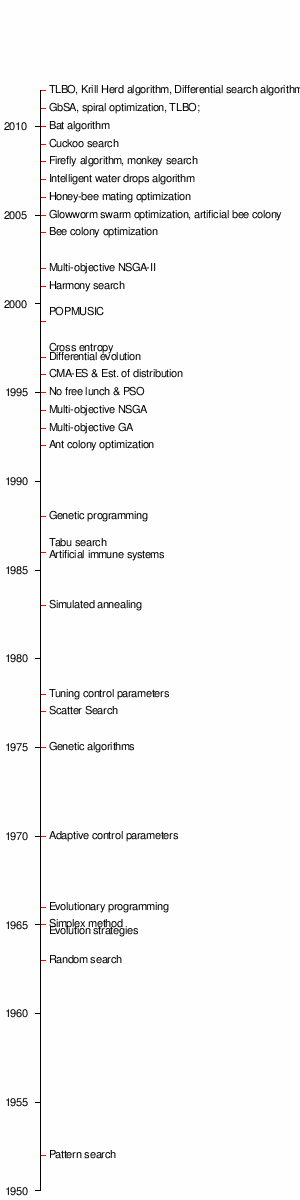
**Main contr****ibutions**

Timeline of main contributions.

Many different metaheuristics are in existence and new variants are continually being proposed. Some of the most significant contributions to the field are:

* 1952: Robbins and Monro work on stochastic optimization methods.[[18]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-robbins52stochastic-17)
* 1952: [Fermi](http://en.wikipedia.org/wiki/Enrico_Fermi) and [Metropolis](http://en.wikipedia.org/wiki/Nicholas_Metropolis) develop an early form of [pattern search](http://en.wikipedia.org/wiki/Pattern_search_(optimization)) as described belatedly by Davidon.[[19]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-davidon91variable-18)
* 1954: Barricelli carry out the first simulations of the [evolution](http://en.wikipedia.org/wiki/Evolution) process and use them on general optimization problems.[[20]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-barricelli54esempi-19)
* 1963: Rastrigin proposes [random search](http://en.wikipedia.org/wiki/Random_search).[[21]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-rastrigin63convergence-20)
* 1965: Matyas proposes [random optimization](http://en.wikipedia.org/wiki/Random_optimization).[[22]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-matyas65random-21)
* 1965: [Rechenberg](http://en.wikipedia.org/wiki/Ingo_Rechenberg) proposes [evolution strategy](http://en.wikipedia.org/wiki/Evolution_strategy).[[23]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-rechenberg65cybernetic-22)|
* 1965: [Nelder](http://en.wikipedia.org/wiki/John_Nelder) and Mead propose a [simplex heuristic](http://en.wikipedia.org/wiki/Nelder-Mead_method), which was shown by [Powell](http://en.wikipedia.org/wiki/Michael_J._D._Powell) to converge to non-stationary points on some problems.[[24]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-nelder65simplex-23)
* 1966: [Fogel](http://en.wikipedia.org/wiki/Lawrence_J._Fogel) et al. propose [evolutionary programming](http://en.wikipedia.org/wiki/Evolutionary_programming).[[25]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-fogel66artificial-24)
* 1970: Hastings proposes the [Metropolis-Hastings algorithm](http://en.wikipedia.org/wiki/Metropolis-Hastings_algorithm).[[26]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-hastings70monte-25)
* 1970: Cavicchio proposes adaptation of control parameters for an optimizer.[[27]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-cavicchio70adaptive-26)
* 1970: Kernighan and Lin propose a graph partitioning method, related to variable-depth search and [prohibition-based (tabu) search](http://en.wikipedia.org/wiki/Tabu_search).[[28]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-kernighan1970efficient-27)
* 1975: [Holland](http://en.wikipedia.org/wiki/John_Henry_Holland) proposes the [genetic algorithm](http://en.wikipedia.org/wiki/Genetic_algorithm).[[9]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-holland75adaptation-8)
* 1977: [Glover](http://en.wikipedia.org/wiki/Fred_W._Glover) proposes [Scatter Search](http://en.wikipedia.org/w/index.php?title=Scatter_Search&action=edit&redlink=1).[[11]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-glover77scattersearch-10)
* 1978: Mercer and Sampson propose a [metaplan](http://en.wikipedia.org/wiki/Meta-optimization) for tuning an optimizer's parameters by using another optimizer.[[29]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-mercer78adaptive-28)
* 1980: Smith describes [genetic programming](http://en.wikipedia.org/wiki/Genetic_programming).[[30]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-smith80learning-29)
* 1983: Kirkpatrick et al. propose [simulated annealing](http://en.wikipedia.org/wiki/Simulated_annealing).[[8]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-kirkpatrick83optimization-7)
* 1986: [Glover](http://en.wikipedia.org/wiki/Fred_W._Glover) proposes [tabu search](http://en.wikipedia.org/wiki/Tabu_search), first mention of the term *metaheuristic*.[[12]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-glover86future-11)
* 1986: Farmer et al. work on the [artificial immune system](http://en.wikipedia.org/wiki/Artificial_immune_system).[[31]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-farmer86immune-30)
* 1986: Grefenstette proposes another early form of [metaplan](http://en.wikipedia.org/wiki/Meta-optimization) for tuning an optimizer's parameters by using another optimizer.[[32]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-grefenstette86optimization-31)
* 1988: First conference on genetic algorithms is organized at the [University of Illinois at Urbana-Champaign](http://en.wikipedia.org/wiki/University_of_Illinois_at_Urbana-Champaign).
* 1988: [Koza](http://en.wikipedia.org/wiki/John_Koza) registers his first patent on genetic programming.[[33]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-koza88nonlinear-32)[[34]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-koza92genetic-33)
* 1989: Goldberg publishes a well known book on genetic algorithms.[[1]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-goldberg89genetic-0)
* 1989: [Evolver](http://en.wikipedia.org/wiki/Evolver_(software)), the first optimization software using the genetic algorithm.
* 1989: Moscato proposes the [memetic algorithm](http://en.wikipedia.org/wiki/Memetic_algorithm).[[35]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-moscato89evolution-34)
* 1991: [Interactive evolutionary computation](http://en.wikipedia.org/wiki/Interactive_evolutionary_computation).
* 1992: [Dorigo](http://en.wikipedia.org/wiki/Marco_Dorigo) proposes the [ant colony algorithm](http://en.wikipedia.org/wiki/Ant_colony_algorithm).[[10]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-dorigo92optimization-9)
* 1993: The journal, *Evolutionary Computation*, begins publication by the [Massachusetts Institute of Technology](http://en.wikipedia.org/wiki/Massachusetts_Institute_of_Technology).
* 1993: Fonseca and Fleming propose MOGA for [multiobjective optimization](http://en.wikipedia.org/wiki/Multiobjective_optimization).[[36]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-fonseca93genetic-35)
* 1994: [Battiti](http://en.wikipedia.org/wiki/Roberto_Battiti) and Tecchiolli propose [Reactive Search Optimization(RSO)](http://en.wikipedia.org/wiki/Reactive_Search_Optimization) principles for the online self-tuning of heuristics.[[37]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-BattitiTecchiolli94-36)[[38]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-BattitiTecchiolli95-37)
* 1994: Srinivas and Deb propose NSGA for [multiobjective optimization](http://en.wikipedia.org/wiki/Multiobjective_optimization).[[39]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-srinivas94multiobjective-38)
* 1995: Kennedy and Eberhart propose [particle swarm optimization](http://en.wikipedia.org/wiki/Particle_swarm_optimization).[[13]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-kennedy95particle-12)
* 1995: Wolpert and Macready prove the [no free lunch](http://en.wikipedia.org/wiki/No_free_lunch_in_search_and_optimization) theorems.[[40]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-wolpert95nofreelunch-39)[[41]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-wolpert97nofreelunch-40)
* 1996: Mühlenbein and Paaß work on the [estimation of distribution algorithm](http://en.wikipedia.org/wiki/Estimation_of_distribution_algorithm).[[42]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-mulhenbein96recombination-41)
* 1996: Hansen and Ostermeier propose [CMA-ES](http://en.wikipedia.org/wiki/CMA-ES).[[43]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-hansen96adapting-42)
* 1997: Storn and Price propose [differential evolution](http://en.wikipedia.org/wiki/Differential_evolution).[[14]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-storn97differential-13)
* 1997: Rubinstein proposes the [cross entropy method](http://en.wikipedia.org/wiki/Cross_entropy_method).[[44]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-rubinstein97optimization-43)
* 1999: Taillard and Voss propose [POPMUSIC](http://en.wikipedia.org/w/index.php?title=POPMUSIC&action=edit&redlink=1).[[17]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-taillard99popmusic-16)
* 2001: Geem et al. propose [harmony search](http://en.wikipedia.org/wiki/Harmony_search).[[45]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-geem01new-44)
* 2001: Hanseth and Aanestad introduce the Bootstrap Algorithm.[[46]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-han2001-45)
* 2002: Deb et al. propose NSGA-II for [multiobjective optimization](http://en.wikipedia.org/wiki/Multiobjective_optimization).[[47]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-deb02fast-46)
* 2004: Nakrani and Tovey propose [bees optimization](http://en.wikipedia.org/w/index.php?title=Bees_optimization&action=edit&redlink=1).[[48]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-nakrani04honey-47)
* 2005: Krishnanand and Ghose propose [Glowworm swarm optimization](http://en.wikipedia.org/wiki/Glowworm_swarm_optimization).[[49]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-krishna09gso-48)[[50]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-krishna06gso-49)[[51]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-krishna05gso-50)
* 2005: Karaboga proposes [Artificial Bee Colony Algorithm](http://en.wikipedia.org/wiki/Artificial_Bee_Colony_Algorithm) (ABC).[[52]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-Karaboga2005-51)
* 2006: Haddad et al. introduces honey-bee mating optimization.[[53]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-had2006-52)
* 2007: Hamed Shah-Hosseini introduces [Intelligent Water Drops](http://en.wikipedia.org/wiki/Intelligent_Water_Drops).
* 2007: Atashpaz-Gargari introduces [Imperialist competitive algorithm](http://en.wikipedia.org/wiki/Imperialist_competitive_algorithm).
* 2008: Wierstra et al. propose [natural evolution strategies](http://en.wikipedia.org/wiki/Natural_evolution_strategies) based on the natural gradient.[[54]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-nes2008-53)
* 2008: [Yang](http://en.wikipedia.org/wiki/Xin-she_Yang) introduces [firefly algorithm](http://en.wikipedia.org/wiki/Firefly_algorithm).[[55]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-firefly2008-54)
* 2008: Mucherino and Seref propose the [Monkey Search](http://www.antoniomucherino.it/en/research.php)
* 2009: Ali Husseinzadeh Kashan introduced the [League Championship Algorithm (LCA)](http://en.wikipedia.org/w/index.php?title=League_Championship_Algorithm_(LCA)&action=edit&redlink=1).[[56]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-LCAsocpar-55)[[57]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-LCAwcci-56)[[58]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-LCAcad-57)
* 2009: [Yang](http://en.wikipedia.org/wiki/Xin-she_Yang) and Deb introduce [cuckoo search](http://en.wikipedia.org/wiki/Cuckoo_search).[[59]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-cuckoo2009-58)
* 2009: Rashedi proposes Gravitational Search Algorithm
* 2009: Josue Cuevas et al. propose Virus Optimization Algorithm
* 2010: [Yang](http://en.wikipedia.org/wiki/Xin-she_Yang) develops [bat algorithm](http://en.wikipedia.org/wiki/Bat_algorithm).[[60]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-bat2010-59)
* 2011: Hamed Shah-Hosseini proposes the Galaxy-based Search Algorithm.[[61]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-gbsa2011-60)
* 2011: Tamura and Yasuda propose [spiral optimization](http://en.wikipedia.org/wiki/Spiral_optimization).[[62]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-tspiral2011-61)[[63]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-spiral2011-62)
* 2011/2012: R. Venkata Rao et al. proposed the [Teaching-learning-based optimization(TLBO)](http://en.wikipedia.org/w/index.php?title=Teaching-learning-based_optimization(TLBO)&action=edit&redlink=1) algorithm and its variants.[[64]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-tlbo2011-63)[[65]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-tlbo2012-64)[[66]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-rtlbo2012-65)[[67]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-btlbo2012-66)[[68]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-etlbo2012-67)[[69]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-mtlbo2012-68)[[70]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-ntlbo2012-69)
* 2012: Gandomi and Alavi proposed the Krill Herd (KH) Algorithm.[[71]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-kha2012-70)
* 2012: Çivicioglu proposed Differential Search Algorithm (DSA). [[72]](http://en.wikipedia.org/wiki/Metaheuristic#cite_note-71) please see <http://www.pinarcivicioglu.com/ds.html> for Matlab Code of DSA.
* 2012: Hajiaghaei-Keshteli and Aminnayeri proposed the Keshtel Algorithm (KA).