Workshop 7: Individual-based models

In class, we have put together an individual-based simulation framework that enables us to follow individuals in 2D space as they move, compete, etc. By incorporating mutation and trait-dependent behaviour, we have opened up a whole world of interesting questions.

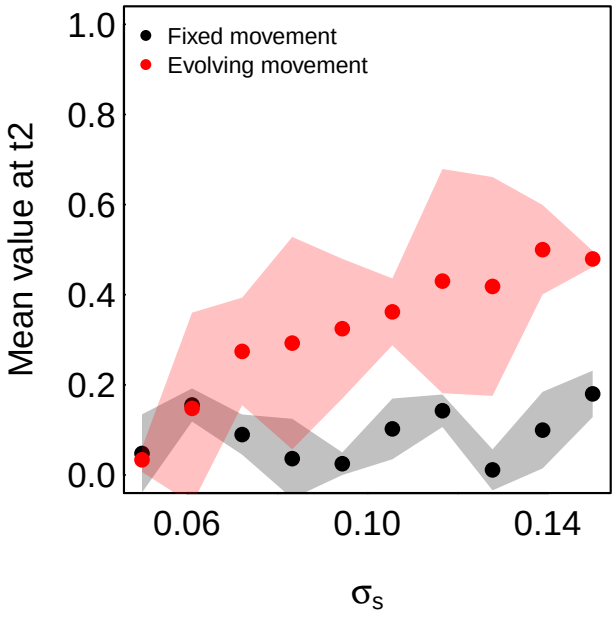
1. We considered random movement and wrap-around movement. Write a new movement function where individuals simply stop moving when they hit the boundary of the landscape (e.g., they do not cross the boundary and they do not bounce or reflect off it). Run the model to confirm that it appears to behave as expected. What should happen if you make `sigma.m` really large?

We coded up movement so that movement distances were either drawn from a normal distribution, with standard deviation `sigma.m`, or they were drawn from a normal distribution with a standard deviation equal to each individual's trait value at the `t2` locus. We then wrote some code to track evolution at the `t2` locus.

2. Run the model for several different values of `sigma.s`. Let's try these values:

```
sigma.s.vals <- seq(from=0.05, to=0.15, length=10)
```

   and run 10 replicates for each value, each for 10^4 generations. Then, plot the mean and standard deviation, across replicates, of the final mean population trait `t2` value, for each value of `sigma.s` (e.g., You will run the model 10 times for a given `sigma.s` and compute the population mean `t2` value in the final generation for each run. Then you'll plot the mean and SD across these 10 replicate runs). Compare the two different movement models and interpret this result. Does it make sense? Your figure could look something like this (note, this is not actual model output - just random values I made up).



Note: we have not built in any checks to prevent crashes. If the population goes extinct, the model will crash. Consequently, some values of `sigma.s` (e.g., very small ones) will cause the model to crash, as all siblings essentially kill each other via competition and die.