The evolutionary ecology of telomere dynamics in semi-free-ranging mandrills (Ref IAP_15_26)

Durham University, Anthropology Department
In partnership with Newcastle University, Centre for Behaviour and Evolution and CIRMF, Gabon

Supervisory Team
- Dr Jo Setchell, Anthropology, Durham University
- Prof Melissa Bateson, Centre for Behaviour and Evolution, Newcastle University
- Dr Barthélemy Ngoubangoye, Centre International de Recherches Medicales de Franceville, Gabon

Key Words
Non-human primate, telomere, stress, ageing, individual variation

Overview
Telomeres are highly conserved, repetitive DNA sequences found at the ends of chromosomes. They stabilise chromosomes and protect against degradation of coding sequences following DNA replication. Telomeres shorten with each cell division and once they reach a threshold length, cell death ensues. Telomere length is, thus, linked to senescence, and has been subject to a great deal of biomedical study.

Telomere length and dynamics show substantial individual variation within species. The relationships between telomere length and individual state offer many potential insights into evolutionary ecology, life history strategies, and fitness. However, the influences of social and ecological factors on telomere length remain poorly understood, particularly outside humans.

This project uses a semi-free-ranging population of mandrills (Mandrillus sphinx) to examine these relationships. Mandrills are semi-terrestrial monkeys that live in very large multi-male, multi-female groups in central Africa. They are perhaps the most sexually dimorphic of all mammals. In addition to extreme body size dimorphism, both sexes have exaggerated secondary sexual traits, which may signal individual quality. These sex differences are linked to sex differences in patterns of growth and in variance in reproductive success, which is much greater in males than in females.

Objectives
1. Investigate patterns of individual variation in telomere length and dynamics with respect to age, sex, early life conditions (maternal age, parity and rank), growth trajectories, condition, and ‘personality’ (behavioural style).
2. Examine the inheritance of telomere length, and the link between telomere dynamics and fitness.
3. Test the hypothesis that telomere attrition provides an integrative measure of the stress experienced by an individual.

Methodology
This project is a part of Dr Setchell's on-going collaboration with the Primate Centre at CIRMF, Gabon. The CIRMF mandrill colony comprises approximately 200 animals of all ages and both sexes and of known date of birth. Known maternal variables include mother’s age at parturition and parity, both of which influence offspring growth and development. Annual measures of body mass allow comparison with standard growth curves.

The student will collect behavioural data to determine dominance ranks and measure personality via behavioural coding and novel object presentation.

We will obtain blood samples from all animals during two annual captures, and measure body size, mass and condition.

We will measure absolute telomere quantity per diploid genome in white blood cells using quantitative PCR.

The project takes advantage of the annual capture of the CIRMF mandrill colony and requires no additional interventions. We will apply for permission from the relevant university ethics boards and from the committee overseeing ethics at CIRMF.

Timeline
This is a 3.5 year PhD studentship with a likely start date of October 2016.

Months 1-6: Initial PhD training and thorough literature review.

Month 7: Dr Setchell will accompany the student to Gabon to learn the individual identities of the mandrills and pilot behavioural collection methods.

Months 8-18: Behavioural data collection to establish mandrill dominance ranks and personality measures.

Month 19: Sample collection during annual capture of the mandrill colony (1).

Months 20-30: Laboratory analysis and cross-sectional data analysis.

Month 31: Sample collection during annual capture of the mandrill colony (2).

Months 32-42: Laboratory analysis followed by longitudinal data analysis. Presentations at national and international conferences and public events.

Prepare and submit manuscripts to peer-reviewed journals. Thesis preparation.

Training & Skills
This project will allow a student to develop skills in behavioural observation, biological sampling, laboratory measurements of telomeres, and complex statistical analysis in R. Transferable skills include analysis and problem-solving, interpersonal skills, project management, information management, self-management and work habits, written and oral communication.

The supervisors at Durham and Newcastle have complementary expertise. Dr Setchell is an expert in primate behaviour and life history and co-runs the Primate@Durham group. Prof Bateson is an expert in the use of telomere length as a biomarker of cumulative stress. She has produced the first evidence for links between telomere attrition and behavioural markers of altered life history. She has current projects on European starlings and laboratory rhesus macaques. The student will benefit from opportunities offered by both groups, and from the broader research environment of the Behaviour, Ecology and Environment Research Centre in Durham, directed by Setchell, and the Centre for Behaviour and Evolution in Newcastle. Durham and Newcastle are 15 minutes apart by train, facilitating interaction.

Dr Setchell will provide training for the study of mandrills. Telomere measurement will take place in the Biomarkers Laboratory at the University of Newcastle. Prof Bateson will provide training in telomere biology and the analysis of telomere data.

References & Further Reading


Further Information
Dr Jo Setchell: joanna.setchell @durham.ac.uk