

## Connections Control without hierarchy

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### Abstract

Understanding how particular natural systems operate without central control will reveal whether such systems share general properties.

Because most of the dynamic systems that we design, from machines to governments, are based on hierarchical control, it is difficult to imagine a system in which the parts use only local information and the whole thing directs itself. To explain how biological systems operate without central control — embryos, brains and social-insect colonies are familiar examples — we often fall back on metaphors from our own products, such as blueprints and programmes. But these metaphors don't correspond to the way a living system works, with parts linked in regulatory networks that respond to environment and context.

<http://www.nature.com/nature/journal/v446/n7132/full/446143a.html>