian Patent Application No. 202311030590, 2023.
- Organic & Biomolecular Chemistry. 2023, doi.org/10.1039/D3OB01038D.