Imperial College London
2019-20 MRes CMEE Seminar Summary

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Contents

1 Deep-time evolution of biological responses to temperature changes

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Climate change is logically one of the major threats to modern biodiversity. This project hence is providing a baseline information of how fast evolution is coping with temperature changes. A variant of Sharpe-Schoolfield model was used to describe the Thermal Performance curve (TPC) of a population. The model had an assumption of "an unit's growth rate considered in the model is only depended on one rate-limited thermal-driven enzyme".

Unsurprisingly, most of the results were expected. Thermodynamic constraints caused a negative correlation between thermal optimal performance (B_{pk}) and the temperature difference between the half-to-peak efficiency (W_{op}). Cell size was weakly- and negatively-correlated with enzymatic peak performance. Existing species were having diversity around local thermal optimums. Phylogenetically patchy evo-rate shifts on thermal sensitivity with high environmental factors involvement. Protein mutations had higher damages in high temperatures due to the increase of sub-molecular kinetics.

There was a point which lacked further explanation. "High temperature select for lower substitution rate" (a result from presentation) does not firmly oppose the idea of "high temperature favours evolution" (the metabolic theory) in this presentation. High temperature increase substitution probabilities in all single nucleotide positions (SNPs) can also accomodate both statements. So even though most of the mutations were selected against (due to the destructive protein kinetics), the rate of getting beneficial mutations was still higher than other scenarios. So more evidence would be beneficial to completely falsify the theory.

In conclusion, the presentation only gave numerical proof to existing knowledge. Hence, more investigations should be done in the future to put this in context of the current climate change.

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