Two frequently used models of morphogenesis are reaction-diffusion, introduced by Turing (1952), and positional information, proposed by Wolpert (1969). Both models postulate passive propagation of form-inducing factors (morphogens) through a diffusive mechanism. However, the phytohormone auxin, which plays a paramount role in plant morphogenesis, is actively transported; furthermore, transport parameters can apparently be controlled by auxin itself. The feedback between auxin concentration, flux, and active transport results in a distinct class of transport-driven models of morphogenesis. The presentation will review developmental processes in the transport-driven class, and focus on two related examples: initiation of organ primordia on the supporting stems (phyllotaxis) and development of leaves. Models of these processes are united by a postulated feedback between growth and the dynamic emergence of auxin convergence points that locally regulate growth parameters. The models have been tested and validated by comparing simulation results with experimental data for Arabidopsis thaliana and its mutants and transgenic variants.