Evolutionary Robotics Solutions

Braitenberg vehicles
There are many possible answers to this problem. Below is just one example:

- genotype:
  $[w_1,w_2]$, where w_i is a float between 0 and 1.
- phenotype:
  motorspeed1 = defaultspeed+w_1*sensor1, motorspeed2 = defaultspeed+w_2*sensor 2
- fitness:
  Attraction: avg_over_time(1/distance_to_light) (assuming non-zero)
  Repulsion: avg_over_time(distance_to_light)
- initial population:
  100 random genomes.
- selection operator:
  tournament selection with elitism.
- crossover and mutation probabilities:
  single point crossover and mutation - probability = 0.1

Evolving cooperation
Robots should be modified to have a light emitter. The genome can remain the same. To favour the evolution of cooperation, the swarm should be homogeneous (the genome is the same for all robots), and the fitness should be awarded based on group performance, for example the overall distance between all the robots averaged over time (higher fitness means that the robots were quicker, hence minimising cost).

Evolving creatures

The 'evolution' show doesn't effectively evolve fast/tall creature.

When setting the show to 'evolution_demo' and the fitness to maximise 'vertical position of body center' (as this mode doesn't demonstrate movement of individuals) while leaving the rest of the settings at their default values, evolution again seems slow to progress to a taller population.

Changing the mutation/crossover rate to 80%/20% created a fairly quick progression towards taller individuals as it seems to generate a sufficiently diversified population. This is to be expected as the starting population seems to have a low vertical body centre. The mutation therefore provides a means of introducing new genes that produce taller "limbs".

When changing the mutation/crossover rates to 20%/80% however, the population appears to converge too quickly to similar individuals and lacks the mutation rate required to produce a population with enough variety that can result in height. The populations continue to mix the current genes present, without diversifying enough to improve the average fitness of the population to any great extent.