



Online International Symposium on World Camel Day, June 22, 2020  
„Camel as the Animal of Future“  
Virtual University of Pakistan, June 22, 2020

# International Camel Consortium for Genetic Improvement and Conservation

[www.ICC-GIC.weebly.com](http://www.ICC-GIC.weebly.com)



[Pamela.Burger@vetmeduni.ac.at](mailto:Pamela.Burger@vetmeduni.ac.at)





## ICC-GIC

- Mission & Statutes & Objectives
- Membership & Registration
- Executive Committee

## Camel Genomic Resources

- Whole genome sequences
- Genome Browser
- Illumina Greater Good Initiative
- SNP array



# ICC-GIC Mission

International Camel Consortium for genetic improvement and conservation

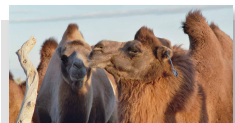
[www.ICC-GIC.weebly.com](http://www.ICC-GIC.weebly.com)



## Mission:

To support at various levels the network of involved scientists and professionals to boost, harmonize, coordinate and share activities on camel genetic conservation, management, animal phenotypic recording and genetic improvement

Founded under the umbrella of ISOCARD



# ICC-GIC Statutes (Article 1-13)



Name & Seat, Character, Mission, Objectives, Membership, Organs, EC, General Assembly,...

*Character: The Consortium is a non-political, non-religious and non profit-making network of actors (individuals/groups, private/public) interested and/or involved in camel conservation, management, animal phenotypic recording and genetic improvement.*

proposed by the **nominated *ad hoc* committee** composed of:

Faisal Almathen (KSA) as Chairmen of the Committee

Fuad Alzuraiq (KSA) Treasurer

Bernard Faye (KSA/France) Vice Chairman responsible for Development Committee

Elena Ciani (Italy) Vice Chairmen, General Secretariat

Pamela Burger (Austria) Vice Chairman responsible for Scientific Committee

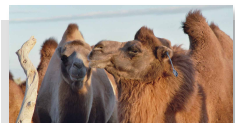
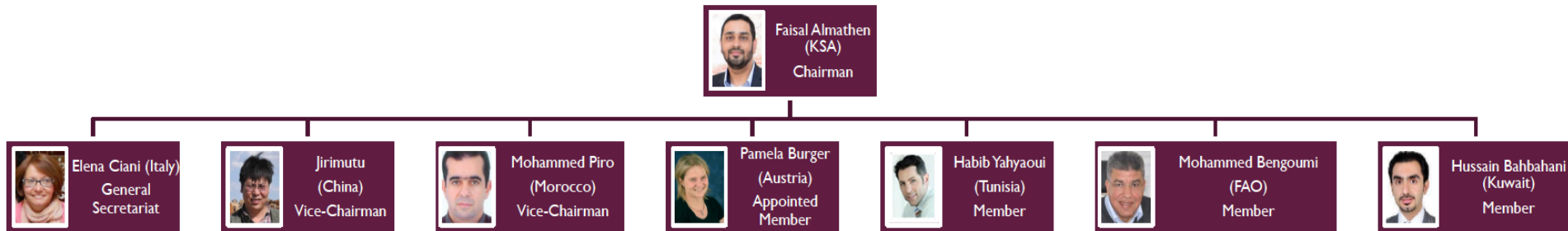
Mohammed Bengoumi (FAO)

Hussain Bahbahani (Kuwait)

Habbib Yahyaoui (Tunisia)



## ICC-GIC ORGANIZATION CHART



# ICC-GIC Membership



[HOME](#) [ABOUT ICC](#) [CAMELS@PAG](#) [RESEARCH](#) [JOIN ICC](#) [CONTACT](#) [BLOG](#) [ISOCARD](#)



Join the ICC-GIC *if you are an active camel scientist or camel holder.*

\* Indicates required field

Name \*

First

Last

[www.icc-gic.weebly.com](http://www.icc-gic.weebly.com)

Email \*

What is you (scientific) background \*

- camel holder
- industry
- animal breeding science
- genetics/genomics
- meat science
- milk science
- physiology



**Contact ICC-GIC** if you are interested to collaborate in a project.

## Camelid Genomic Research and Conservation

The ICC-GIC has two working groups, which interact for a conservation of phenotypic and genetic diversity and genetic improvement

### Phenotyping working group

Establish standardized animal ID system and protocols for trait measurements

### Genomic working group

Improve the assemblies of the current draft genomes  
Establish new genomic resources: SNPchip, physical genome maps

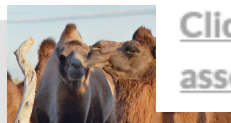
## LATEST RESEARCH

[Click here to see the latest Bactrian camel chromosome-assembled reference genome](#)

VIEW PUBLICATION

[Click here to see the latest dromedary chromosome-assembled reference genome CamDro3](#)

DOWNLOAD PUBLICATION





## ICC-GIC

- Mission & Statutes & Objectives
- Executive Committee
- Membership & Registration

## Camel Genomic Resources

- Whole genome sequences
- Genome Browser
- Illumina Greater Good Initiative
- SNP array





## ARTICLE

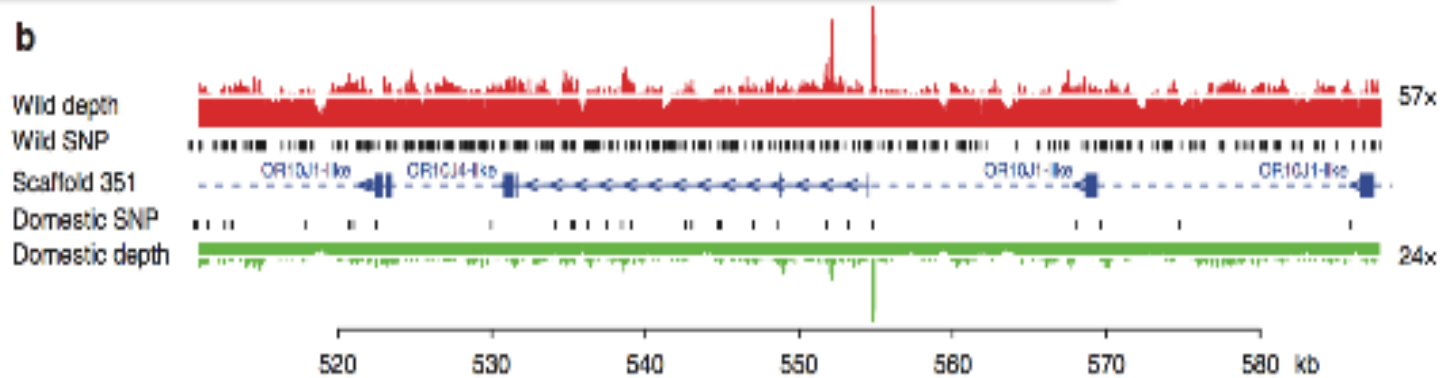
Received 4 May 2011 | Accepted 8 Oct 2012 | Published 13 Nov 2012

DOI: 10.1038/ncomms2192

# Genome sequences of wild and domestic bactrian camels

The Bactrian Camels Genome Sequencing and Analysis Consortium\*

Jirimutu et al. 2012 Nat Com



## ■ Genome-wide divergent selection

- overall lower heterozygosity  
in the domestic genome
- artificial selection during domestication



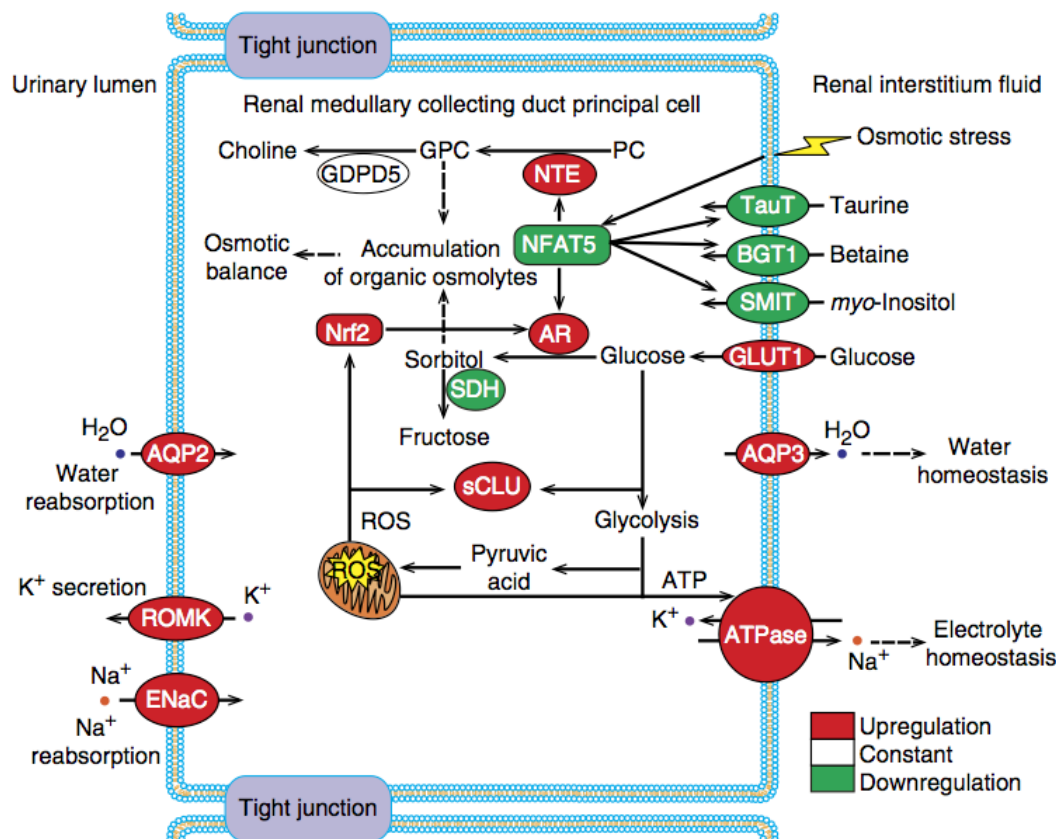
## ARTICLE

Received 6 Feb 2014 | Accepted 9 Sep 2014 | Published 21 Oct 2014

DOI: 10.1038/ncomms6188

## Camelid genomes reveal evolution and adaptation to desert environments

Huiguang Wu<sup>1,\*</sup>, Xuanmin Guang<sup>2,\*</sup>, Mohamed B. Al-Fageeh<sup>3,\*</sup>, Junwei Cao<sup>1,\*</sup>, Shengkai Pan<sup>2,\*</sup>, Huanmin Zhou<sup>1,\*</sup>, Li Zhang<sup>1</sup>, Mohammed H. Abutarboush<sup>3</sup>, Yanping Xing<sup>1</sup>, Zhiyuan Xie<sup>2</sup>, Ali S. Alshanqeeti<sup>3</sup>, Yanru Zhang<sup>1</sup>,



Selected genes involved in osmoregulation and water reservation

# Old World camels genomic resources

## De novo assembly of a female dromedary genome

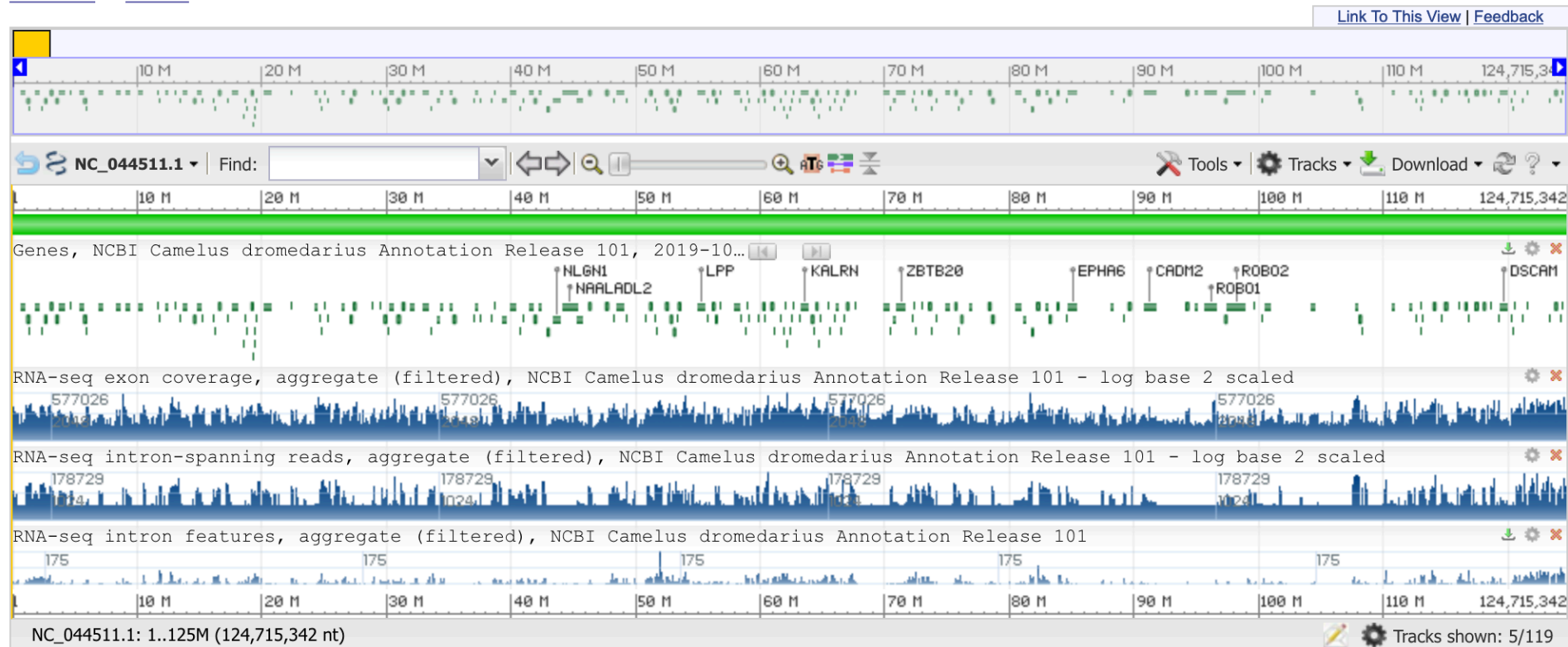
- 66-fold coverage, 2.06 GB
- annotation of 452 (98.7%) CEGs

*Fitak et al. & Burger 2015 Mol Ecol Res*  
*Elbers et al. & Burger 2019 Mol Ecol Res*

## Camelus dromedarius isolate Drom800 breed African chromosome 1, CamDro3, whole genome shotgun sequence

NCBI Reference Sequence: NC\_044511.1



[GenBank](#) [FASTA](#)



## MOLECULAR ECOLOGY RESOURCES

RESOURCE ARTICLE

### Chromosome-level assembly of wild Bactrian camel genome reveals organization of immune gene loci

Liang Ming, Zhen Wang , Li Yi, Mijiddorj Batmunkh, Tao Liu, Dalai Siren, Jing He, Namuunaa Juramt, Tuyatsetseg Jambl, Yixue Li, Jirimutu 

First published: 03 February 2020 | <https://doi.org/10.1111/1755-0998.13141>

Liang Ming and Zhen Wang contributed equally to this work.

Download genome assembly from:

[https://figshare.com/articles/Data\\_from\\_Chromosome-level\\_assembly\\_of\\_wild\\_Bactrian\\_camel\\_genome\\_reveals\\_organization\\_of\\_immune\\_gene\\_loci/11297489](https://figshare.com/articles/Data_from_Chromosome-level_assembly_of_wild_Bactrian_camel_genome_reveals_organization_of_immune_gene_loci/11297489)



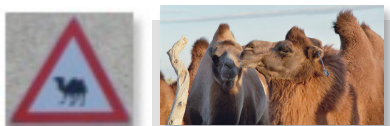
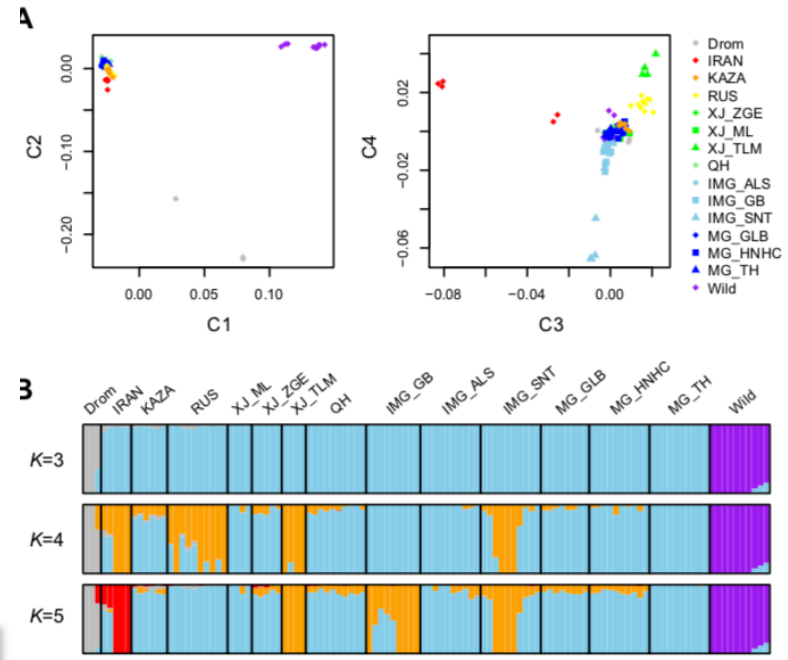
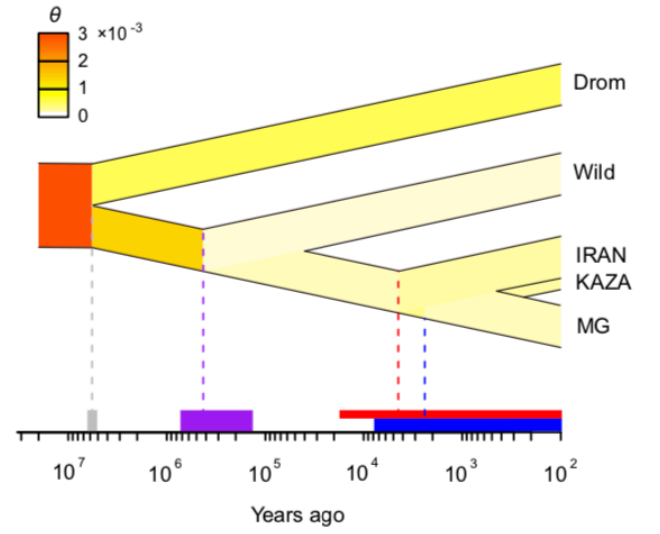
ARTICLE

<https://doi.org/10.1038/s42003-019-0734-6>

OPEN

## Whole-genome sequencing of 128 camels across Asia reveals origin and migration of domestic Bactrian camels

Liang Ming et al.<sup>#</sup>



Check for updates

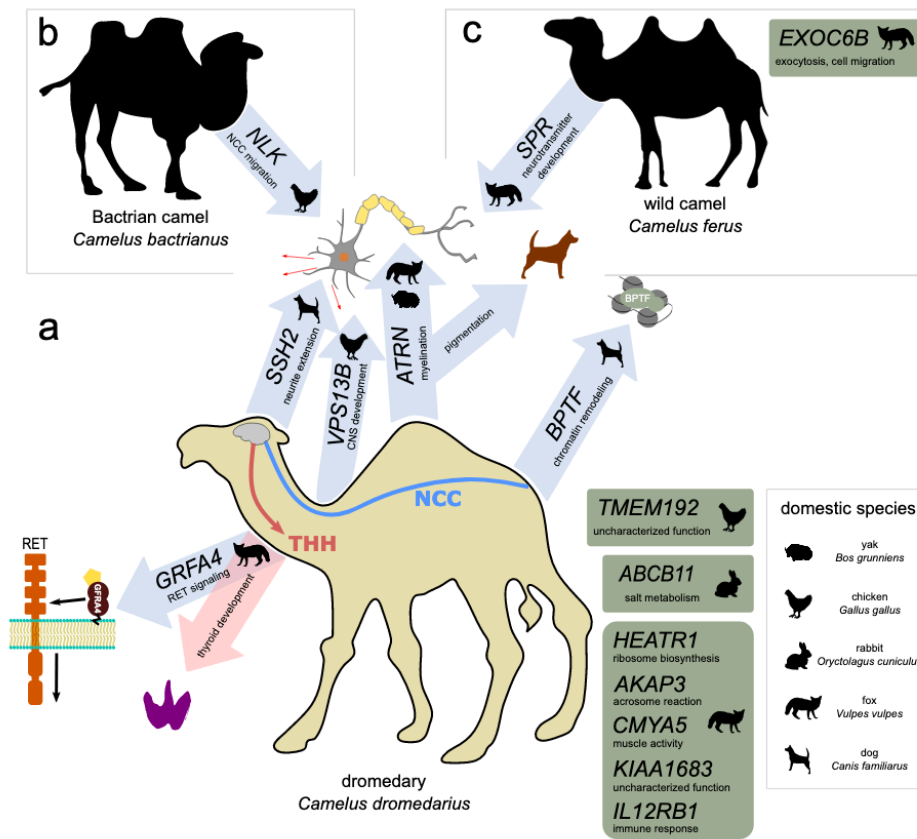
ARTICLE

<https://doi.org/10.1038/s42003-020-1039-5>

OPEN

## Genomic signatures of domestication in Old World camels

Robert Rodgers Fitak<sup>1,15</sup>, Elmira Mohandesan<sup>1,2</sup>, Jukka Corander<sup>3,4,5</sup>, Adiya Yadamsuren<sup>6,7</sup>, Battsetseg Chuluunbat<sup>8</sup>, Omer Abdelhadi<sup>9</sup>, Abdul Raziq<sup>10</sup>, Peter Nagy<sup>11</sup>, Chris Walzer<sup>12,13</sup>, Bernard Faye<sup>14</sup> & Pamela Anna Burger<sup>1,13</sup>



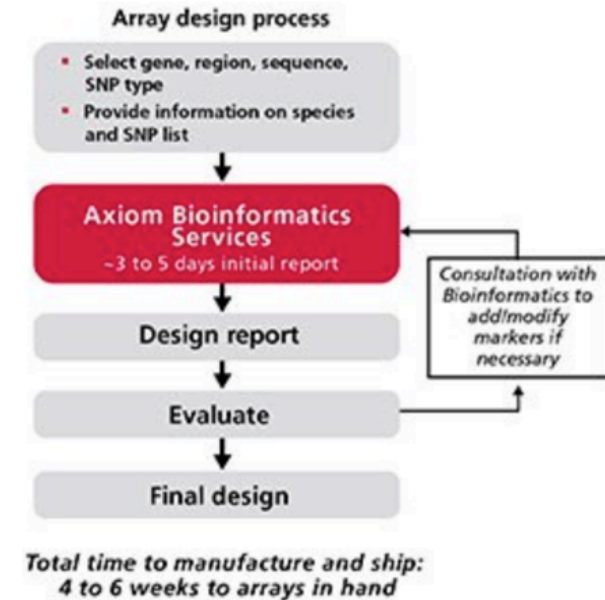
# Old World camels genomic resources



Joint FAO/IAEA Programme  
Nuclear Techniques in Food and Agriculture

## 180K SNP camelid array

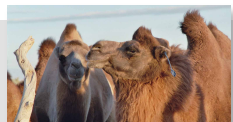
- 60K Bactrian camel
- 60K dromedary
- 60K llama/ alpaca



## Axiom myDesign Genotyping Arrays

‘ Axiom Genotyping Solution for  
Agrigenomics

**Axiom myDesign Genotyping Arrays**



# Illumina Announces Eleventh Agricultural Greater Good Initiative Grant Winner

Recipient Focused on Genetics Research of Camels



**400 camel  
whole genomes  
sequences**





## Relevant phenotypes

- Milk yield and content
  - Growth, meat, carcass
  - Reproduction
  - Wool/ fiber
  - Health, immunity
  - Beauty
  - Racing
  - Animal welfare
- No standardized phenotype recording
  - No animal ID system in place



# Phenotyping



- Identify breeders for developing recording guidelines
- Animal Identification
- Collaboration with FAO
  
- Evaluate newly measured phenotypes
- Initiate first GWAS study(ies)
  
- Develop genomic tools



- Improvement of livestock is always an improvement for people
- Camels are the most promising livestock species for sustainable utilization
- Conservation of the last wild camels and of locally adapted diversity

