Electron micrograph of a macrophage white blood cell engulfing a bead of latex: Does the human immune system really respond to all non-self objects or does it react to specific 'danger' signs?

Sensing Danger

Could immunology-inspired research protect your computer?

As adventurous research goes, taking a controversial idea from immunology and applying it to computing is setting your sights rather high. Yet it was exactly this streak of ambition that caused EPSRC to recently award funding to Dr Uwe Aickelin of the University of Nottingham under its 'adventure' call. Dr Aickelin's plan is to apply a concept from immunology, known as 'Danger Theory', to the problem of detecting people who might be tampering with your computer system.

Dr Aickelin first became interested in the idea for the project after his student, Steve Cayzer, investigated so-called 'Artificial Immune Systems' (AIS). Aickelin and Cayzer found that they could devise AIS algorithms that were useful for solving complex data mining problems. This led him to ask immunologist Julie McLeod what she and her colleagues thought of AIS: "It turned out that they had never heard of the area!" says Dr Aickelin, "after some interesting discussions I asked Julie what is currently hot in immunology and she gave me a paper entitled 'The Danger Theory.'" This controversial theory suggests that the traditional idea that the body differentiates between self and non-self is wrong and that instead the immune system identifies 'danger' and then responds to it. Dr Aickelin immediately saw the potential benefits of an Intruder Detection System (IDS) using Danger Theory-based AIS.

While current Artificial Immune Systems show great potential for tackling intruders they have been held back by the huge amount of processing involved in following traditional models of natural immune systems: "Consider using the classical paradigm to protect a computer network against non-self: It means mapping the rest of the world!" says Dr Aickelin. "This project will try and overcome this restriction by using ideas based on Danger Theory. This should allow the construction of effective artificial defence mechanisms in areas such as computer security, financial fraud detection, network fault management or intrusion detection." The project has attracted IDS experts from UCL, immunologists from Bristol, heuristic optimisation researchers from Nottingham and support from Hewlett Packard and ECSC, a leading computer security company. Dr Aickelin believes that despite the adventurous nature of the research it's bound to produce valuable results: "The immunological results will stand regardless of the IDS and also regardless of whether the Danger Theory itself is ultimately accepted by immunologists."

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