

Projeto Genoma Equino



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Projeto Genoma Equino



■ 1980:

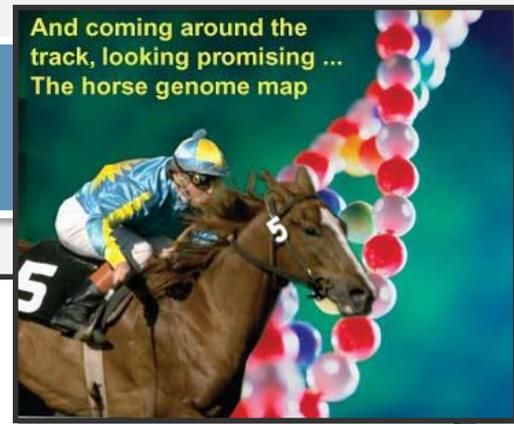
- ✓ Surgiu o plano de sequenciamento do genoma equino;

Objetivo inicial:

- ✓ mapa genético do cavalo (32 cromossomos);
- ✓ elucidar doenças, criar vacinas e tratamentos;
- ✓ características genéticas de cor da pelagem;
- ✓ desenvolvimento de testes diagnósticos de doenças;

Projeto Genoma Equino

And coming around the track, looking promising ...
The horse genome map



■ Em 1990:

- ✓ Aprovados US\$ 3 bilhões;
- ✓ Maior parte da verba era destinada a modernos equipamentos de sequenciamento, programas e computadores de bioinformática;
- ✓ **Projeto do Genoma Equino baseado no Projeto Genoma Humano;**

■ Em 1995:

- ✓ 70 cientistas de 20 países se reuniram em Lexington/Kentucky para montar o plano de mapeamento do genoma do cavalo;
- ✓ mapeados 7 genes de 1 cromossomo;
- ✓ 15 cavalos foram coletados e distribuídos em 22 laboratórios de 12 países;

- ✓ Elaboração do Projeto Genoma Equino
- ✓ Foto da reunião de outubro de 1995 em Lexington/Kentucky;
- ✓ Havia 70 cientistas de 20 países
- ✓ foram 7 reunião de 1995 a 2007



- 1995 in Lexington/Kentucky
- 1997 in San Diego/ California
- 1999 in Uppsala/Sweden
- 2001 in Brisbane/Australia
- 2003 in Kruger Park/South Africa
- 2005 in Newbridge/Ireland
- 2007 at Lake Tahoe/California

Sequenciamento do Genoma Equino

- Em 2002:

- ✓ **900 genes mapeados**

- ✓ US\$ 7 milhões e US\$ 10 milhões para completar o mapa do genoma

- * Financiamento:

- Equine Research Coordination Group - AAEP, AQHA, Grayson-Jockey Club Research Foundation e Morris Animal Foundation

- * Principais Universidades envolvidas:

- University of California-Davis, Cornell University, University of Kentucky, University of Minnesota, Texas A&M University, Tufts University

- * Laboratórios Privados:

- Australia, New Zealand, France, Sweden, Germany, South Africa, Japan, Czech Republic, Poland, Denmark, Norway, and the United Kingdom.

Sequenciamento do Genoma Equino

* se estimava 100.000 a 300.000 genes

Mas... na verdade 20.000 genes (representando 2% dos cromossomos)

▪ Em 2005:

o Instituto Nacional de Pesquisa do Genoma Humano alertou para os benefícios do sequenciamento do genoma equino na Medicina.

▪ Em 2006:

- ✓ o sequenciamento começou em fevereiro;
- ✓ o genoma foi cortado em 30 milhões de pedaços;
- ✓ sequenciamento de cada pedaço estava completo em julho;
- ✓ montagem da sequência concluída em janeiro de 2007;

[UCSC Genome Browser Home](#)



genome.gov

National Human Genome Research Institute

National Institutes of Health

Research Funding

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Health

Education

Issues in Genetics

Newsroom

Highlights



The heart of the matter: genomics and cardiovascular disease

Please join NHGRI at a 'genomics and cardiovascular disease' lecture by Les Biesecker, M.D., Genetic Disease Research Branch, NHGRI. The April 13 lecture at Suburban Hospital in Bethesda, Md., focuses on the genetically distinct components of cardiovascular disease and how genomic diagnostic approaches can provide the basis for individualized patient treatment. [Read more](#)

- benefícios do sequenciamento do genoma do cavalo para a pesquisa médica e veterinária;
- sequenciamento de 24 genomas de mamíferos para identificar semelhanças e diferenças com o genoma humano;

Institute Diversity Action program, has taken big steps towards his dream



http://genome.ucsc.edu/index.html

genome.ucsc.edu/index.html UCSC Genome Browser Home

UCSC Genome Bioinformatics

Genomes - Blat - Tables - Gene Sorter - PCR - VisiGene - Session - FAQ - Help

genome.ucsc.edu/cgi-bin/hgGateway?hgsid=370815601_iTzzmYWvuaakeixY3z3PQInFtGnc&clade=mammal&org=Horse&db=0 UCSC Genome Browser Home

Horse Genome Browser – equCab2 assembly (sequences)

The Sep. 2007 *Equus caballus* draft assembly EquCab2 (UCSC version equCab2) was produced by [The Broad Institute](#). For more information about this assembly, see [EquCab2.0](#) in the NCBI Assembly database.

Sample position queries

A genome position can be specified by the accession number of a sequenced genomic region, an mRNA or EST, a chromosomal coordinate range, or keywords from the GenBank description of an mRNA. The following list shows examples of valid position queries for the Horse genome. See the [User's Guide](#) for more information.

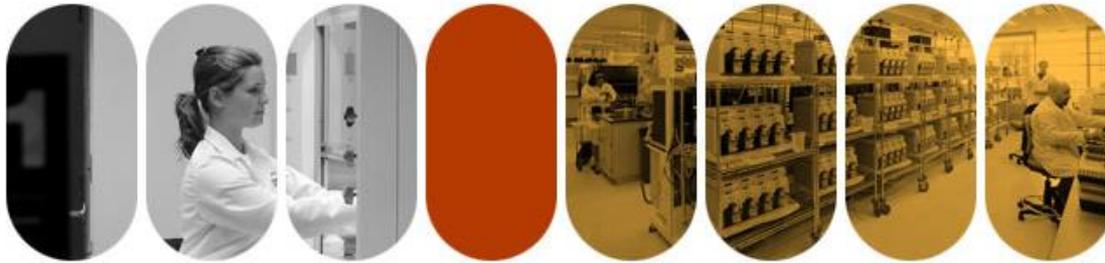
Request:	Genome Browser Response:
chr13	Displays all of chromosome 13
chr13:1-1000000	Displays first million bases of chromosome 13
chr13:1000000+20000	Displays a region of chr 13 that spans 20,000 bases, starting with position 1,000,000
AF506972	Displays region of mRNA with GenBank accession number AF506972
BM734875	Displays region of EST with GenBank accession BM734875 on chr chr11
pseudogene mRNA	Lists transcribed pseudogenes, but not cDNAs
zinc finger	Lists many zinc finger mRNAs
kruppel zinc finger	Lists only kruppel-like zinc fingers
smith	Lists mRNAs deposited by scientist named Smith
Collins,M.E.	Lists mRNAs deposited by co-author M.E. Collins

Use this last format for author queries. Although GenBank requires the search format *Collins ME*, internally it uses the format *Collins,M.E.*



"Twilight" - *Equus caballus*
Photo courtesy of NHGRI ([press photos](#))

Assembly details



Who is Broad?

The Broad Institute brings together a diverse group of individuals from across its partner institutions — undergraduate and graduate students, postdoctoral fellows, professional scientists, administrative professionals, and academic faculty.

The culture and environment at the Broad is designed to encourage creativity and to engage all participants, regardless of role or seniority, in the mission of the Institute. Within this setting, researchers are empowered — both intellectually and technically — to confront even the most difficult biomedical challenges.

[Leadership](#) >[Core Members](#) >[Core Member Labs](#) >[Associate Members](#) >[Programs](#) >[Platforms](#) >[2010 Annual Report](#) >

Broad Institute:

- Instituto de pesquisa biomédica
- Centro colaborador no sequenciamento para NHGRI

Horse Genome Project

The domestic horse, *Equus caballus*, is a member of the mammalian order *Perrisodactyla*. The horse genome is being sequenced for two reasons. It is expected to help identify functional genome features common to all **mammals**, and it will serve as a tool for researchers to better understand the diseases that affect equines. The recent creation of modern breeds and the presence of specific diseases within certain breeds together suggest that trait mapping may be relatively easy within horse breeds. Since horses and humans share a number of medical conditions (such as allergies and arthritis), mapping disease genes using horse populations may in turn benefit human health.

The equine genome sequencing project, performed mostly at the Broad Institute, has produced a high-quality draft sequence of a female thoroughbred horse. BAC end reads for the project were generated by the University of Veterinary Medicine, in Hanover, and the Helmholtz Centre for Infection Research in Braunschweig, Germany. In addition, the project generated a large collection of single-nucleotide polymorphisms (SNPs), to allow the mapping of genetic traits in horse populations. SNPs will be identified from a variety of modern and ancestral breeds, including the Akal-teke, Andalusian, Arabian, Icelandic, Quarterhorse, Standardbred, and Thoroughbred.

Current Status



Projeto Genoma Equino

<http://www.uky.edu/Ag/Horsemap/welcome.html>



Horse Genome Project

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[about the hgp](#)

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\(terms and definitions\)](#)

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The Horse Genome Project is a cooperative international effort by over 100 scientists in 20 countries to define the genome, the DNA sequence, of the domestic horse. With this knowledge, scientists can begin to understand the genetic aspects of equine physiology and disease. Genetic tools have the potential to help researchers find new therapies and treatments for diseases such as laminitis, respiratory diseases, etc.

Some horsemen may worry that once the horse genome is sequenced, all the mystery and magic will be gone from horse breeding and ownership -- colorful characters around a racetrack replaced by colorless scientists with computer printouts and test tubes. Fear not. The study of the horse genome is more like studying the weather than inventing a sports car. Consider the following. All our research on the weather has shown we can experience a sunny day in Florida knowing that a hurricane will arrive in two days, but we cannot change the hurricane. Still the knowledge allows us to make choices; when the hurricane approaches we can abandon town or we can shore up our foundations. Successful use of genomic tools will help the horse breeders, veterinarians and horse owners to do better what they already do... anticipate problems, predict outcomes and enjoy the unique interaction between horses and people.

RECENT NEWS

International Equine Genome Mapping Workshop
The 8th Dorothy Russell Havemeyer Foundation International Equine Genome Mapping Workshop took place near Newmarket, UK from July 22 to 25, 2009...[\[more\]](#)

MEDIA ECLIPSE AWARD

Writers at the Louisville Courier Journal recently won the 2008 Media Eclipse Award for journalism based



Horse Genome Project

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\(terms and definitions\)](#)[applications of
genome study](#)[faq](#)[links](#)[contact us](#)

Twilight is a Thoroughbred mare bred and raised at the McConville Barn at Cornell University. She provided the DNA for the whole genome sequence of the horse that was completed and assembled at the Broad Institute in Cambridge, MA. The Thoroughbred originated in England during the late 1600s as a race horse. One of the oldest stud books was established to maintain records and aid breeders in selecting for sound, fast race horses. Thoroughbred racing was popular and was adopted worldwide over the next 3 centuries. All modern Thoroughbred horses trace 81% of their genes to 31 ancestors.



Bravo is a male Thoroughbred, closely related to Twilight. He lives at the McConville Barn at Cornell University with Twilight. DNA from his blood cells was cut into large fragments and cloned into a tool called a bacterial artificial chromosome (BAC). The collect of clones is called a "BAC Library".

Scientists can use BAC libraries to find and study DNA sequences. Scientists use the information from Bravo's DNA together with Twilight's whole genome sequence to better understand the interplay of genetics, health and performance in horses.



Hrafnhetta is an Icelandic horse mare currently living in Prospect, Kentucky. She was chosen for random sequencing for comparison to the DNA sequence of Twilight. Icelandic horses come from Iceland and are noteworthy for their fast, comfortable ambling gait called a tölt. The population was established from horses brought by the Norwegians in the 9th century and maintained as an isolated breed.

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[Courier-Journal Web site wins award for horse project](#)
[Genetics may hold key to injury-prone horses](#)
[December 2008]

HORSE GENOME SEQUENCE COMPLETE

The first draft of the horse genome sequence was recently completed and deposited...
[\[JAVMA News, April 2007\]](#)

HORSE GENOME ASSEMBLED

<http://www.uky.edu/Ag/Horsemap/hgphorses.html>



Horse Genome Project

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AN INTERNATIONAL EFFORT

The Horse Genome Project is a collaborative effort by many research partners in North America, Europe, Asia, and Australia:



[\[North America\]](#) [\[Europe\]](#) [\[Asia\]](#) [\[Australia\]](#)

RECENT NEWS

[International Equine Genome Mapping Workshop](#)
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HORSE GENOME ASSEMBLED
Data on Equine Genome Freely Available to Researchers Worldwide
[NIH News, February 2007]

HORSE GENOME SEQUENCED
The first genome map of a horse complete...
[provides scientists with ne](#)

<http://www.uky.edu/Ag/Horsemap/hgppeople.html>



Twilight

Égua Puro-Sangue, da Cornell University Ithaca/ NY

Amostra de sangue

Foi escolhida devido ter menor diversidade de marcadores genéticos entre 10 cavalos testados



Kerstin Lindblad-Toh

Eli and Edythe L. Broad Institute, Massachusetts Institute of Technology and Harvard University / Cambridge

Senquenciamento do genoma de mamíferos: camundongo, cão, cavalo, chimpanzé, gambá



Claire Wade

Computational Biology and Animal Genetics, The University of Sydney

Projeto Genoma Equino

- ✓ gastos US\$ 15 milhões;
- ✓ Tamanho do genoma: 2,7 bilhões de pb de DNA;
- ✓ Mapa de variação genética entre raças (Andaluz, Puro-Sangue, Árabe, Quarto de Milha, Akel Teke, Icelandic, Standardbred)
- ✓ 1 milhão de SNPs - <http://www.broadinstitute.org/mammals/horse>
- ✓ 90 variantes genéticas similares aos distúrbios observados em seres humanos (musculoesqueléticas, doenças neuromusculares, cardiovasculares, respiratórias e de infertilidade)

→ Pesquisas Concluídas/Andamento:

- ✓ Imunodeficiência combinada severa do cavalo Árabe
- ✓ Paralisia periódica hipercalêmica do Quarto de Milha
- ✓ Síndrome branca letal no Paint Horse
- ✓ Laminite
- ✓ Deformidades ósseas
- ✓ Cólica
- ✓ Hipoplasia cerebelar
- ✓ Megacólon
- ✓ Doenças musculares
- ✓ Doenças ósseas
- ✓ Cor da pelagem
- ✓ Performance Atlética
- ✓ Fertilidade
- ✓ Comportamento



* Publicado dia 6 de novembro de 2009.



**Genome Sequence, Comparative Analysis, and
Population Genetics of the Domestic Horse**

C. M. Wade, *et al.*

Science **326**, 865 (2009);

DOI: 10.1126/science.1178158

Genome Sequence, Comparative Analysis, and Population Genetics of the Domestic Horse

C. M. Wade,^{1,2,3*} E. Giulotto,⁴ S. Sigurdsson,^{1,5} M. Zoli,⁶ S. Gnerre,¹ F. Imsland,⁵ T. L. Lear,⁷ D. L. Adelson,⁸ E. Bailey,⁷ R. R. Bellone,⁹ H. Blöcker,¹⁰ O. Distl,¹¹ R. C. Edgar,¹² M. Garber,¹ T. Leeb,^{11,13} E. Mauceli,¹ J. N. MacLeod,⁷ M. C. T. Penedo,¹⁴ J. M. Raison,⁸ T. Sharpe,¹ J. Vogel,¹⁵ L. Andersson,⁵ D. F. Antczak,¹⁶ T. Biagi,¹ M. M. Binns,¹⁷ B. P. Chowdhary,⁸ S. J. Coleman,⁷ G. Della Valle,⁶ S. Fryc,¹ G. Guérin,¹⁹ T. Hasegawa,²⁰ E. W. Hill,²¹ J. Jurka,²² A. Kiialainen,²³ G. Lindgren,²⁴ J. Liu,²⁵ E. Magnani,⁴ J. R. Mickelson,²⁶ J. Murray,²⁷ S. G. Nergadze,⁴ R. Onofrio,¹ S. Pedroni,¹⁴ M. F. Piras,⁴ T. Raudsepp,⁸ M. Rocchi,²⁸ K. H. Røed,⁹ O. A. Ryder,³⁰ S. Searle,¹⁵ L. Skow,¹⁸ J. E. Swinburne,³¹ A. C. Syvänen,²³ T. Tozaki,³² S. J. Valberg,²⁶ M. Vaudin,³¹ J. R. White,¹ M. C. Zody,^{1,5} Broad Institute Genome Sequencing Platform,¹ Broad Institute Whole Genome Assembly Team,¹ E. S. Lander,^{1,33} K. Lindblad-Toh^{1,5*}



Supporting Online Material for

Genome Sequence, Comparative Analysis, and Population Genetics of the Domestic Horse

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This PDF file includes:

Materials and Methods
SOM Text
Figs. S1 to S11
Tables S1 to S14
References

Sequenciamento

- O DNA de 1 égua (amostra de sangue)
- Biblioteca de BACs (314,972 BAC)
- Sequenciador ABI 3730 (Applied Biosystems)
- Arachne 2.0
- EquCab 2.0
- Genomas Humano, Bovino, Canino e Camundongo
- **Resultados:**
 - ✓ O tamanho do genoma é de 2.7 Gb
 - ✓ maior que o cão (2.5 Gb) e menor que o bovino e humano (2,9Gb)
 - ✓ 2% do DNA codifica proteína (98% “DNA Lixo”)
 - ✓ 46% do genoma são sequências repetitivas



Animais utilizados nos estudos genômicos

Table S1. Sources of Samples

Strain	Numb er	Use †	Contributor
Twilight - Thoroughbred	1	GSDR L	Cornell University (USA)
Andalusion Horse	1	SDRL	University of Kentucky (USA)/Kentucky Horse Park
Icelandic Horse	1	SDRL	University of Kentucky (USA)/Kentucky Horse Park
Akhal teke	1	SDRL	University of Kentucky (USA)/Kentucky Horse Park
Thoroughbred Horse	1	SDRL	University of Kentucky (USA)
Standardbred-Pacer	1	SDRL	University of Kentucky (USA)
Quarter Horse	1	SDRL	University of California -Davis (USA)
Arabian Horse	1	SDRL	University of Kentucky (USA)/Kentucky Horse Park
Przewalskii Horse (Equid)	1	RL	San Diego Zoo's Institute for Conservation Research (USA)
Donkey (Equid)	1	RL	San Diego Zoo's Institute for Conservation Research (USA)
Paso Fino	1	RL	University of Kentucky (USA)/Kentucky Horse Park
Exmoor Pony	1	RL	University College of Dublin (Ireland)
Trakehner	1	RL	University of Kentucky (USA)/Kentucky Horse Park
Friesian	1	RL	University of Kentucky (USA)/Kentucky Horse Park
Belgian draft	1	RL	University of Minnesota (USA)
Norwegian Fjord	1	RL	University of Kentucky (USA)/Kentucky Horse Park
Shire	1	RL	University of Kentucky (USA)/Kentucky Horse Park
Suffolk Punch	1	RL	University of Kentucky (USA)/Kentucky Horse Park
Lusitano	1	RL	University of Kentucky (USA)/Kentucky Horse Park
American Saddlebred	1	RL	University of Kentucky (USA)
French Trotter	1	RL	INRA (France)
Selle Francais	1	RL	INRA (France)
Thoroughbred	24	L	University of Kentucky (USA)
Arabian	24	L	University of Kentucky (USA)
Icelandic Horse	24	L	Uppsala University (Sweden)
Hokkaido	24	L	Laboratory of Racing Chemistry (Japan)
Belgian draft	24	L	University of Minnesota (USA)
Quarter horse	24	L	University of California -Davis (USA)
French Trotter	24	L	INRA (France)
Standardbred-Pacer	24	L	University of Kentucky (USA)
Hanoverian	24	L	Institute of Animal Breeding and Genetics (Germany)
Norwegian Fjord	24	L	Norwegian School of Veterinary Science (Norway)
Andalusian	24	L	University of Kentucky (USA)
Przewalskii Horse	8	R	San Diego Zoo's Institute for Conservation Research (USA)

† Genome sequencing (G), SNP discovery (S), Re-sequencing (R), L=Linkage Disequilibrium and Haplotype analysis (L)

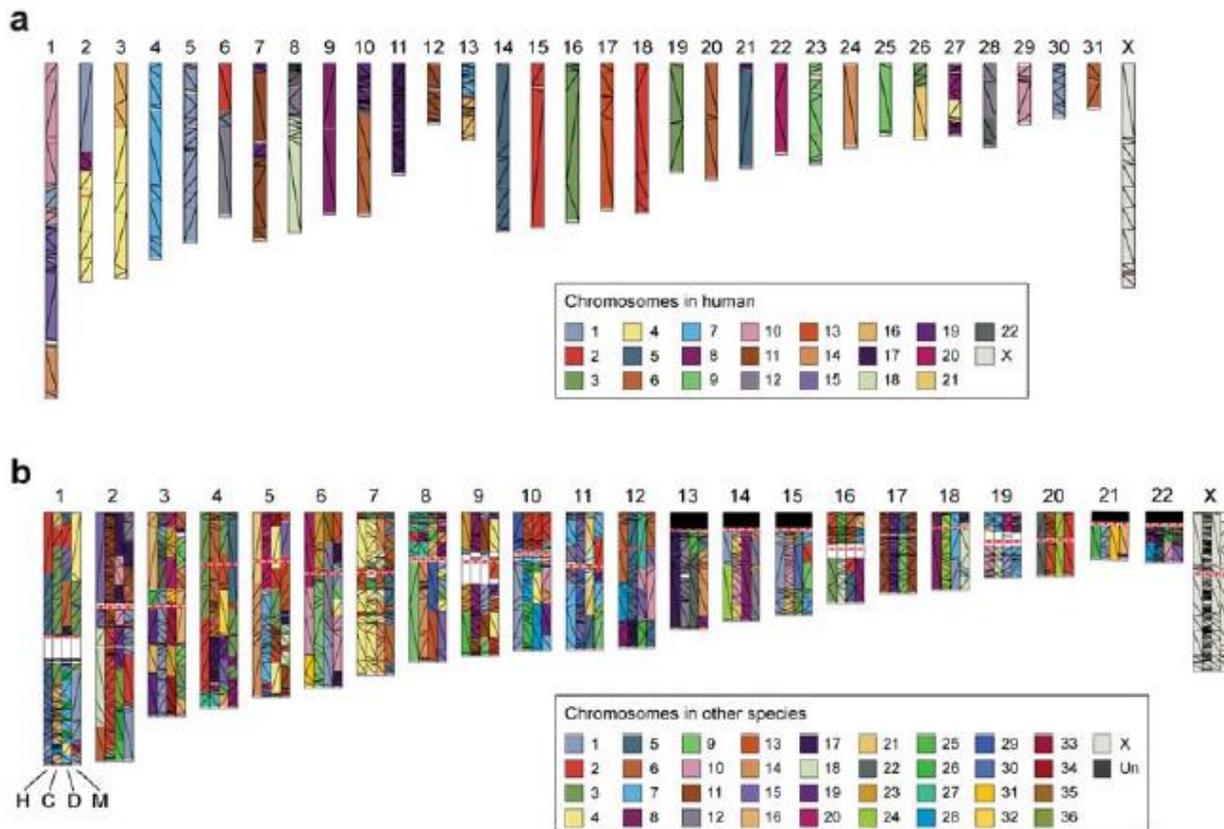
Equino x Humano

- revela sintonia conservada entre as espécies
- 17 cromossomos (53%) do cavalo compõem o material de 1 cromossomo humano (cão é 29%)
- 15.027 genes ortólogos com humanos
- 90 hereditariedades podem servir para modelo humano:
 - ✓ Infertilidade
 - ✓ Doenças inflamatórias
 - ✓ Desordens musculares

Sintonia: propriedade de dois ou mais genes estarem localizados no mesmo cromossomo em espécies diferentes.



Supporting Figures



Sintenia Conservada

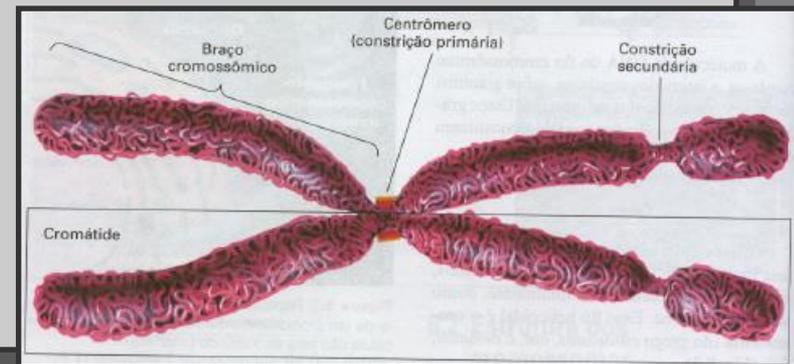
A - Cromossomos do Cavalo é colorido com o correspondente Humano

B - Cromossomos Humanos são coloridos com Cavalo (H), Bovino (C), Cão (D) e Camundongo(M).

Característica Inesperada

- Novo Centrômero Evolucionário (**ENC**) no cromossomo 11 (**ECA11**)
- mudança de posição centromérica sem rearranjo do cromossomo
 - ✓ ECA11 região conservada em mamíferos
 - ✓ formação evolutiva muito recente em equinos
 - ✓ é funcional e estável em todos os cavalos

* *Região Centromérica de mamíferos é tipicamente complexa, com repetições satélite em tandem*



a

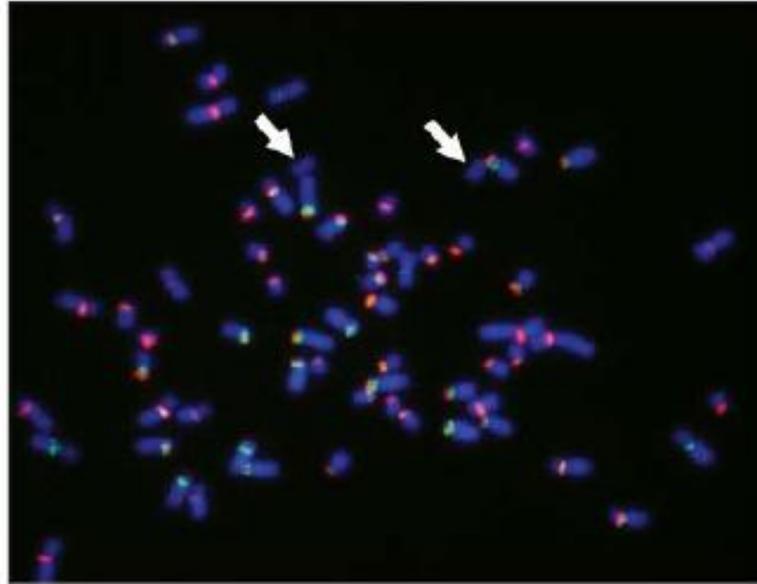
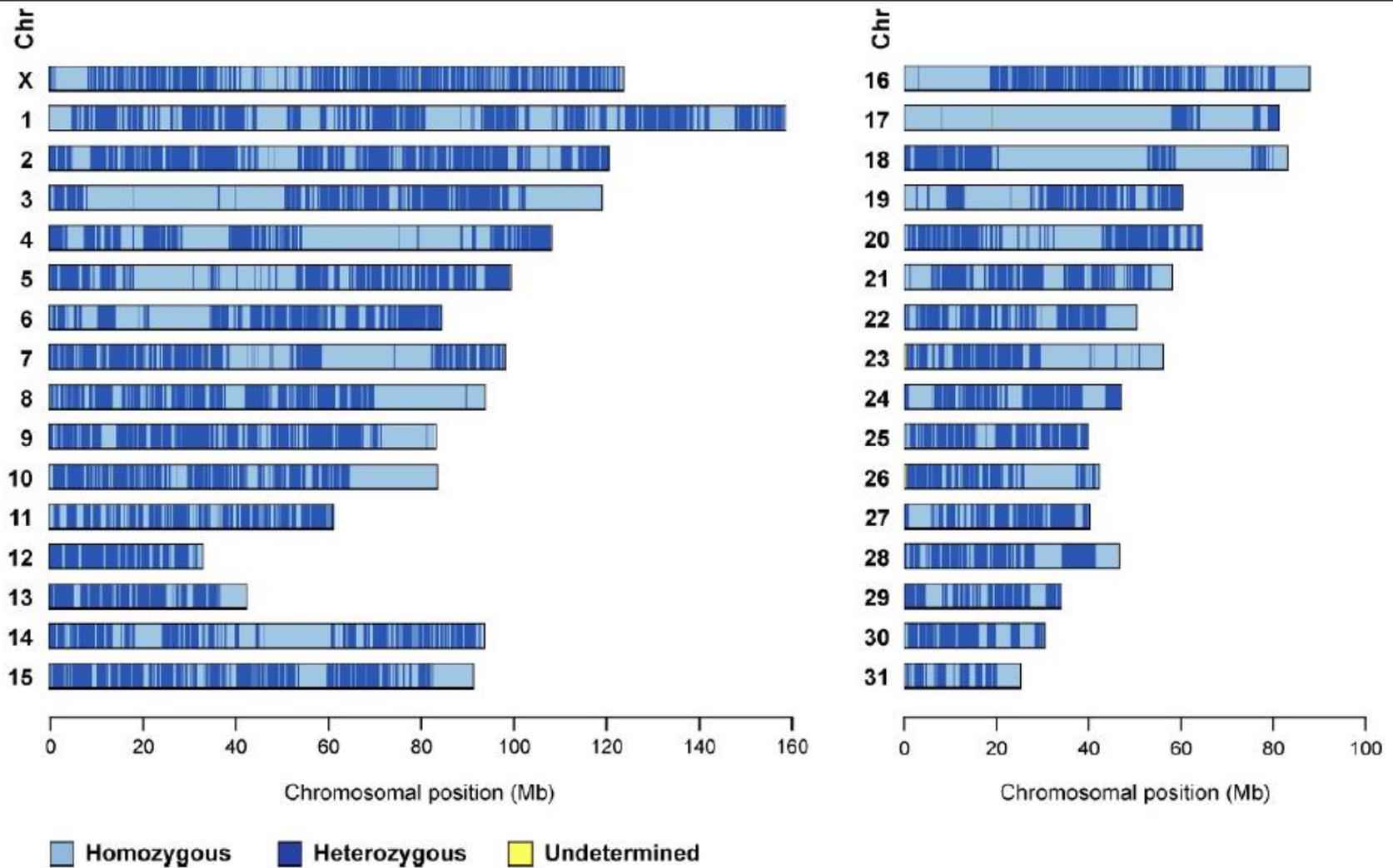
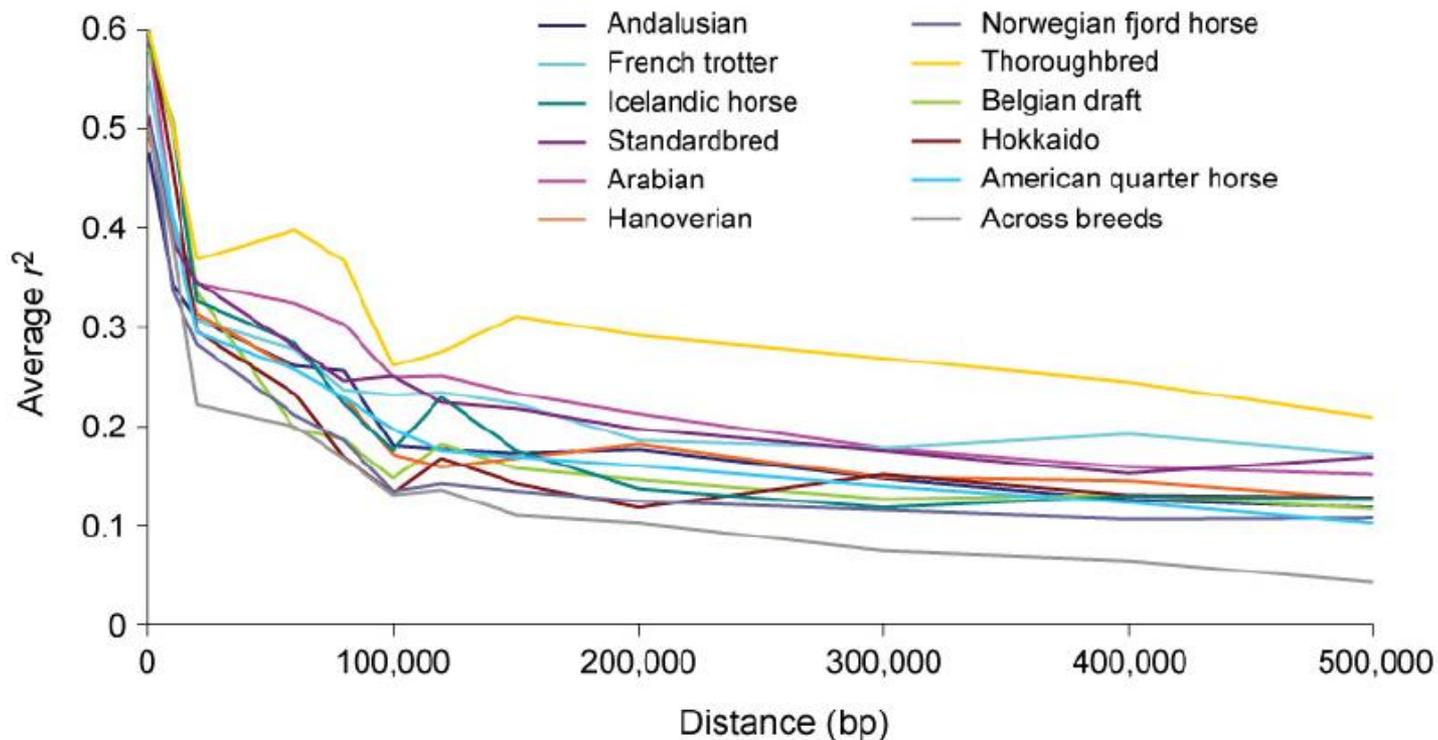


Fig. S2. Localization and sequence analysis of the ECA11 centromere. (a) Hybridization of the two major horse satellite sequences on horse chromosomes; the 23 bp repeat (2p1) is labeled in red and the 221 bp repeat (37cen) is labeled in green. All centromeres are labeled with one or both satellite probes except chromosome 11 (arrows). **(b)** Schematic representation of the cytogenetic localization of the primary



Homozignose no genoma do cavalo

- ✓ 46% homozigoto
- ✓ maior % observado entre os genomas seqüenciados



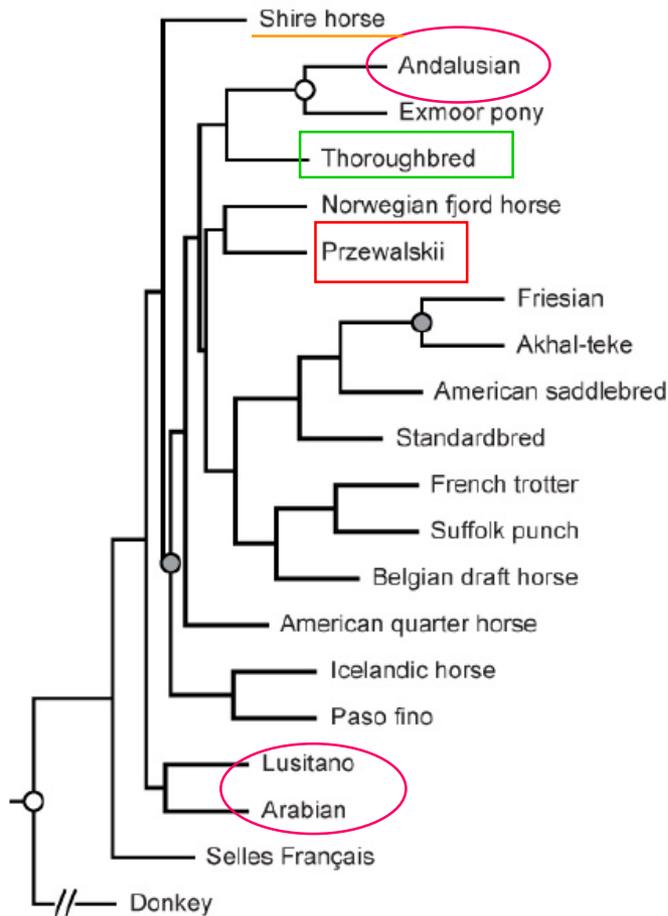
LD (Linkage Disequilibrium) por raça.

- ✓ Maioria das raças apresentam LD semelhante
- ✓ Puro-Sangue LD mais distante
- ✓ 100.000 SNPs para mapeamento de raças

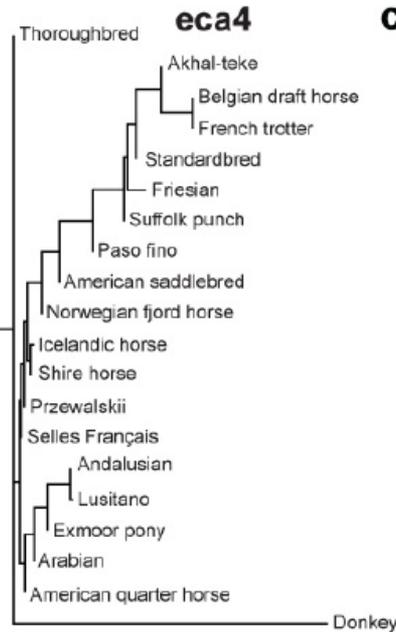
Desequilíbrio de Ligação: associação não-aleatória de polimorfismos em dois ou + locus, não necessariamente no mesmo cromossoma

a

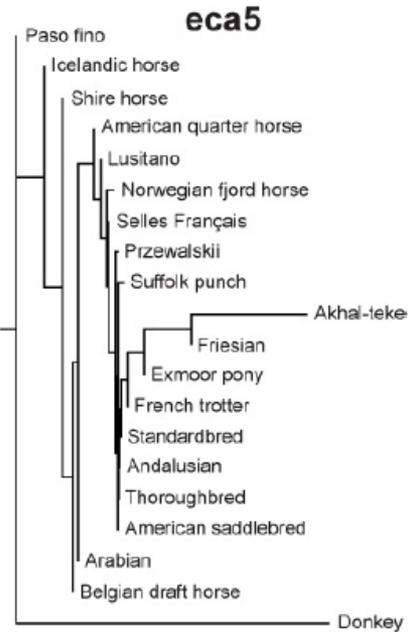
Filogenia



b



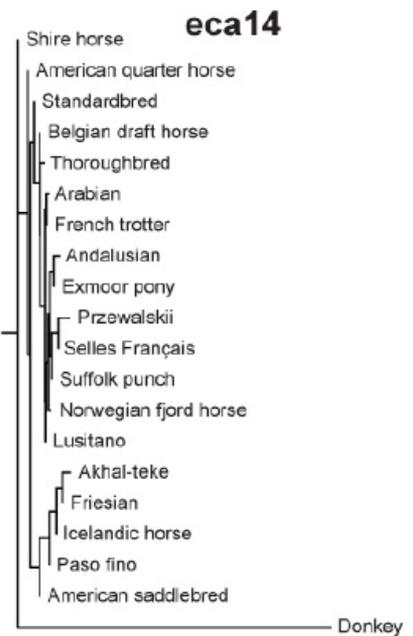
c



d



e





Shire



Przewalski



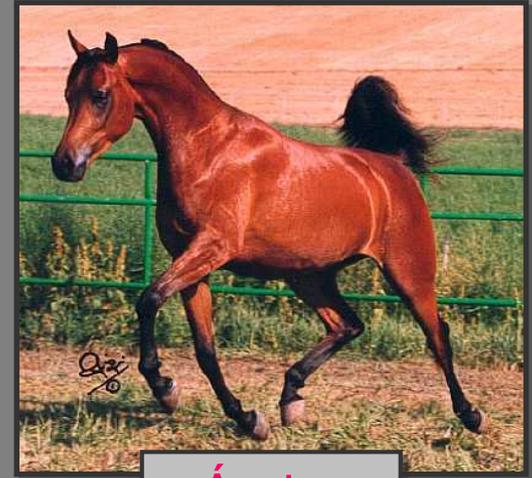
PSI



Lusitano



Andaluz



Árabé

SNP

- 98% dos SNPs são polimórficos (verdadeiros);
- sugerindo a expansão da população e estrangulamento da seleção genética;
- Raça Akhal Tekel apresenta menor nível de polimorfismo (61%) e SNPs específicos;
- Tx de SNP no cavalo é 1 / 1.200 pb ;
- Tx SNP similar ao homem e o cão
- 100.000 SNP para o mapeamento genético;
- Mapeamento de raças antigas;



Akhal Tekel

SNP



Standardbred

- 74,3% de polimorfismos
- maior nível de polimorfismo



Akhal Tekel

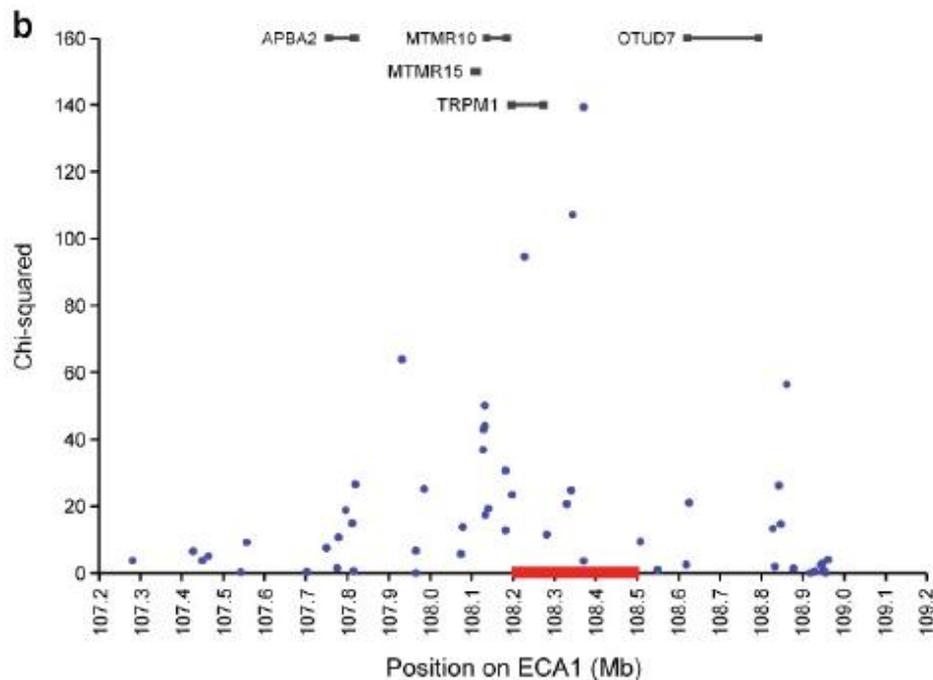
- 61% de polimorfismos
- menor nível de polimorfismo

Pelagem Leopardo do Apaloosa

a



b



- ✓ Heterozigoto – muitas manchas brancas
- ✓ Homozigoto – poucas manchas brancas (cegueira)
- ✓ 85 indivíduos Apaloosa – 70 SNP identificados, sendo 2 em regiões conservadas



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Animal Reproduction Science 107 (2008) 208–218

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Potential applications of equine genomics in dissecting diseases and fertility[☆]

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Introdução



■ Importância do mapeamento genético

*isolamento de genes e marcadores associados com características importantes economicamente, como:

- ✓ Resistência ou suscetibilidade a doenças
- ✓ Crescimento
- ✓ Reprodução
- ✓ Desempenho Atlético
- ✓ SNP (identificação rápida de doenças específicas dos cromossomos)
- ✓ Desenvolvimento de SNP-chip

Table 1a
Equine genetic disorders with available genetic tests

Trait/condition	Locus	Chromosome
Glycogen storage disease IV, GBED	GBE1	ECA26q
Hereditary equine regional dermal asthenia, HERDA	PPIB	ECA1
Herlitz junctional epidermolysis bullosa, H-JEB	LAMC2	ECA5p
Hyperkalemic periodic paralysis, HYPP	SCN4A	ECA11p
Overo lethal white foal syndrome, OLWFS	EDNRB	ECA17q
Polysaccharide storage myopathy, PSSM	GYS1	ECA10
Severe combined immunodeficiency, SCID	PRKDC	ECA9p

GBED: Quarto de Milha e Paint Horse, letal e recessiva

HERDA: Quarto de Milha, recessivo, potros de 1,5 anos.

H-JEB: semelhança Homem

HYPP: Quarto de Milha, semelhança Homem.

OLWFS: gene Overo

PSSM: 10% de Quarto de Milha e 36% de Belgas

SCID: 8% dos cavalos Árabes

Equine genetic disorders with known linked markers

Trait/condition	Locus	Chromosome
Anterior segment dysgenesis, ASD	ms	ECA6
Cerebellar abiotrophy	DMAP1, PRNPIP	ECA2p
Degenerative suspensory ligament desmitis, DSLD	ms	ECA14qter
Endurance performance	ACE	ECA11
Epitheliogenesis imperfecta	LAMA3	ECA8
Fertility (sperm-egg fusion)	CRISP1	ECA20q
Insect bite hypersensitivity, IBH	HMS01	ECA15
Laminitis	KIT downregulation	ECA3
Osteochondrosis and navicular disease	8 candidate genes, SNPs	Five chromosomes
Recurrent airway obstruction	ms	ECA13
Recurrent exertional rhabdomyolysis, RER	ms, gene exclusion	ECA4/ECA12?
Sex reversal	Y deletion including SRY	ECAY

✓ Projeto em andamento no Texas para determinar SNPs e expressão gênica ligados a regulação da fertilidade e determinação do sexo. Analisando em condições de anormalidades.

✓ 10 – 15% da infertilidades do Homem são causadas em mutações no Y

Banco de Dados

Equus Caballus Assembly V1 - Mozilla Firefox

Arquivo Editar Exibir Histórico Favoritos Ferramentas Ajuda

Oiel - primleon@gmail.com - G... x Methotrexate diethyl ester-load... x Equus Caballus Assembly V1 x Horse Genome Project x NOX5 NADPH oxidase, EF-hand ... x Google Tradutor x +

genomes.sapac.edu.au/equine/cgi-bin/gbrowse/equine_v1/ equine genome

Equus Caballus Assembly V1

Instructions
Search using a sequence name, gene name, locus, or other landmark. The wildcard character * is allowed. To center on a location, click the ruler. Use the Scroll/Zoom buttons to change magnification and position.
Examples: chr30, chr30:80,000..120,000.

[\[Help\]](#) [\[Reset\]](#)

Search
Landmark or Region: Search

Data Source
Equus Caballus Assembly V1

Reports & Analysis:
Download Decorated FASTA File

Tracks
 All on All off

<input type="checkbox"/> contig	<input type="checkbox"/> gene	<input type="checkbox"/> pseudogenic_transcript	<input type="checkbox"/> STS
<input type="checkbox"/> DBEST	<input type="checkbox"/> OMIM	<input type="checkbox"/> RepeatMasker	<input type="checkbox"/> tRNA
<input type="checkbox"/> EST by EquineGenome	<input type="checkbox"/> polypeptide	<input type="checkbox"/> Repeats By Piler	
<input type="checkbox"/> Gap	<input type="checkbox"/> pseudogene	<input type="checkbox"/> SNPs	

Display Settings
Image Width: 450 640 800 1024
Highlight feature(s) (feature1 feature2...):

Key position
 Between Beneath Left Right
Highlight regions (region1:start..end region2:start..end):

Track Name Table
 Alphabetic Varying
 Show grid

Add your own tracks
Upload your own annotations: [\[Help\]](#)
Upload a file Nenhum arquivo selecionado.

Add remote annotations: [\[Help\]](#)

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Banco de Dados

Equus caballus (ID 145) - Genome - NCBI - Mozilla Firefox

Arquivo Editar Exibir Histórico Favoritos Ferramentas Ajuda

Entrada (1.098) - primleon@gm... x Methotrexate diethyl ester-load... x Equus Caballus Assembly V1 x Horse Genome Project x Equus caballus (ID 145) - Genom... x Google Tradutor x +

www.ncbi.nlm.nih.gov/genome?term=equus caballus

O Firefox impediu que o plugin desatualizado "Adobe Flash" fosse executado em www.ncbi.nlm.nih.gov.

NCBI Resources How To Sign in to NCBI

Genome Genome equus caballus Search

Save search Limits Advanced Help

Display Settings: Overview Send to:

Organism Overview ; Genome Project Report ; Genome Annotation Report ; Organelle Annotation Report

 **Equus caballus (horse)**
horse

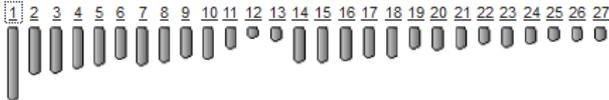
Lineage: Eukaryota[2419]; Metazoa[917]; Chordata[352]; Craniata[346]; Vertebrata[346]; Euteleostomi[338]; Mammalia[136]; Eutheria[131]; Laurasiatheria[54]; Perissodactyla[7]; Equidae[5]; Equus[4]; Equus[1]; Equus caballus[1]

Equus caballus, the domestic horse, has played a crucial role in the development of human civilization. It has economic importance throughout the world and is used for transportation, work, entertainment, and even war. It is a model organism for research on biomechanics and exercise physiology. The genome sequence will facilitate the identification [More...](#)

Representative

Reference genome:
[Equus caballus EquCab2.0](#)

Chromosomes



28 29 30 31 X

Related information

- BioProject
- Gene
- Components
- Protein
- PubMed
- Taxonomy

Search details

"Equus caballus" [Organism]

Search See more...

Recent activity

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Horse Genome Project | Broad Institute of MIT and Harvard - Mozilla Firefox

Arquivo Editar Exibir Histórico Favoritos Ferramentas Ajuda

Entrada (1.098) - primleon... x Methotrexate diethyl ester... x Equus Caballus Assembly ... x Horse Genome Project x Horse Genome Project | Br... x Equine (Horse) Genome Ef... x Google Tradutor x +

www.broadinstitute.org/mammals/horse

equine genome

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Horse Genome Project

The domestic horse, *Equus caballus*, is a member of the mammalian order *Perrisodactyla*. The horse genome is being sequenced for two reasons. It is expected to help identify functional genome features common to all **mammals**, and it will serve as a tool for researchers to better understand the diseases that affect equines. The recent creation of modern breeds and the presence of specific diseases within certain breeds together suggest that trait mapping may be relatively easy within horse breeds. Since horses and humans share a number of medical conditions (such as allergies and arthritis), mapping disease genes using horse populations may in turn benefit human health.

The equine genome sequencing project, performed mostly at the Broad Institute, has produced a high-quality draft sequence of a female thoroughbred horse. BAC end reads for the project were generated by the University of Veterinary Medicine, in Hanover, and the Helmholtz Centre for Infection Research in Braunschweig, Germany. In addition, the project generated a large collection of single-nucleotide polymorphisms (SNPs), to allow the mapping of genetic traits in horse populations. SNPs will be identified from a variety of modern and ancestral breeds, including the Akal-teke, Andalusian, Arabian, Icelandic, Quarterhorse, Standardbred, and Thoroughbred.

Current Status

Initial Shotgun Sequence 6.8X complete



EquineSNP50 Genotyping BeadChip

The EquineSNP50 Genotyping BeadChip features more than 54,000 evenly spaced and validated SNPs derived from the EquCab2 assembly. This 12-sample Infinium® BeadChip presents a cost-effective and high-quality genotyping solution for equine research.

EquineSNP50 BeadChip Highlights

- **Uniform Coverage:**
High-density, evenly distributed coverage across the entire genome
- **High Throughput:**
12 samples per BeadChip, 54,602 SNP assays per sample
- **Streamlined Workflow:**
PCR-free protocol
- **Low Sample Input:**
200 ng per sample
- **Integrated Data Analysis:**
BeadStudio Software

Introduction

The EquineSNP50 Genotyping BeadChip was developed in collaboration with the International Equine Genome Mapping Workshop¹ and the Morris Animal Foundation's Equine Genome Consortium². This

Figure 1: EquineSNP50 BeadChip

