



Plant and Animal Genome XXIV Conference, San Diego, Jan 9 2016

Genomic footprints of selection during domestication in Old World camelids

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Special thanks to the organizers!

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- oldest German speaking Vetmeduni in Europe
- founded in 1765

250
1765-2015
RESPONSIBILITY FOR ANIMALS AND PEOPLE

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Introduction



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'Camelid Group'

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Collaborators

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Funding

Austrian Science Foundation FWF, Austrian Academy of Science, Eurasia Pacific Uninet



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Overview



DOMESTICATION

Background

- domestication syndrome hypothesis
- Old World camelid domestication
- Old World camel genome research
- International Camel Consortium for Genetic Improvement and Conservation

GENOME RESEQUENCING

Results

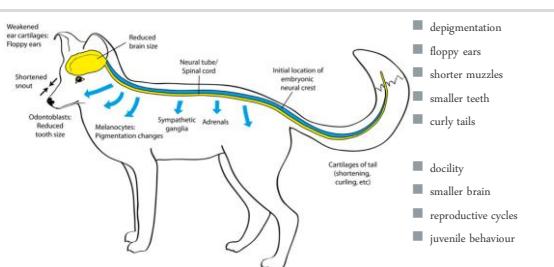
- Genetic Variation
- Admixture/Demographic History
- Identifying selected loci



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"domestication syndrome" hypothesis



mild neural crest cell deficits during embryonic development

Wilkins et al. 2014



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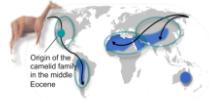
Domestication of the Old World camelids



Camelus dromedarius



Camelus bactrianus



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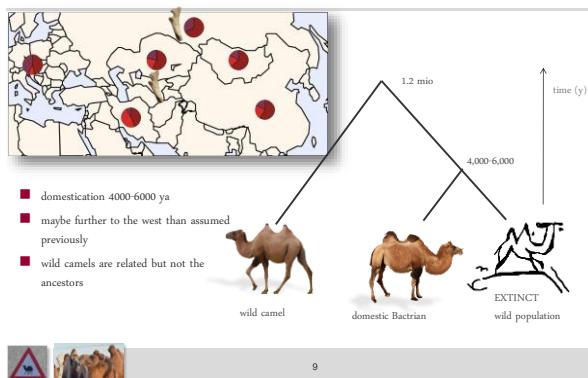


Camelus ferus

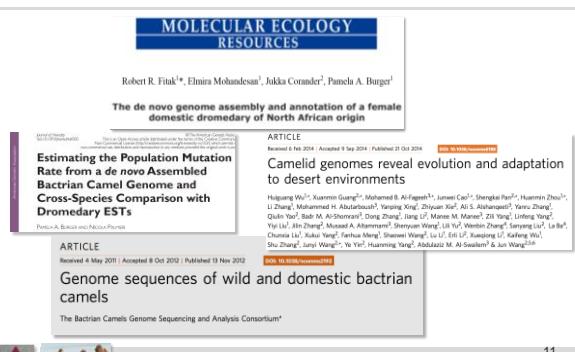
Great Gobi Strictly Protected Area "A"



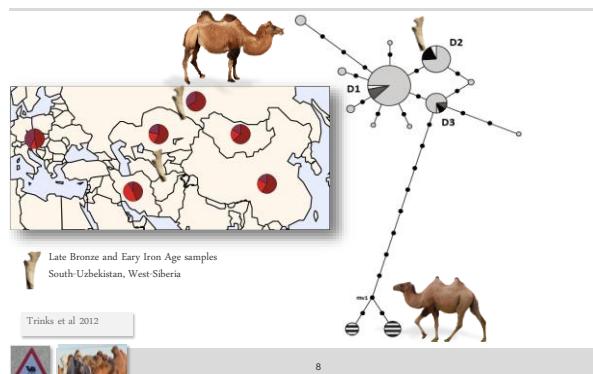
Bactrian camel domestication



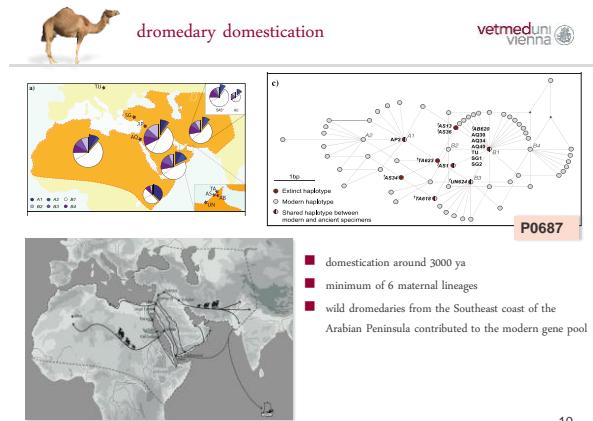
Old World Camel genome resources



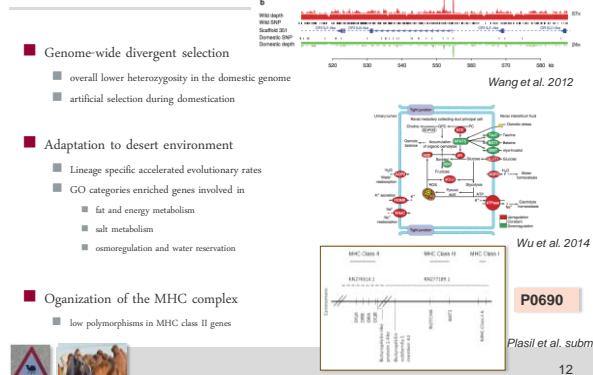
Bactrian camel domestication



Bactrian camel domestication



Old World Camel genomes



The International Camel Consortium (ICC-GIC) website features a yellow header with the logo and name. Below the header, there's a navigation bar with links to HOME, ABOUT ICC-GIC, RESEARCH, MEMBERSHIP, CONTACT US, ISOCARD, and BLOG. A main text block states: "The ICC-GIC is an international group of camel holders and scientists for the improvement of camel performances as an important genetic resource while conserving biodiversity and local adaptation." It includes a download button for the AGENDA. To the right is a photograph of several camels.

- FAO meeting in Riyadh April, 2015: 23 participating countries
- established at the 4th ISOCARD conference in Almaty, June 2015

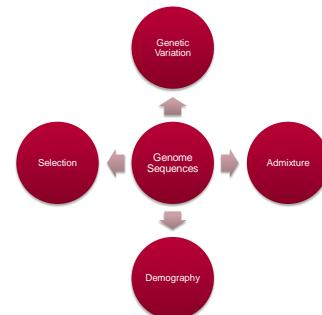
www.icc-gic.weebly.com in preparation

www.isocard.org

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Genome Resequencing

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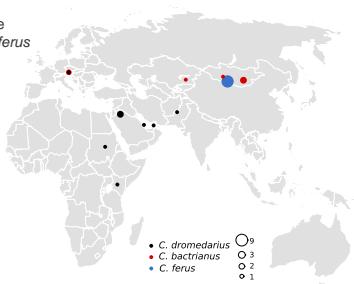
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Dataset

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25 Genomes
~15X coverage
Mapped to *C. ferus*

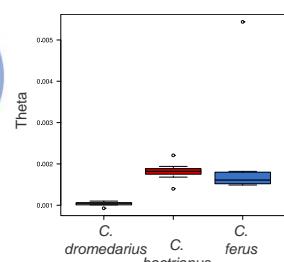
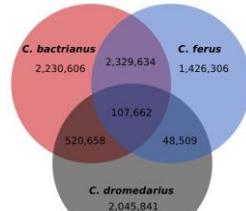


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Genetic Variation

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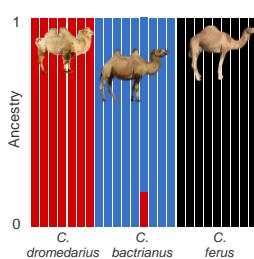


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Admixture/Demography

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Detecting Selection

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Genetic-centric approach

- Homogeneity Test
- Polymorphism vs divergence
- Species A vs. [species B + C]

HKA Test

- Gene vs. genome-wide average
- Only if significant in a particular lineage

Genome-wide approach

- Heterozygosity & S^2Fst
- Pairwise species comparisons
- Reduced heterozygosity and high S^2Fst

SMILEFINDER
(Guiblet et al. 2015,
Oleksyk et al. 2008)



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Detecting Selection

■ Homogeneity/HKA Test

- Dromedary vs [C. ferus/bactrianus]: 6,662 genes analyzed
 - STARTD9: microtubule motor
 - PRKDC: double strand break repair
 - CENPF: centromere-associated, transcription factor binding
 - DNAH1: ATPase activity, microtubule motor
 - FAM208B: protein binding
- C. ferus vs C. bactrianus
 - ANKYRIN2: protein kinase binding and ion channel binding
 - OTOP1: behavior, neurological
 - ABCA13: ATPase activity

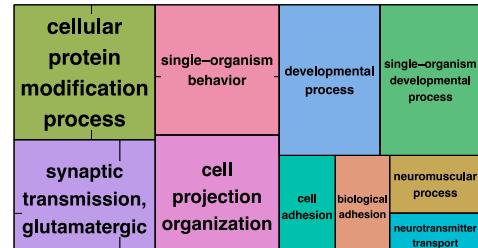


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Detecting Selection

■ Extreme H_E and S²F_{ST}: C. dromedarius



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Summary

- Introgression from domestic to wild camel threatens the genomic integrity of *Camelus ferus*
- Population expansion of the wild camel during the last glacial maximum followed by a rapid decline
- Selection during domestication affects genes associated with neural-physiology
 - "domestication syndrome"



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Questions???

■ Please see posters:

- P0686
- P0687
- P0690



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"domestication syndrome" hypothesis

