melanophores and nuclear targeting of adenovirus particles, respectively [15,16].

Particularly relevant is a recent report from the Jansen lab studying ciliary transport in *C. elegans* [17]. Ciliary biogenesis and maintenance depend on a highly conserved transport process, intraflagellar transport (IFT), in which ciliary structural components and signaling molecules are delivered by two IFT motors of the kinesin-2 family, heterotrimeric kinesin-II and homodimeric OSM-3 [18]. In *C. elegans*, genetic screens have identified a wide variety of IFT components — for example, dye-filling (*dyf*) mutants often have defective cilia in the exposed sensory neurons that can take up fluorescent dyes. Previous work has shown that *dyf-5* encodes a predicted serine/threonine kinase homologous to MAK kinases, a subfamily of MAPKs with unknown function [19]. The recent work of Jansen and colleagues [17] showed that mutations in *dyf-5* affect cilia length and morphology as well as the coordinated transport of IFT particles by the kinesin-II and OSM-3 motors (Figure 2B).

So trafficking and signaling pathways collide. Signaling complexes transported by microtubule-based motors are not just passive passengers. Rather, the recent work of Horiuchi *et al.* [2] and Burghoorn *et al.* [17] suggests ways that signaling pathways can regulate their own, and possibly other, transport events.

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DOI: 10.1016/j.cub.2007.07.005

Animal Communication: Reading Lizards' Body Language in Context

A recent study has shown that Jacky lizards adjust their movement-based visual signaling in response to the varying environmental conditions; the results indicate that this species has highly sophisticated communication and sensory processing strategies.

Johannes M. Zanker

Communication usually involves the targeted exchange of information between a sender and a receiver, using a mutually agreed code. Evolution has shaped a rich spectrum of communication systems amongst animals, exploiting a striking range of channels for transmitting information [1]. We find cases of third parties tuning into signal exchanges to eavesdrop, as well as cases in which misleading signals are sent to unsuspecting receivers — camouflage, encryption and code-breaking are some of the more thrilling 'information management' strategies that are used not just by humans. Communication across species boundaries, however, is comparatively rare and rather limited in scope, usually characterised by one-directional information flow, as in Batesian mimicry [2], and often reflecting antagonistic relationships such as predation.

So what do animals tell us? The legend of Saint Francis of Assisi, who preached successfully to birds and wolves, and the children's book character of Dr Doolittle, remind us of the human quest to communicate across species boundaries and 'understand' animals *sensu stricto*. Ethologists in the 19th and 20th centuries made much progress listening carefully to a range of animals, often carrying sophisticated recording gear into their gardens and forests, deep into the jungle, and into the depth of oceans — so we have some idea, and in some cases a good idea, how birds talk to each other, and what about, what kind of messages monkeys exchange with their alarm calls, and why whales produce, to us at least, beautifully relaxing songs [3–5]. Much of this sophisticated spy-work was driven by the assumption so intuitive to the human mind that language is transmitted most effectively, most naturally and most easily through the acoustic channel. But there are other channels that enable rather different communication strategies. For instance, the private chemical (pheromone) channel that moths use to attract the opposite sex for mating [6] requires very specific sensory filters on the part of the receiver. Visual signals usually do not rely on specific adaptations of the receiver's visual system, so this channel lends itself to some rather public statements to a wide audience — if such communication is to retain any secrets, an animal has to develop a specific signal lexicon that is highly visible, but cannot be decoded without prior knowledge.

Which brings the ethologists back into the field, with their recording equipment and patient observation skills! Decoding the language of the honeybee, the waggle dance used to indicate the location of food sources to their sisters (a visuo-tactile communication strategy), is one of the flagship achievements of classical ethology [7]. Less well known, but equally spectacular, is the fancy foot-work of fiddler crabs which signal, by waving their impressive claws (Figure 1A), their species identity, their strength, their size and other useful facts of self-esteem [8]. It may be tempting to associate such behaviour with certain aspects of human body language (Figure 1B), such as various forms of hand-waving in the context of greeting, dancing or threatening; at least in a fixed cultural context, it is easy to decode such signals without any particular training. But decoding other information requires specific skills and experience: appreciating the intricacies of general body language may benefit from the special training of a psychologist; reading lips or sign language requires a decent amount of exposure to this language; and most of us would probably be hopelessly lost at sea when trying to produce or read a semaphore distress call conveyed by colourful flag-waving.

Figure 1. Body language is used across the animal kingdom for social communication.
(A) A fiddler crab (*Uca vomeris*) in territorial display. (Photo courtesy of Martin How.) (B) H.-G.-E. Degas "Two Dancers Entering the Stage" c.1877–78, Fogg Art Museum; Photo: Harvard K. Kallsen © President and Fellows of Harvard College.

Whereas studies of visual communication strategies have often been confined to the standard sender–receiver model, the last few decades have seen a growing interest in the environmental factors that constrain signal detection [9,10]. Despite a general recognition that sensory processing — which defines the bottleneck of information transfer for the receiver — is critically linked to its ecological context, transmission channel properties are still little understood. A paper published recently in *Current Biology* [11] thus makes a notable contribution, focusing as it does on the relationship between motion vision and movement-based signaling. Peters *et al.* [11] studied the signal content of the visual communication gestures of lizards in their natural habitat. The tail-flicking displays of Jacky lizards in territorial disputes were recorded in their natural habitat, the Australian bush. The movement signal arising from the tail flick needs to be picked up by the motion processing system of the observer, and to be separated from motion signals generated by wind-blown vegetation behind the displaying animal. Earlier studies [12,13] investigated the spatial and temporal structure of movement-based communication signals as seen against background motion noise with the aid of computational models of motion processing. Peters *et al.* [11] have made a big leap by experimentally manipulating wind speed, and consequently the background noise level that constrains the detection of the lizard tail-flick by a conspecific observer. Their surprising finding is that this particular lizard does not increase the speed of the flick in the presence of wind, as other lizards do [10], but rather it changes the temporal structure and the duration of the display.

A number of exciting research questions arise from these observations: which aspects of environmental motion make the lizards adjust their choreography? What is the specific relationship between tail-flick dynamics and noise-signal distribution that leads to this particular signalling strategy? Which properties of low-level motion detectors and higher level motion integration mechanisms are required to optimise such signal detection in the presence of noise? Whatever the details that future work will uncover, the current paper demonstrates for the first time how a visual communication system is smartly adjusted to specific dynamic environmental conditions.

The study of animal communication, which bewilders the scientist with its variety and complexity, has the opportunity to achieve a new level of understanding by considering the communication signal content in the context of the neural processing necessary to enable 'secure' communication in real life, which is dynamic, noisy and short. This task requires the classically trained ethologist to communicate and collaborate with researchers in diverse other fields, such as ecologists, physicists, sensory physiologists and computational modelers. So what has this genuinely cross-disciplinary approach in stall for us as scientific community, for our sponsors, for our society? Studying motion processing mechanisms under natural operating conditions can provide essential clues to understanding how complex distributions of local motion signals can be segmented into meaningful patterns [14]. A deeper understanding of communication processes in other species will also provide new insights into the nature of human communication, its opportunities and limitations, and perhaps will even generate ideas for repairing or augmenting damaged or insufficient communication mechanisms. Comparative studies may be particularly helpful for analyzing body language in humans, a topic which has only recently seen the introduction of more rigorous quantitative methods, for instance, to investigate dynamic face perception [15]. Understanding how particular communication channels are optimized, how signal processing and signal production are shaped by external constraints, can further help to design sophisticated methods of signal extraction in a wide range of technical applications. And perhaps — blending the legend of Saint Francis, the fiction of Doolittle, and the passion of pet lovers into reality — we might eventually even be able to tap into animal communication channels and speak to the birds and the wolves.

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DOI: 10.1016/j.cub.2007.07.006

Circadian Rhythms: Rho-Related Signals in Time-Specific Light Perception

A recent study shows that a small GTPase, LIF1, helps to coordinate the plant circadian clock with the daily light–dark cycle.

E. Kolmos and S.J. Davis

Virtually all life on Earth is exposed to rhythmic environments. On a daily scale, and at most latitudes, our planet's rotation results in a diurnal light–dark cycle involving significant changes in light quality and quantity, as well as duration. Many species have been shown to have an endogenous 'metronome' which anticipates these predictable changes. This timing device is a biological clock that controls rhythmic processes in the organism, and has a period length of about 24 hours; it has thus been termed the *circadian* clock. Importantly, circadian clocks are autonomous and enable sustained rhythmicity in the absence of environmental cues. And equally as