

ARC Vision Centre

MEDIA RELEASE

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## ANTS SEE THE WAY TO SAFER TRAFFIC

Ants may hold one of the secrets to reducing the devastating toll of death and injury on our roads as well as traffic bottlenecks.

The reason is that ants, with their simple but effective eyes and navigation systems, find their way to their destination and organise their traffic flows rather better than we humans – and can potentially teach us much, says Dr Ajay Narendra of The ARC Vision Centre and Australian National University

Ajay has dedicated the last decade to understanding how ants read their world so efficiently and accurately. Despite their small brains they manage to navigate from the nest to food sources and back countless times, using a sky compass, measuring distances and relying on familiar landmarks in their environment. Many ants also march along orderly trails using scent signals or tactile cues to maintain uninterrupted traffic flow.

His latest discoveries, in collaboration with national and international researchers, revolve around bull ants of the Australian Capital Territory. They have found how four ant species that nest at the same location divide up the day into shift work, allowing each of them a fair share of the available food. “Bull ants have massive jaws and a sting, so dividing up the day into shifts also avoids competition and potential conflict. It’s a very sensible arrangement,” he explains.

The four bull ant species vary in their activity times from active in daylight only, to part-twilight to predominantly nocturnal. To navigate through the complex Australian scrub, the ants rely chiefly on their eyes to recognise landmarks – trees and shrubs – which guide them to the food and back to the nest. This involves calculating the apparent change in the size of the landmark as they approach them.

“One remarkable adaptation we have found is that each ant species has adapted to its time niche by modifying its eye structure,” Ajay explains. “The nocturnal ants have evolved larger eye facets and rhabdoms (light gathering structures) nearly four times wider, resulting in a 27-fold difference in their optical sensitivity compared to their daylight counterparts. This

adaptation enables the nocturnal ants to capture more photons during their working times. These ants probably use the patterns of trees and vegetation against the brighter sky to find their way.”

“All these ants are extremely well-directed when leaving the nest. They head straight for the tree that produces the sap they use as food, even if it is 25 metres away, and then return home at the appropriate hour.”

Bull ants are primitive ants that have retained the features of large eyes and a potent sting from their ancestors, the wasps. These ants rely primarily on vision for navigating in their complex environment - but perhaps use methods such as step-counting to measure distances, as well as steering by the position of the sun and the pattern of polarised light in the sky, he says. Combining these methods is known as path integration – a remarkable sensing and computing feat for such a tiny creature, a main strategy used by ants living in featureless landscapes.

“Insects are already providing us with reliable systems for use in robot vision, surveillance systems and unmanned aircraft, but I believe they have potential to teach us much more,” Ajay says.

“Ants are social animals, and communicate effectively with each other. This cooperation enables them to organise exploration, foraging and to manage forager lane traffic efficiently. If we can understand how they do this, we can probably apply the same principles to motor vehicles.”

Thanks to GPS, cars already ‘know’ where they are in real time and can find their way to their destinations, but this needs to be combined with sensing to avoid collisions and other forms of intelligence to improve traffic flow.

“Army ants forage in four or five columns in a perfectly synchronised flow, without disrupting their lanes. We can use the principles underlying these behaviours for better traffic management and make our roads safer and commuting more efficient,” Ajay says.

Ajay’s enthusiasm for ants and their remarkable abilities have led to his organising ‘guided tours’ in the Australian national capital, where he escorts fascinated members of the public to see how the local ants carry out their complex tasks of navigation and social organisation.

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More information:

Dr Ajay Narendra, ARC Vision Centre and ANU, +61 (0)2 6125 4799 or  
[ajay.narendra@anu.edu.au](mailto:ajay.narendra@anu.edu.au)

Professor Trevor Lamb, ARC Vision Centre, ph +61 (0)2 61258929 or 0434022375

Professor Julian Cribb, ARC Vision Centre media contact, 0418 639 245

Martyn Pearce, ANU media , ph +61 (0)2 6125 5575 or 0416 249 245