

in many leukocyte interactions but also in the recognition of pathogens and tumor cells [19], both Mincle and CLEC9A might also recognize other self or non-self ligands.

At the interface of innate and adaptive immunity, dendritic cells are the essential effectors that can decode the immunogenicity level of cell death. Although the quest for dendritic cell maturation and activation signals deriving from dying cells is still in its infancy, Mincle and CLEC9A provide us with a first glimpse. A better understanding of the cellular processes and the molecular players involved in the immune response triggered by immunogenic cell death could pave the way for more effective immunotherapy against cancer. In fact, although in solid tumors cell death regularly takes place with concomitant infiltration of inflammatory cells, the overall capacity of the immune system to exploit immunogenic tumor cell death and eradicate malignant cells remains ineffective. Recent observations indicate that the tumor microenvironment does not favor the dendritic cell activation needed for proper effector T-cell stimulation. In particular, the presence of specialized myeloid-derived suppressor cells within the tumor microenvironment favors tolerance [20]. These suppressor cells represent a heterogeneous population of bone-marrow-derived myeloid cells comprising macrophages, granulocytes and dendritic cells at early stages of differentiation that is effectively recruited towards tumor sites [20]. The C-type lectin repertoire expressed by these cells is unknown and the involvement of C-type lectins associated with these cells in the sensing of necrotic tumor cells remains to be established.

There are many unresolved issues in understanding dendritic-cell-derived responses to immunogenic cell death that include the number of different danger signals, their specific molecular signature and their exact spatio-temporal sequence. Also, the receptors and signaling pathways that sense these danger signals await further elucidation. Ultimately, it may be possible to exploit these signals and their sensing receptors to manipulate immune responses, for example, as adjuvants in dendritic-cell-based anti-tumor vaccines, or to inhibit them to treat autoimmunity or (chronic) inflammation.

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Nijmegen Centre for Molecular Life Sciences (NCMLS), Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands.
*E-mail: c.figdor@ncmls.ru.nl

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Social Learning: What Do *Drosophila* Have to Offer?

The recent finding that female *Drosophila* copy the mate-choice criteria of other females introduces a mainstream model species to the study of how animals use social information.

Ellouise Leadbeater

In humans, success with the opposite sex renders individuals more desirable, and cruelly enough, failure begets more failure [1]. Non-human animals are apparently also vulnerable to the beguiling influence of popularity, as female fish, birds, and mammals have also been shown to ‘follow the herd’ when making the all-important decision

of who to mate with [2,3]. In this issue of *Current Biology*, Mery et al. [4] report on a surprising addition to the list: their discovery that female fruit flies of the genus *Drosophila* learn about what to consider attractive from their conspecifics provides a rare opportunity for this field to exploit the wealth of resources that a mainstream model species has to offer.

Mate-choice copying is interesting because, in theory, it provides fertile ground for sexual selection. If attracting mates is self-perpetuating, the fitness gap between good-looking males and their less fortunate counterparts grows, magnifying the advantages of being attractive [5]. Furthermore, if preferences can be copied across generations, then they could be 'inherited' culturally, with no genetic basis [6], setting the stage for speciation. One might at first imagine, however, that the complexity of this behaviour would present a stumbling block for the small-brained *Drosophila*. Cultural transmission of mating preferences would require that females copy not only the outcome of others' decisions — a preference for a certain individual — but also the criteria on which they are based [6,7]. In other words, females must generalize their socially-acquired preferences to other, similar males — an ability that has been demonstrated only rarely, in birds [8] and fish [9]. Do the cognitive capacities of a fruit fly stretch to social learning about what features to look for in a male?

In their first experiment, Mery *et al.* [4] focused on the question of whether popularity renders individual males attractive. They let female fruit flies each make an initial choice between a high-condition and a low-condition male, gauging each subject's preference by the relative time that she spent in each male's vicinity. Not surprisingly, the females preferred the high-condition males. But the authors then carried out the same test after allowing the observer female to watch only one of the two potential suitors enclosed with another female, to create the impression that he had successfully attracted a mate. Subjects that saw the other female with the high-condition male clung to their original preference, but those that saw her seem to choose the poor-condition alternative male spent more time with him when allowed to rethink their initial choices. Two control groups showed that this effect could not be explained by differences in male behaviour after recent female company, or by an attraction to larger groups. Thus, the sight of an 'ugly' male interacting with a perfectly normal female had clearly boosted his credentials.

Thus far, the authors had shown that females copy preferences for individuals, but not necessarily that the

criteria on which to judge unfamiliar males can be acquired socially. To this end, they went on to create distinctive male phenotypes by dusting male flies with green or pink powder. A new set of females were then each allowed to view a male of one colour successfully copulating, and a male of the other colour failing to convince a different female to mate with him. After several repetitions of this voyeuristic experience, the observer female was then offered the choice between an entirely unfamiliar, but also colour-dusted, pair of green and pink males. Females showed a strong preference for the colour type that their conspecifics had appeared to accept, even though they had never witnessed previous interactions between those particular males and any female.

Mate choice copying is hard to explain in terms of simple associative learning, because choosing an appropriate mate does not offer immediately perceivable rewards on a proximate level. Thus, the experiments of Mery *et al.* [4] elegantly illustrate a cognitively interesting process in an invertebrate, reinforcing that the taxonomic distribution of social learning is more likely to reflect ecology and social dynamics than cognitive abilities [10,11]. Demonstrating that insects are capable of more than simple associative learning is interesting, but will not come as a surprise to those who have repeatedly demonstrated the impressive capabilities of small brains in recent years [12,13]. Instead, the most welcome and valuable aspect of this development is the long-overdue use of a highly familiar model species, offering a wealth of genomic resources and experimental opportunities.

The model species of mainstream biology remain an underutilized resource for behavioural ecologists [14]. Perhaps this reflects the poor availability of information on the behaviour of *Drosophila*, the zebrafish *Danio rerio*, the mouse *Mus musculus* and other models in the wild. Or maybe the mechanistic focus typically associated with such species seems to contrast with the tradition of the phenotypic gambit [15], which assumes that given sufficient time, evolution will lead to behavioural adaptation through whatever means possible. But tracing the physiological, and ultimately genetic, basis of behaviour is often necessary to

understand why evolution has taken a particular course [14,16,17]. The abundance of genomic information available for *Drosophila*, the scope for linking genetics to physiology and behaviour in this genus, and the ease of obtaining speedily replicable results under controlled conditions have much to offer behavioural ecology [18,19].

By demonstrating that the *Drosophila* behavioural repertoire includes social information use, Mery *et al.* [4] open the door to a more practical exploration of the mechanistic basis of such behaviour than has previously been possible. In terms of mate-choice copying, many open questions remain, not the least of which is a lack of empirical evidence for a clear fitness advantage to copying other females' preferences [20]. A focus on new, less traditional study species paves the way for new exploration of both how and why animal social information use evolves.

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Department of Biology and Environmental
Science, University of Sussex, Brighton BN1
9QG, UK.
E-mail: e.leadbeater@sussex.ac.uk

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