What's the difference between a human and a fruit fly?

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Fruit flies are dramatically different from humans not in their number of genes, but in the number of protein interactions in their bodies, according to scientists who have developed a new way of estimating the total number of interactions between proteins in any organism.

The new research, published today in the *Proceedings of the National Academy of Sciences* journal, shows that humans have approximately 10 times more protein interactions than the simple fruit fly, and 20 times as many as simple, single-cell yeast organisms.

This contradicts comparisons between the numbers of genes in different organisms, which yield surprising results: humans have approximately 24,000 genes, but fruit flies are not far behind, with approximately 14,000 genes.

The interaction between different proteins is behind all physiological systems in the human body. When the body digests food, responds to a change in temperature, or fights off an infection, numerous combinations of protein interactions are involved. However, until now it has been impossible to calculate the numbers of interactions that take place within different organisms.

Professor Michael Stumpf from Imperial College London's Department of Life Sciences, one of the paper's authors, explains the significance of the new study, saying:

“Scientists have believed for some time that the complexity of an organism’s protein interactions determine its biological complexity, but until now it’s been impossible to put a number on the size of one organism’s interaction network compared to another, as relatively little work has been done to identify and map these interactions.”

Scientists refer to the total number of protein interactions in the body as the “human interactome”, likening it to the human genome, which is most commonly associated with giving us our human traits.

Professor Stumpf adds: “Understanding the human genome definitely does not go far enough to explain what makes us different from more simple creatures. Our study indicates that protein interactions could hold one of the keys to unraveling how one organism is differentiated from another.”

The researchers devised a mathematical tool which allows them to predict the total size of an organism’s protein interaction network based on currently available, incomplete data.

The researchers’ next steps will be to make much more detailed predictions based on careful comparisons between species. This will be crucial in order to understand, for example, why some fungal species, such as baker’s yeast are important in the production of bread and beer, while other closely related species cause fungal infections with high mortality rates.

Source: Imperial College London