

Secrets of dark proteome

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Understanding the structure of the dark proteome will provide scientists with insights into the function of the protein sequence and reveal molecular processes of life that are currently unknown. Credit: CSIRO

Proteins are often referred to as the building blocks of life, and make up about 15 per cent of the mass of the average person, performing a wide variety of essential functions in the body.

Scientists have long speculated about the nature of the dark proteome, the area of proteins that are completely unknown, but a recent study by CSIRO has mapped the boundaries of these dark regions, bringing us one step closer to discovering the complete structure and function of all proteins.

The work, led by Dr Sean O'Donoghue, a data visualisation scientist with CSIRO and the Garvan Institute, has been published today in the prestigious *Proceedings of the National Academy of Sciences* journal.

As knowledge of three-dimensional protein structures continues to expand, we can identify regions within each protein that are different to any region where structure has been determined experimentally, coined the 'dark proteome'.

"These dark regions are unlike any known structure, so they cannot be predicted," Dr O'Donoghue said.

"Identifying these areas is very exciting as we now have a map to focus our research efforts."

"Our map defines the boundaries right at the edge of protein knowledge."

The research has yielded some surprising results, including that nearly half of the proteome in eukaryotes is dark and has unexpected features, including an association with secretory tissues, disulfide bonding, low evolutionary conservation, and very few known interactions with other proteins.

This work will help future research shed light on the remaining dark proteome, revealing molecular processes of life that are currently unknown.

It may also provide insight into [protein](#) based illnesses like cancer, type 2 diabetes, and many neurodegenerative diseases, such as Parkinson's disease and Alzheimer's.

Protein molecules compose many of the major elements of our body,

and dark proteins—those with completely unknown structure—are abundant in skin and hair, and glands that make saliva, semen, and milk.

"The dark proteome undoubtedly plays a key role in human health, as well as many other areas of life science," Dr O'Donoghue said.

"We believe that studying the dark proteome will clarify future research directions, as studies of dark matter have done in physics."

The discovery was made using Aquaria, CSIRO's free web based tool that uses data from the Protein Data Bank to create 3D structural models for 546,000 [protein sequences](#).

More information: N. Perdigao et al. Unexpected features of the dark proteome, *Proceedings of the National Academy of Sciences* (2015). [DOI: 10.1073/pnas.1508380112](https://doi.org/10.1073/pnas.1508380112)

Provided by CSIRO

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