

**OR055***Formation of efficient transportation networks in the Argentine ant***Simon Garnier**, David Neiman, Subashkusum Ray, Andrea Perna, Guy Theraulaz, Iain Couzin

Transportation networks play a crucial role in the success of human societies and ant colonies. Their topology and morphology can dramatically affect the distribution of individuals, materials and information, and the overall productivity of a population. In a recent study, we discovered that the asymmetrical organization of bifurcations in ant pheromone trail networks was responsible for a 3-fold increase in the amount of food transported to the nest compared to a symmetrically organized network. Such asymmetrically organized networks have been found in several ant species but the mechanisms responsible for their formation remain unknown. Here we present for the first time experimental and theoretical evidence that the formation of asymmetrical bifurcations in ant trail networks is caused by a simple interaction between the trail-following behavior of ants and properties of their walking behavior. We measured the trajectories of ants following a pheromone trail that bifurcated with different angles into two trails. For narrow angles, ants tended to alter their course after crossing the point at which the trail bifurcated. For wide angles, they tended to alter their course before the bifurcation point. For intermediate angles similar to the angles found in natural networks, ants altered their course around the trail bifurcation point. We used computer simulations to show that the repetition of this behavior at a bifurcation point leads to a stable, asymmetrical organization of the bifurcation and we explored the impact of the linear and angular speeds of ants on the final shape of the bifurcations. Our results demonstrate that efficient transportation networks can emerge solely from the activity of network users, without prior planning. Uncovering simple mechanisms that lead to the formation of robust and efficient transportation networks is critical to understanding the ecological success of ants and to proposing new solutions for man-made systems.