Research area: *Non-derivative methods* for unconstrained optimization: minimize $\min_{x \in \mathbb{R}^n} f(x)$

The niche:

- $f$ is very expensive to calculate
- $f$ is unpredictably nonsmooth, undefined, discontinuous, or noisy
Practitioners have loved these methods for more than 50 years, but there were very few theoretical results until the 1990s.

Many open questions remain, including:

1. “Realistic” convergence proofs. (One person’s reality is another person’s fantasy...)  
   • • • “Convergence of the restricted Nelder-Mead algorithm in two dimensions”, J. Lagarias (Michigan), B. Poonen (Berkeley), and MHW (2008) • • •

2. Analysis of behavior patterns in practice.

3. Reliable computational tests to distinguish good behavior from bad.