A team of international researchers led by Professor in Physics at Trinity, Martin Hegner, an Investigator in CRANN, has for the first time observed how proteins fold while being produced in real time.

The work has significant implications for understanding protein synthesis generally, and particularly in neurodegenerative diseases such as Alzheimer’s and Parkinson’s. The team’s findings have been published in the prestigious journal *Proceedings of the National Academy of Sciences*.

Professor Hegner’s work focuses on individual ribosomes, which are complex molecules that use genetic information to assemble proteins. There can be several million ribosomes in a typical human cell and they are about 20 nanometres in diameter. The assembly of proteins is crucial for a healthy functioning body as all the proteins in our bodies must fold into complex shapes to do their job.

While protein synthesis is of fundamental importance in cellular processes, how they are created is not fully understood. One of the events that occurs during protein synthesis is “folding”, where the chains of amino acids (polypeptides) fold into their final 3-dimensional structures.

Several neurodegenerative diseases (such as Alzheimer’s) and many allergies are believed to result from misfolded proteins. This research is thus important in developing further understanding of such conditions and in developing drugs that can target and prevent certain foldings. There has been interest expressed in Professor Hegner’s work by pharmaceutical companies.

Professor Hegner said: “The ribosome translation machinery is a highly complex system, involving many different factors such as energy input, messenger RNA decoding, amino acids, as well as their relative movements and interactions. Investigating this system at the single-molecule level required a highly ambitious and multi-faceted approach that pushes the boundaries of what is technically possible.

“We have identified key mechanisms within individual ribosomes using our unique optical tweezer instrumentation, of which there are only approximately five world-wide. Our expertise in the design of the device and the biological experiment, along with colleagues in Germany enabled us to “grab” the ribosome and the nascent protein chain and provided sufficient stability and sensitivity to observe the synthesis and folding of single polypeptides in real time at the nanometer scale. This was the first time this was observed world-wide and it is very significant to the research community and in developing more in-depth understandings of protein synthesis, – folding and certain diseases.”

Source: Trinity College Dublin
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