From bacteria to lions – how tiny proteins which control our responses to both could be linked

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New research from the University of Birmingham and the University of Cambridge has uncovered a relationship between proteins that control immunity and proteins that control activity in the brain.

The research looks at the way in which selected members of the Toll receptor family of proteins acts in fruit flies – an animal which shares 75 per cent of disease causing genes with humans.

The Toll receptor proteins were first discovered in the fruit flies, called Drosophilia, and are vitally important in humans as they help to control innate immunity – preventing us from becoming ill every time we come into contact with bacteria.

The researchers discovered that two members of the Toll family in the fruit flies were not acting to fight bacteria, but were affecting formation of the central nervous system instead. In addition, they were interacting with fly neurotrophin proteins, and binding to them.

In humans, neurotrophins are proteins that help form the brain as we develop and grow, and control synaptic activity in the adult brain, and many psychiatric and neurodegenerative diseases are associated with neurotrophin problems.

If the same relationship between the Toll and neurotrophin protein families is observed in humans as in fruit flies, it could pave the way for new avenues of research looking at links between immunity and brain illnesses, like neurodegenerative and neuroinflammatory diseases.

The new relationship also suggests that the Toll and neurotrophin proteins, which have been found in organisms that share a common ancestor dating back 500million years, may form part of common ancient mechanism of formation of the nervous and immune systems.

Dr Alicia Hidalgo, from the School of Biosciences at the University of Birmingham, said.

“If both Tolls and neutrophins originated from the same genetic toolkit, it would not be surprising, as they are both about defining the self as different from other living things.

“The Tolls defend the body from the tiniest – bacteria – while the neutrophins control the brain and enable behaviour, such as ‘fight or flight’, defending the body from the biggest, like lions.”

These findings are important in understanding how the brain originated and how it evolved – such as to what extent the fly brain is similar or different from the human brain - how it is formed and how it works.

The findings also now pave the way for more research, to see if the same relationship between these protein families does exist in humans. This could have important implications for understanding brain function and brain disease.

Notes to editors

The paper Toll-6 and Toll-7 function as neurotrophin receptors in the Drosophila melanogaster CNS is published on Nature Neuroscience’s website today (28 July).

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For further information, contact **Kara Bradley (mailto:k.j.bradley@bham.ac.uk)**, University of Birmingham press office, +44(0)121 414 5134 or the out of hours press office on 07789 921165

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