Mammals and birds have well defined sex chromosomes bearing a gene that triggers a conserved testis-determining pathway. The mammal XY chromosomes are not homologous to the bird ZW chromosomes, and the two systems act through different sex determining genes. Other reptiles, frogs and fish have different sex chromosome systems and we now know of many distinct sex determining genes which act at different points of the conserved sex determining pathway. This astonishing variety of sex determining genes and chromosomes is the result of the rapid birth and death of sex chromosomes.

There are many reptiles and some fish that have no sex chromosomes. Sex is determined by environmental factors such as temperature (TSD), through epigenetic changes whose nature has been a longstanding mystery. We work with the dragon lizard, which has a ZW system driven by yet another sex determining gene. However, when it’s hot, all the eggs hatch as females. ZZ sex-reversed females are fertile, and when mated with ZZ males produce all ZZ offspring, whose sex depends entirely on temperature. Remarkably, we have changed the sex determining system from GSD to TSD in a single generation. This is happening in the wild as temperatures rise.

We have used this system to investigate how TSD works. We found that the transcriptome of ZZ females contains upregulated stress markers and unique transcripts of two epigenetic markers. This suggests that temperature acts, via the stress pathway, to activate epigenetic modifications involved in male determination. Have we discovered the mechanism of TSD at last?

Host: Art Arnold, arnold@ucla.edu