Genetic algorithms (GAs)—search procedures inspired by the mechanics of natural selection and genetics—have been increasingly applied across the spectrum of human endeavor, but some researchers mistakenly think of them as slow, unreliable, and without much theoretical support.

This talk briefly introduces GAs, but quickly shifts to a line of work that has succeeded in supporting GA mechanics with bounding design theory that has been used to demonstrate GA scalability, speed, and range of reliable applicability. Key elements of this theory are discussed to give insight into this accomplishment and to make the point that fast, scalable GAs may also be viewed as first-order models of human innovative or inventive processes. The talk highlights recent results in breaking the billion-variable optimization barrier for the first time, and points to a variety of opportunities for efficiency enhancement that should be useful in the application of genetic algorithms to a variety of software engineering problems.