

# Race & Genetics

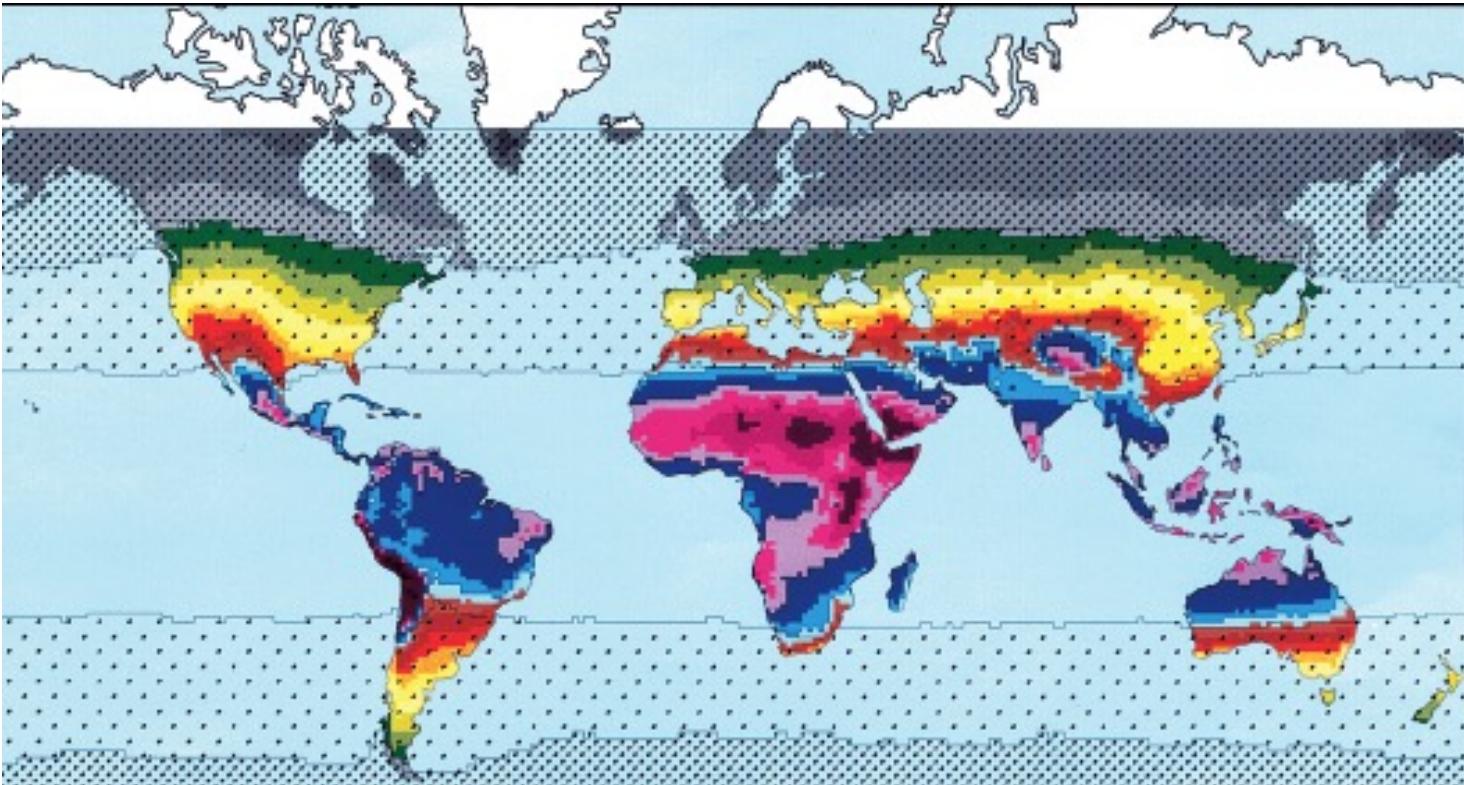
“I am, somehow, less interested in the weight and convolutions of Einstein’s brain than in the near certainty that people of equal talent have lived and died in cotton fields and sweatshops”

~Stephen J. Gould

**Is there a biological basis for race?**

# The Biology of Skin Color –

## A function of UV prevalence and diet in human populations

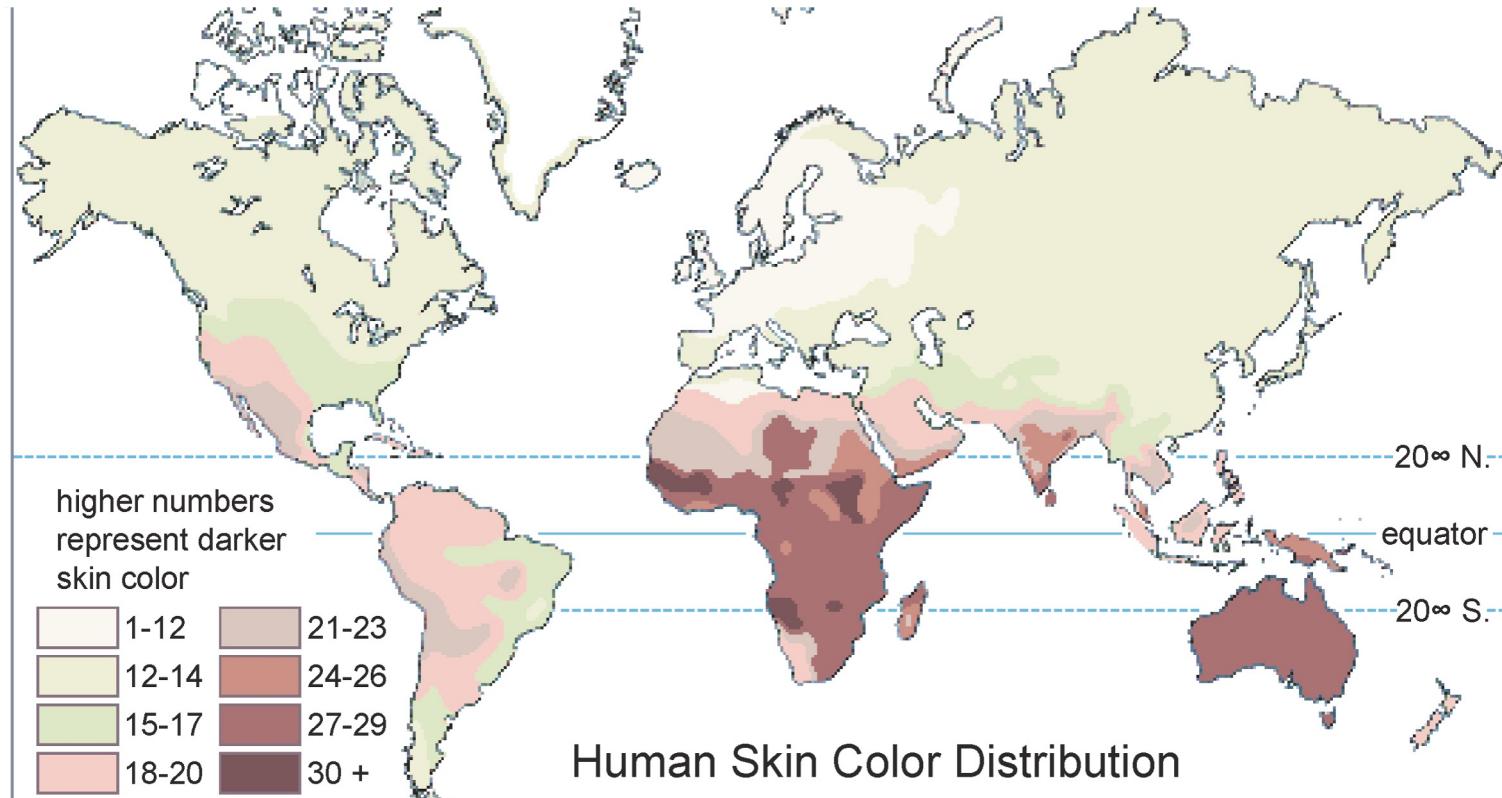


UV Intensity on Earth

Jablonski and Chaplin 2000. J Human Evol

# The Biology of Skin Color –

## A function of UV prevalence and diet in human populations



Human Skin Color

Barsh et al., 2003 PNAS

# The Biology of Skin Color –

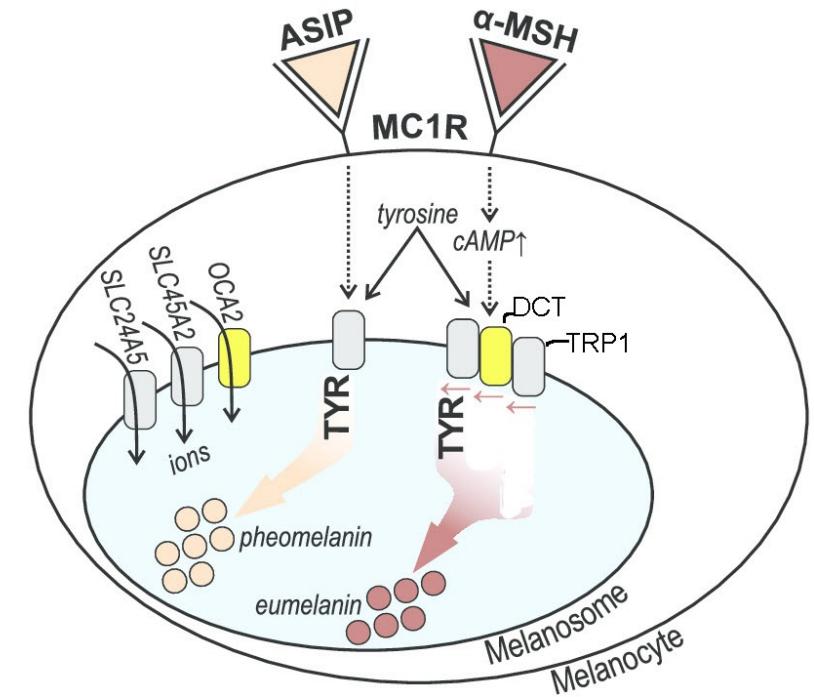
A function of UV prevalence and diet in human populations

Melanin produced via the MC1R pathway (figure), encoded by the MC1R gene

Eumelanin provides a brown – black pigment

Pheomelanin provides a red – brown pigment

Ratio of eumelanin to pheomelanin determines skin color

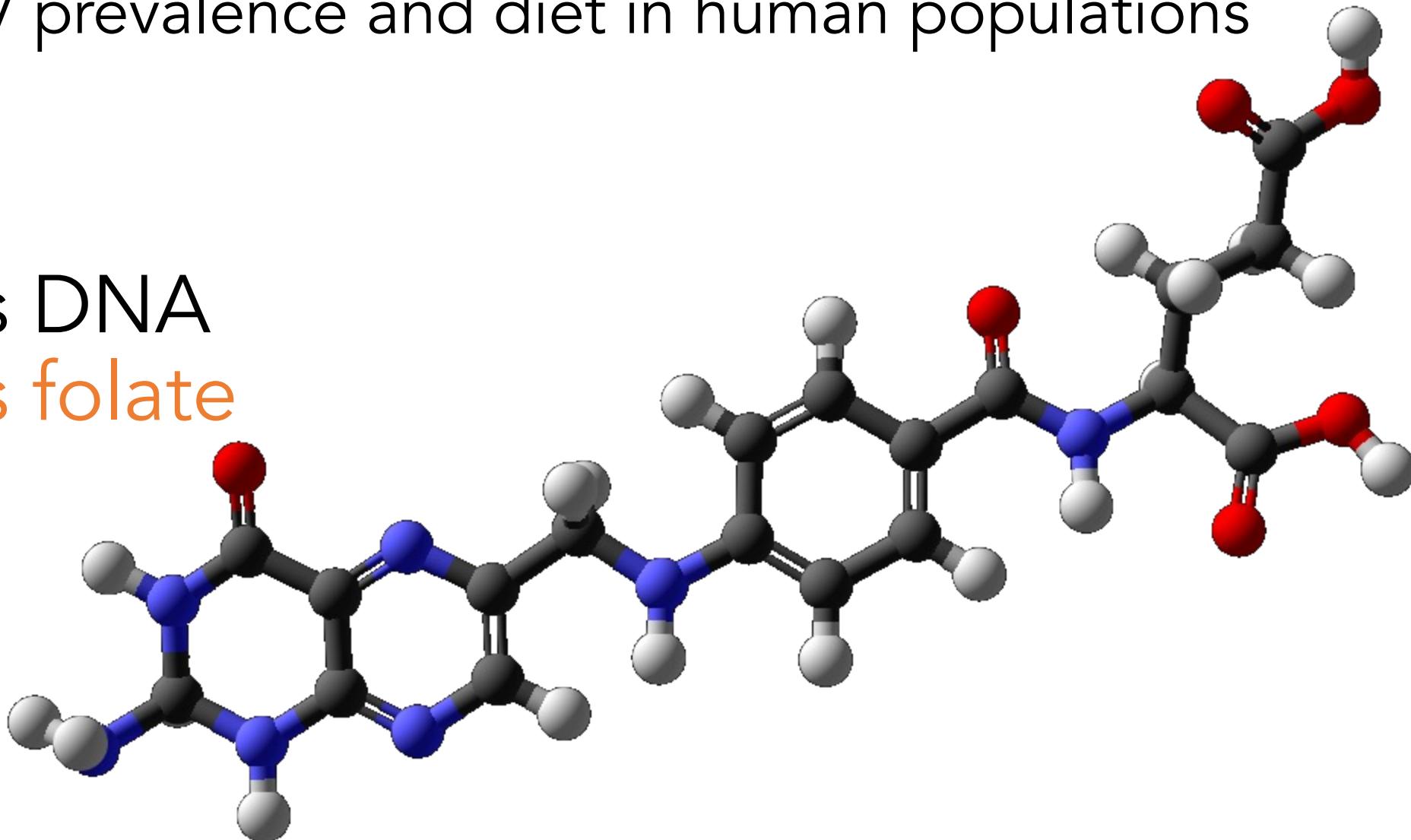


# The Biology of Skin Color –

A function of UV prevalence and diet in human populations

## Eumelanin

- protects DNA
- protects folate



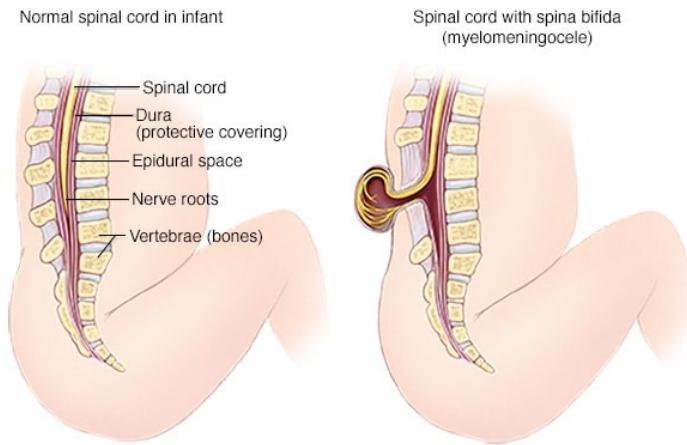
By KaiserDog21 - Created with ChemDraw Professional and Discovery Studio Visualizer., CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=67823174>

# The Biology of Skin Color –

## A function of UV prevalence and diet in human populations

Eumelanin

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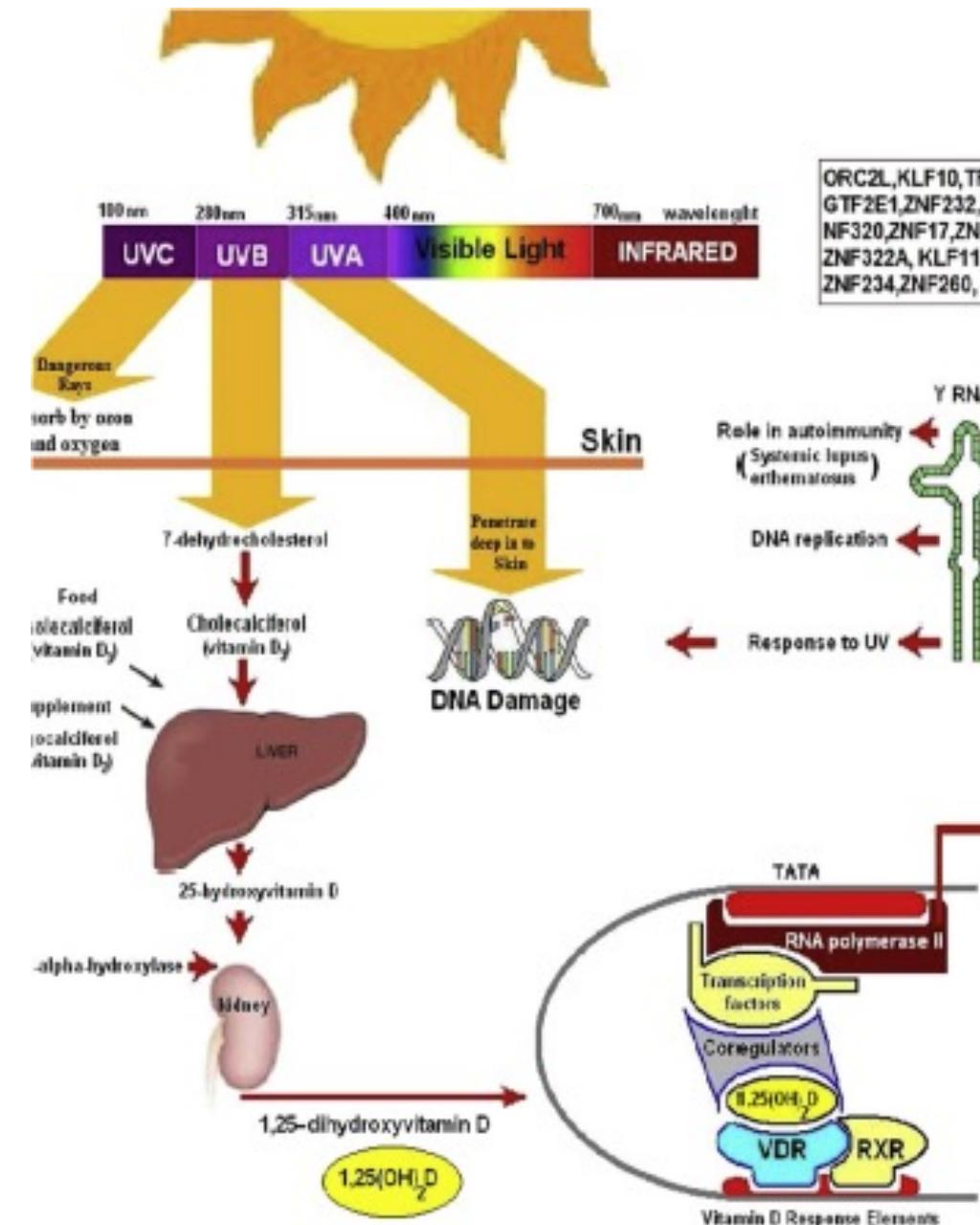
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**Why don't we all have dark skin?**

# The Biology of Skin Color – A function of UV prevalence and diet in human populations

Vitamin D synthesis requires UVB light

If eumelanin blocks UV, vitamin D must  
be ingested through diet



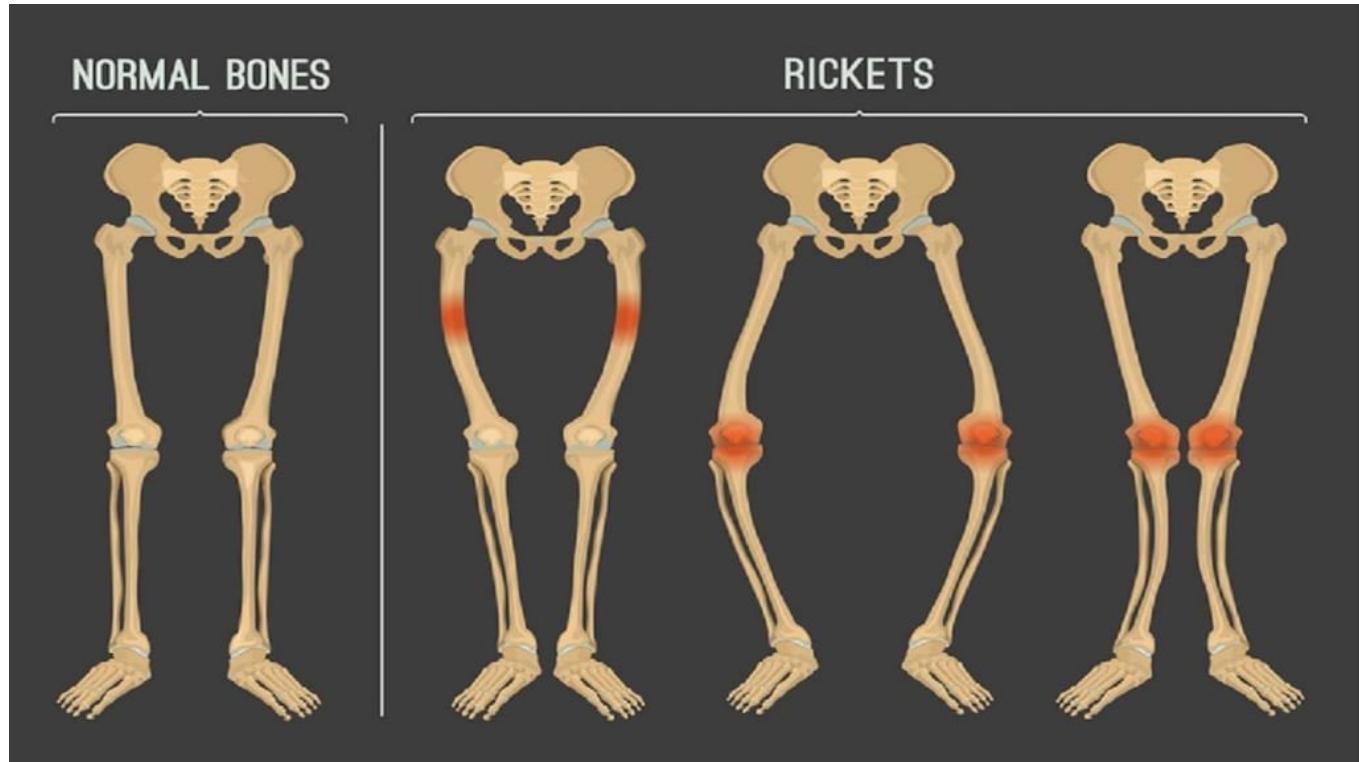
Holick 2014. J. Clin. Trans. Epidim

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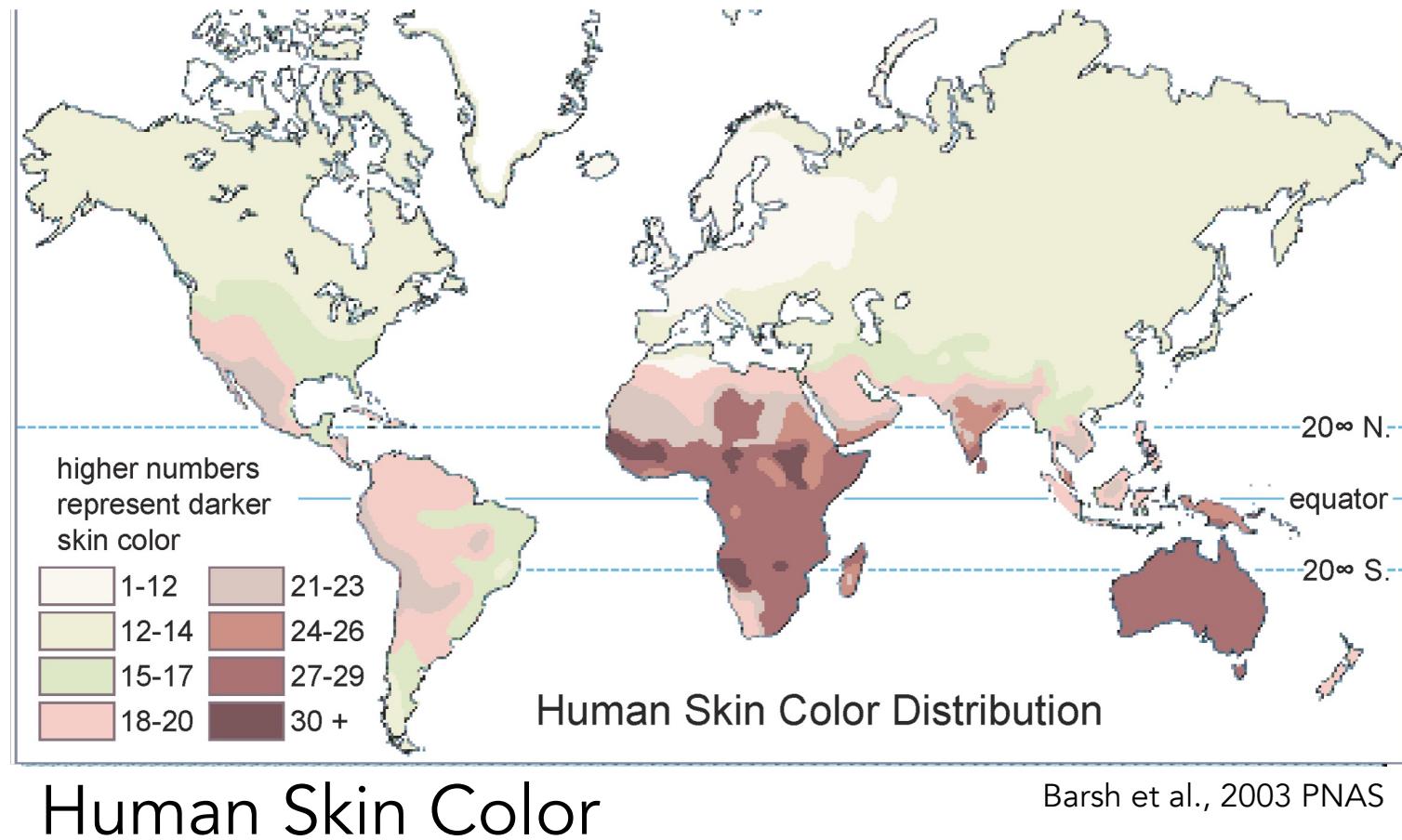
# The Biology of Skin Color –

## A function of UV prevalence and diet in human populations

Trade-off between UV protection and vitamin D synthesis governs skin color distributions

MC1R shows little variation in African populations  
(strong negative selection)

MC1R variation not linked to variation in other traits



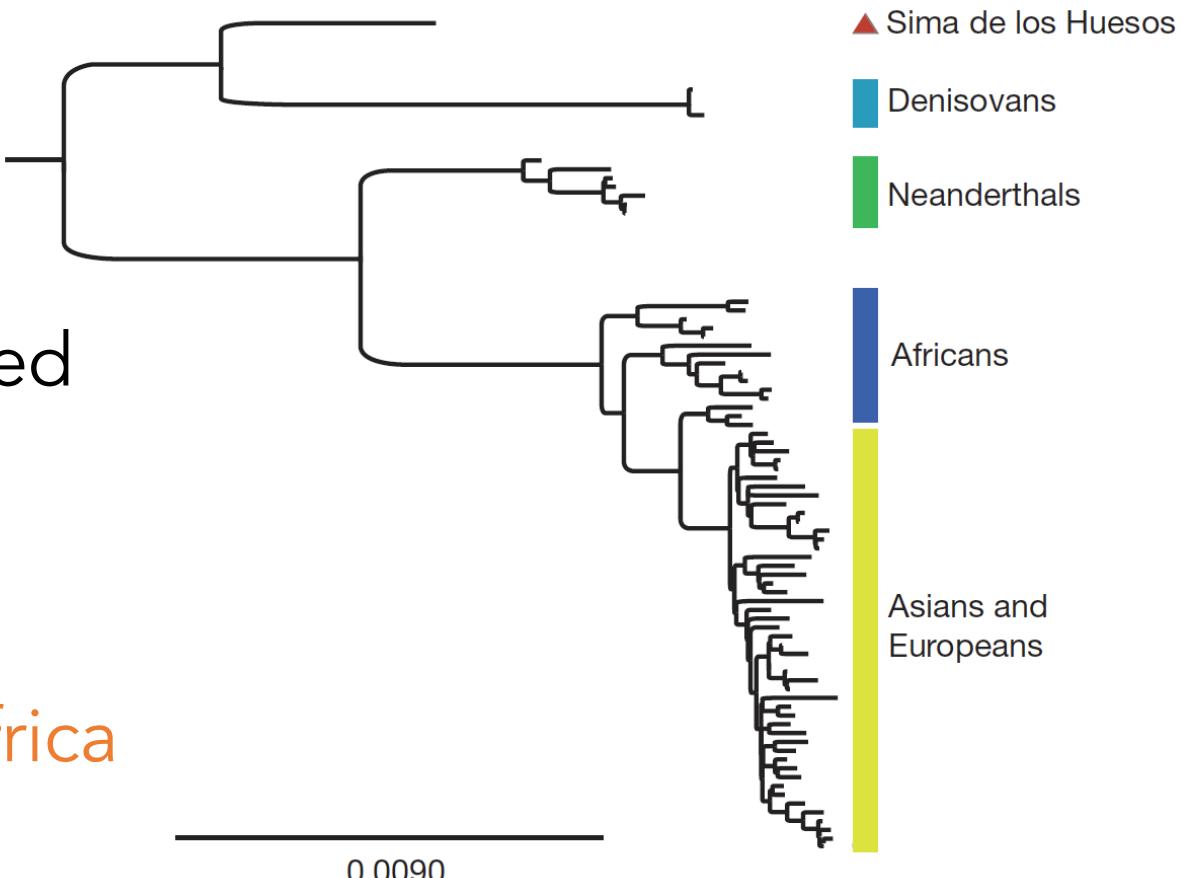
Barsh et al., 2003 PNAS

# Population genetics of humans –

## Non-African humans are a subset of African humans

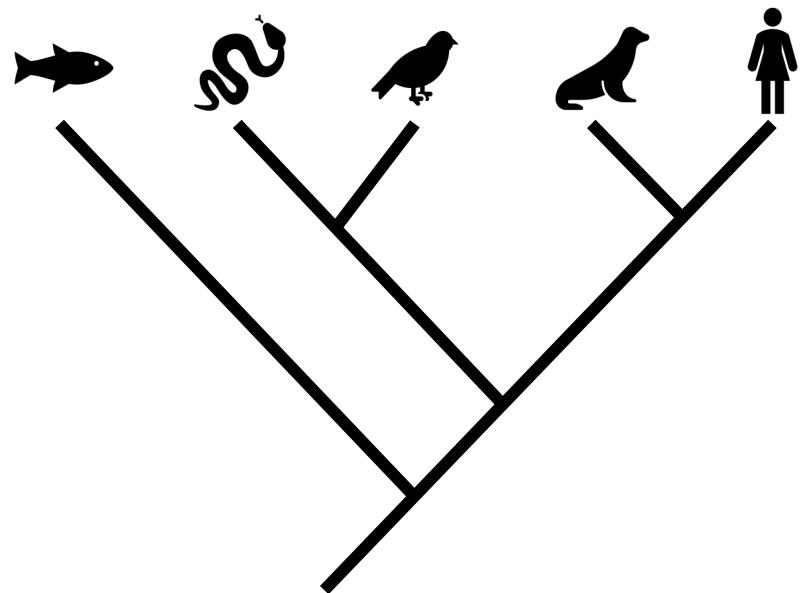
Non-African populations are nested  
within African populations –

We are all African, we just vary in  
how long ago our ancestor left Africa



mtDNA tree – Meyer et al. 2014 *Nature*

# Detour: How to read a phylogenetic tree

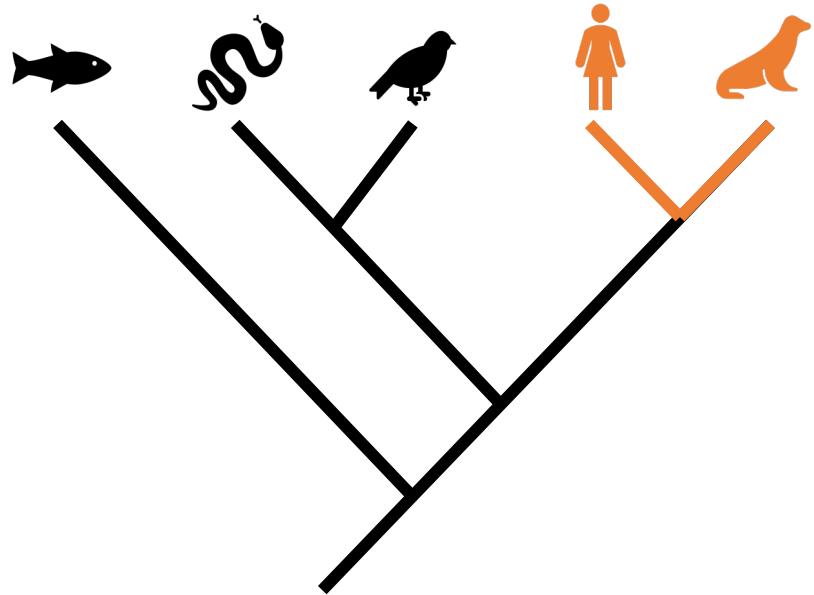


Trees are nested, hierarchical relationships

Read them from root to tips!!  
Not tips to root.

Nodes can rotate (like a mobile), but  
the branches can't change to new  
nodes

# Detour: How to read a phylogenetic tree



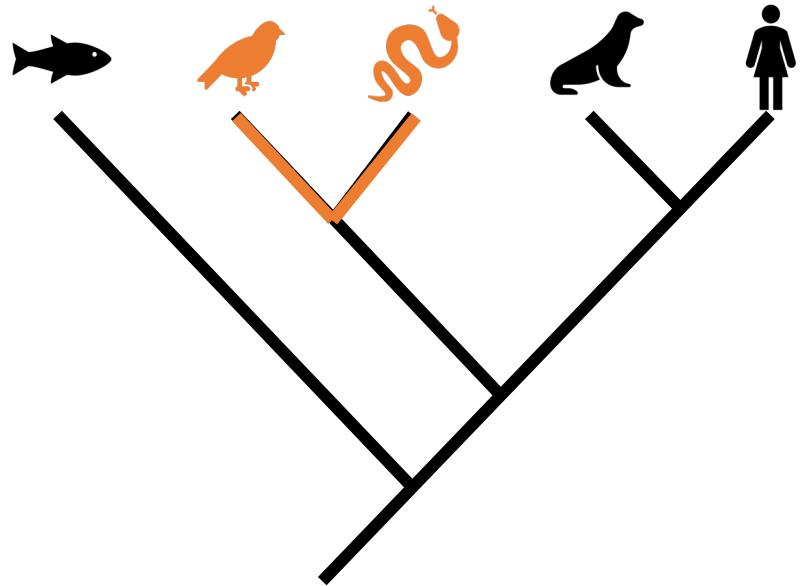
Same tree as before

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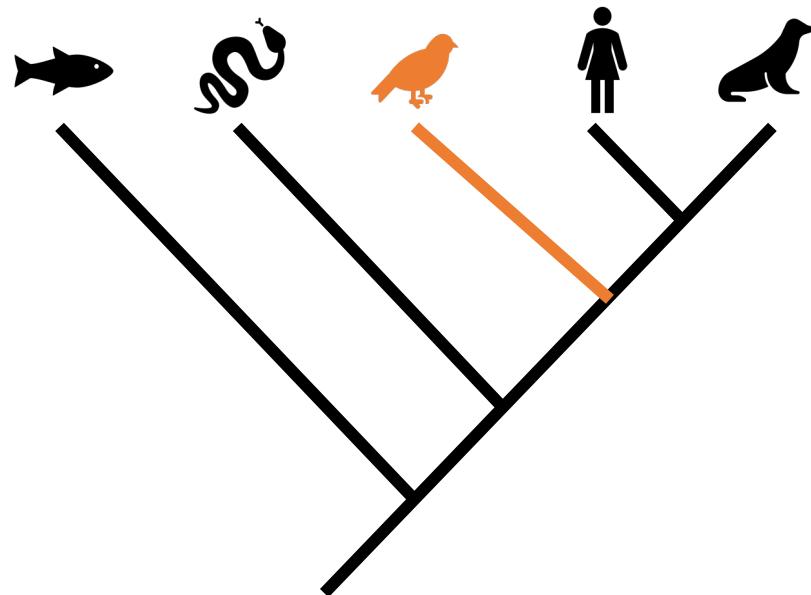
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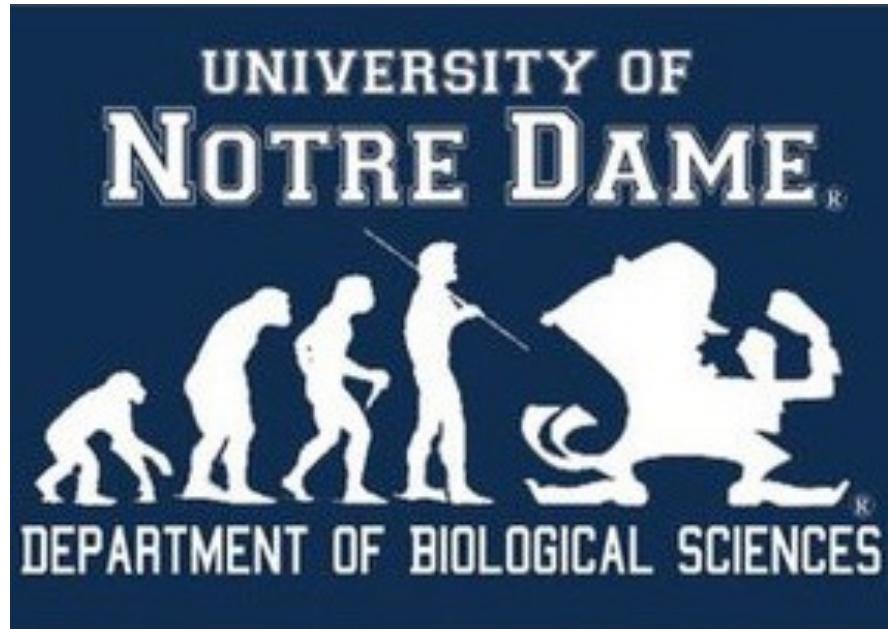
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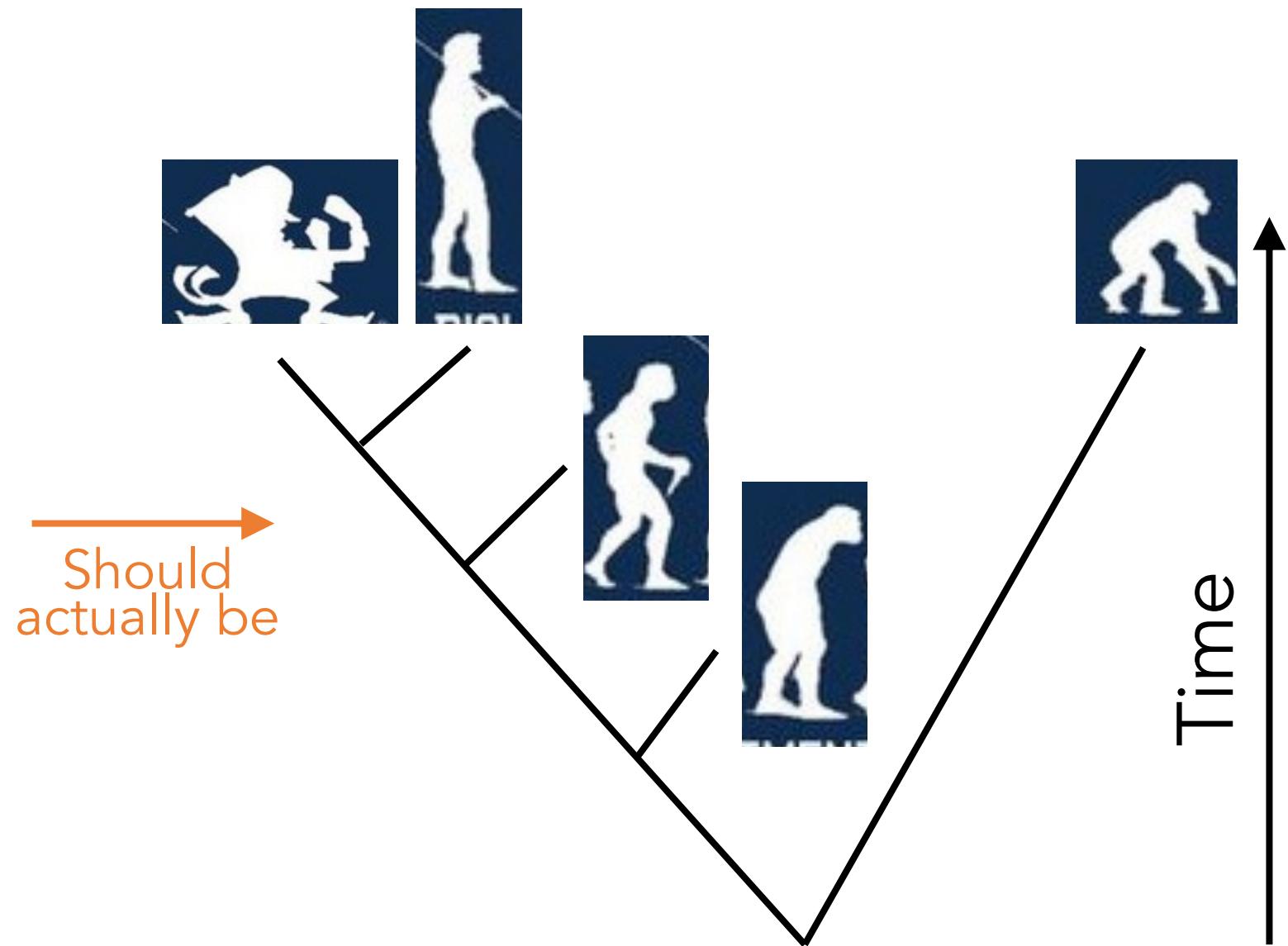
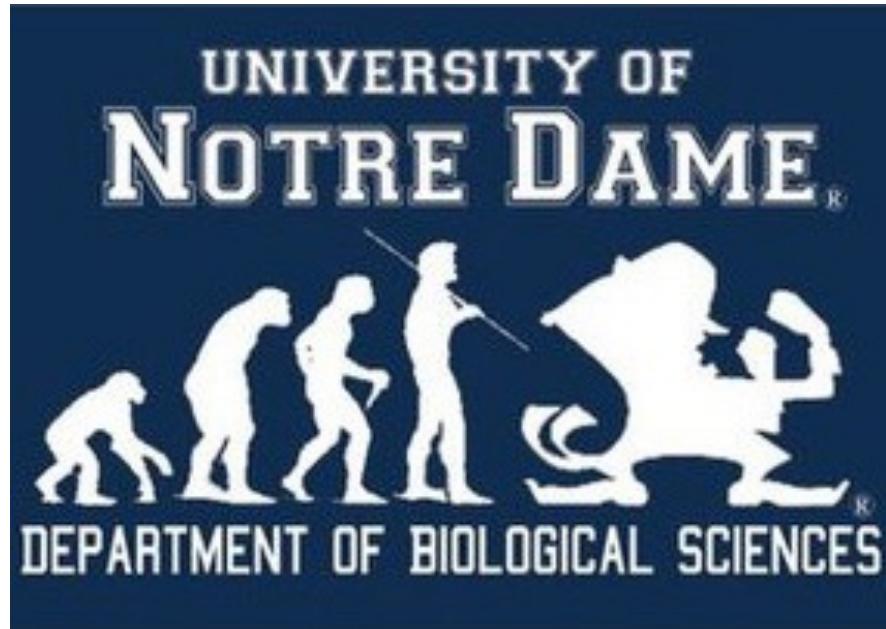
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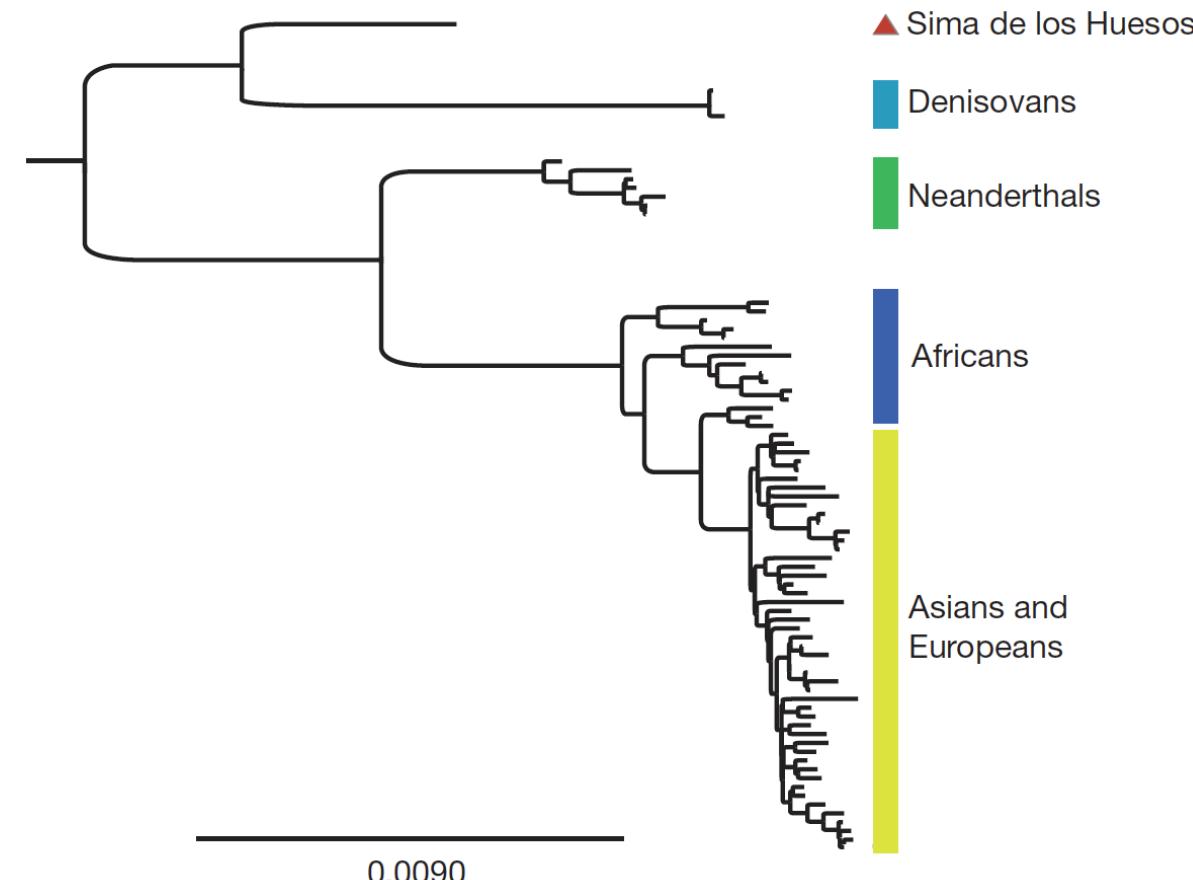
Should  
actually be

# Population genetics of humans –

Non-African humans are a subset of African humans

Non-African populations are nested within African populations –

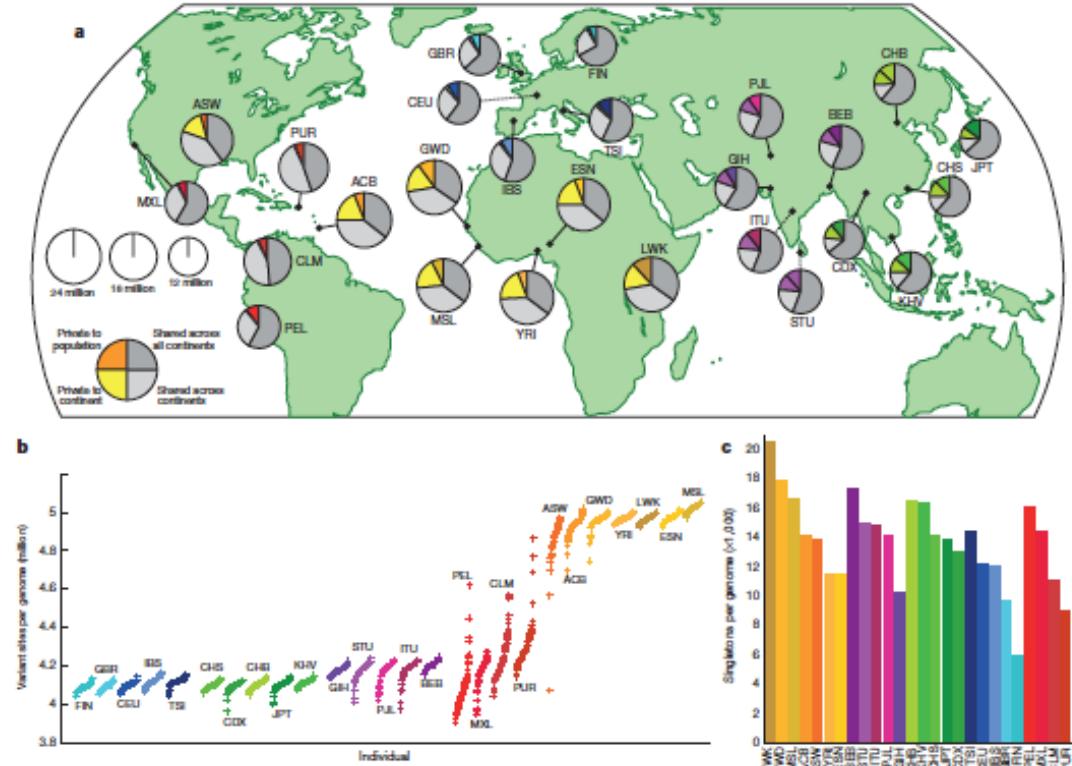
We are all African, we just vary in how long ago our ancestor left Africa



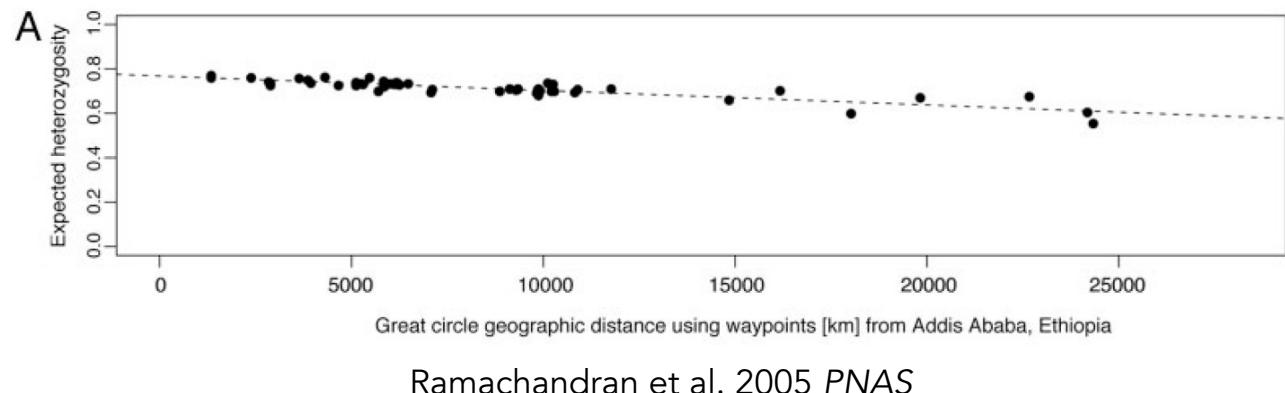
mtDNA tree – Meyer et al. 2014 Nature

# Population genetics of humans –

## Non-African humans are a subset of African humans



1000 Genomes project. 2015. Nature



Ramachandran et al. 2005 PNAS

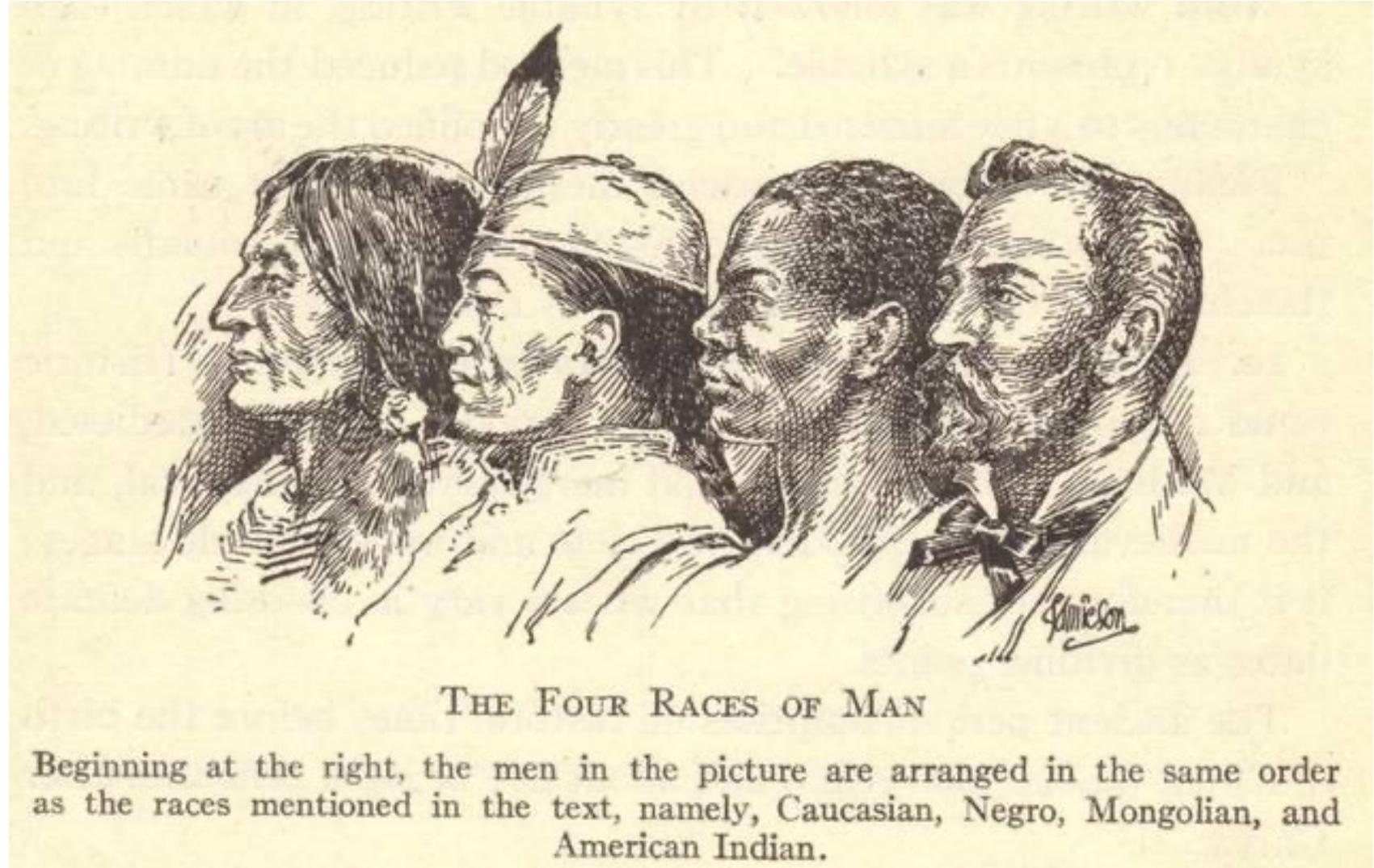
African populations harbor more genetic diversity than non-African populations

# **Is there a biological basis for race?**

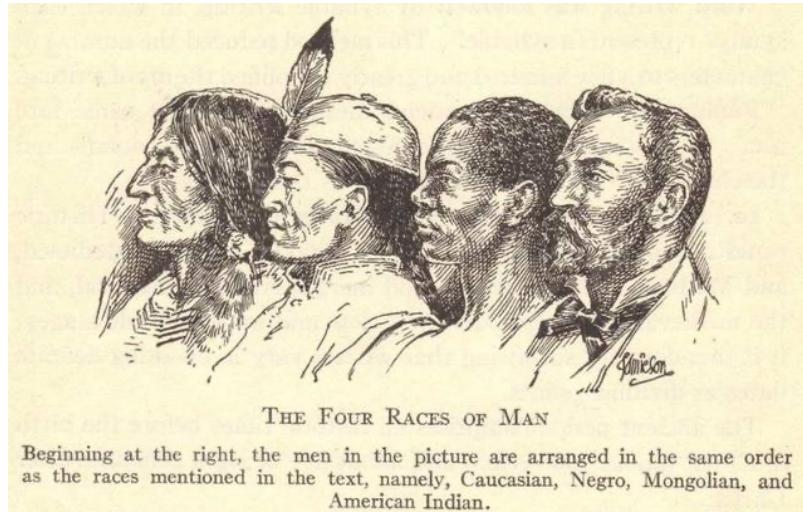
**There is no evolutionary basis  
for human races**

# The (Ongoing) Eugenics Movement

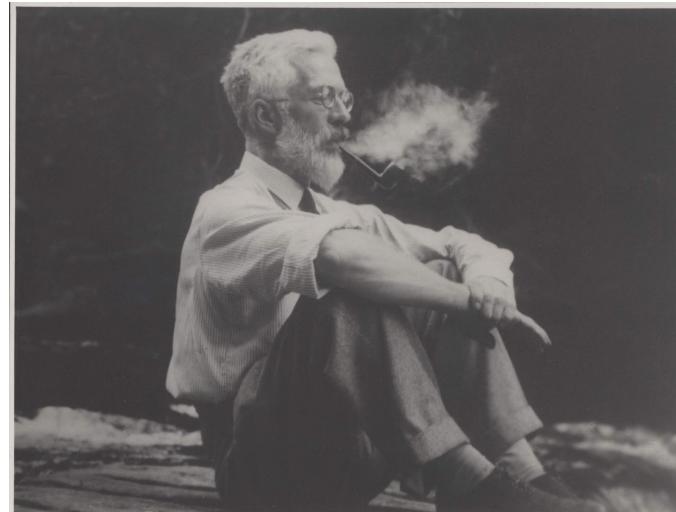
Carl Linnaeus  
Systema Naturae  
Father of Modern Taxonomy



# Roots of racism in genetics run deep



Carl Linnaeus  
Father of Taxonomy

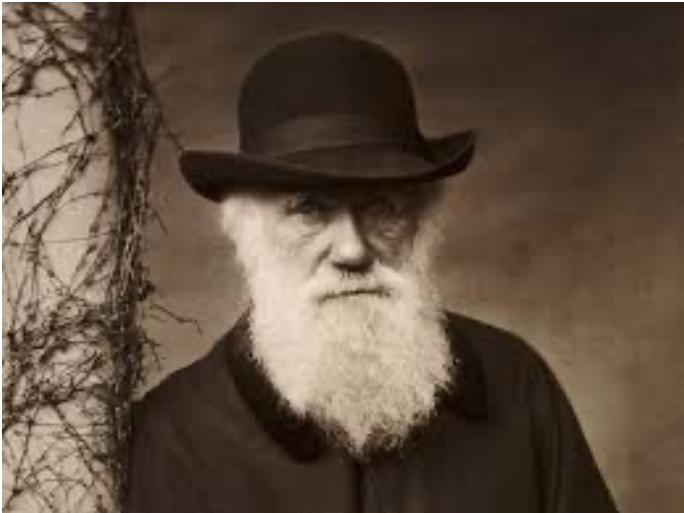


Ronald A. Fisher  
Architect of Modern Synthesis  
Eugenicist

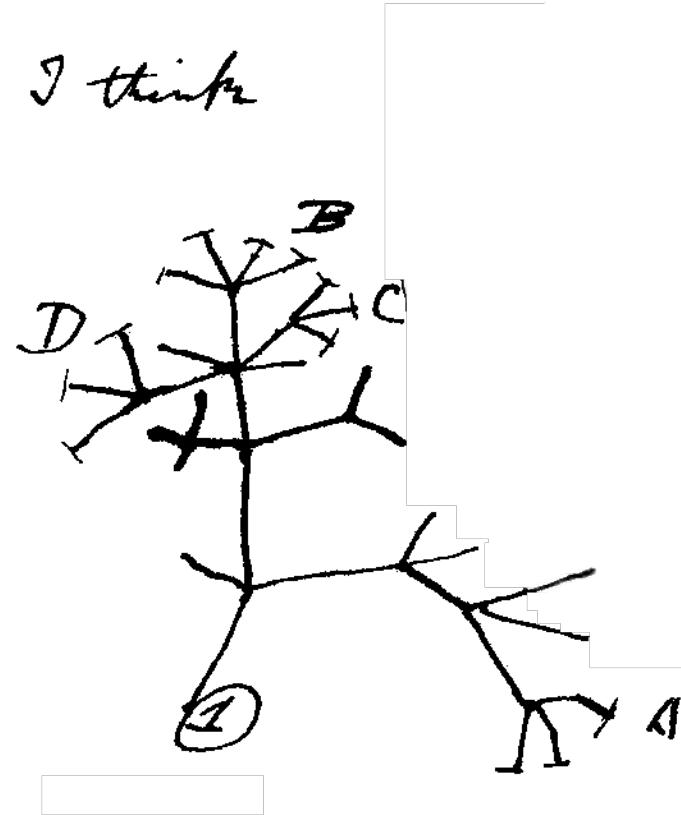


James Watson  
Famous for structure of DNA  
Eugenicist, racist

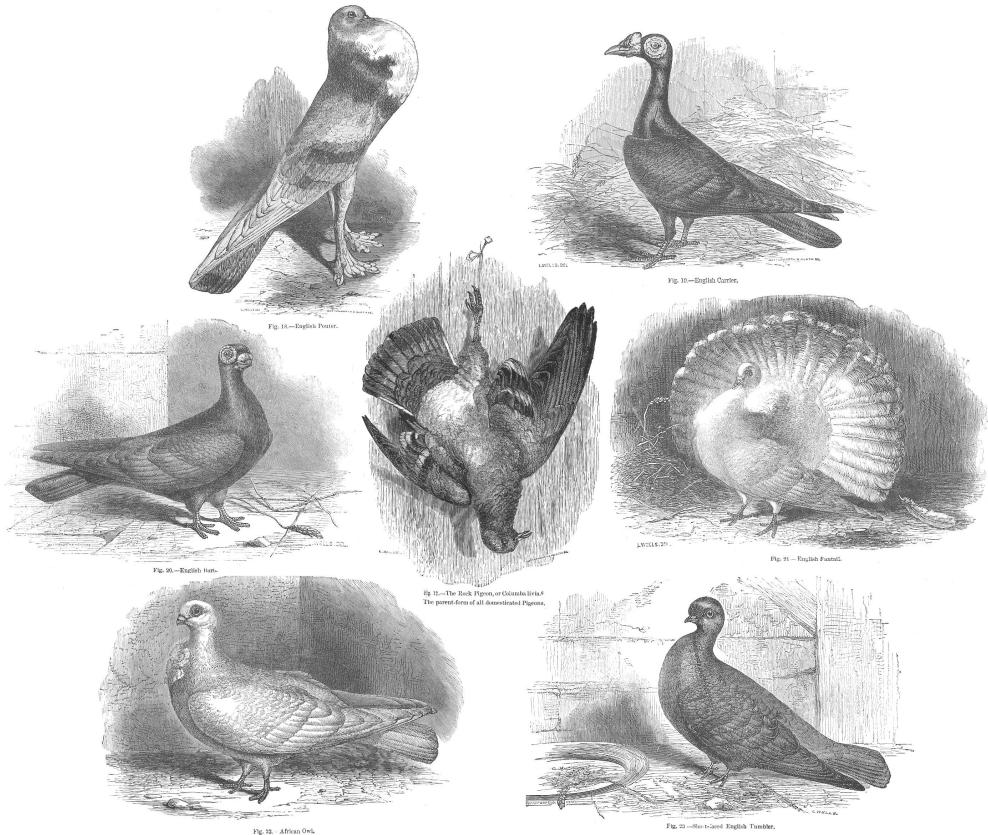
# Darwin didn't share the sentiments of his day, but Social Darwinism caused much harm



Charles Darwin  
Author of On the Origin of Species



# Darwin didn't share the sentiments of his day, but Social Darwinism caused much harm



Darwin's pigeons,  
Variation in Animals and Plants under Domestication, 1868

Chapter 1 of the "Origin of Species" describes how selective breeding of pigeons can produce astounding forms

Francis Galton took this idea and applied it to humans, coining the term eugenics (meaning – "good/true origins")

# The origins of the eugenic movement

# Racism in genetics is not ancient history

## *Microcephalin, a Gene Regulating Brain Size, Continues to Evolve Adaptively in Humans*

Patrick D. Evans,<sup>1,2</sup> Sandra L. Gilbert,<sup>1</sup> Nitzan Mekel-Bobrov,<sup>1,2</sup>  
Eric J. Vallender,<sup>1,2</sup> Jeffrey R. Anderson,<sup>1</sup> Leila M. Vaez-Azizi,<sup>1</sup>  
Sarah A. Tishkoff,<sup>4</sup> Richard R. Hudson,<sup>3</sup> Bruce T. Lahn<sup>1\*</sup>

## Ongoing Adaptive Evolution of *ASPM*, a Brain Size Determinant in *Homo sapiens*

Nitzan Mekel-Bobrov,<sup>1,2</sup> Sandra L. Gilbert,<sup>1</sup> Patrick D. Evans,<sup>1,2</sup>  
Eric J. Vallender,<sup>1,2</sup> Jeffrey R. Anderson,<sup>1</sup> Richard R. Hudson,<sup>3</sup>  
Sarah A. Tishkoff,<sup>4</sup> Bruce T. Lahn<sup>1\*</sup>



ARTICLES

<https://doi.org/10.1038/s41588-022-01016-z>



OPEN

Polygenic prediction of educational attainment within and between families from genome-wide association analyses in 3 million individuals

Aysu Okbay<sup>1,197,198</sup>✉, Yeda Wu<sup>2</sup>, Nancy Wang<sup>3</sup>, Hariharan Jayashankar<sup>3</sup>, Michael Bennett<sup>10,3</sup>,  
Seyed Moeen Nehzati<sup>4</sup>, Julia Sidorenko<sup>10,2</sup>, Hyeokmoon Kweon<sup>1</sup>, Grant Goldman<sup>3</sup>,  
Tamara Gjorgjieva<sup>10,3</sup>, Yunxuan Jiang<sup>5</sup>, Barry Hicks<sup>5</sup>, Chao Tian<sup>5</sup>, David A. Hinds<sup>10,5</sup>, Rafael Ahlskog<sup>6</sup>,  
Patrik K. E. Magnusson<sup>10,7</sup>, Sven Oskarsson<sup>10,6</sup>, Caroline Hayward<sup>10,8</sup>, Archie Campbell<sup>10,9,10</sup>,  
David J. Porteous<sup>10,9,11</sup>, Jeremy Freese<sup>12</sup>, Pamela Herd<sup>13</sup>, 23andMe Research Team\*, Social  
Science Genetic Association Consortium\*, Chelsea Watson<sup>4</sup>, Jonathan Jala<sup>4</sup>, Dalton Conley<sup>14</sup>,  
Philipp D. Koellinger<sup>1,15</sup>, Magnus Johannesson<sup>16</sup>, David Laibson<sup>17</sup>, Michelle N. Meyer<sup>18</sup>, James J. Lee<sup>19</sup>,  
Augustine Kong<sup>20</sup>, Loic Yengo<sup>2,198</sup>, David Cesarini<sup>13,21,22,198</sup>, Patrick Turley<sup>23,24,198</sup>, Peter M. Visscher<sup>2,198</sup>✉,  
Jonathan P. Beauchamp<sup>25,198</sup>, Daniel J. Benjamin<sup>10,3,4,26,198</sup>✉ and Alexander I. Young<sup>4,26,197,198</sup>✉

# Racism in genetics is not ancient history

*Microcephalin, a Gene Regulating*

Brair

Graves Jr. *Evo Edu Outreach* (2019) 12:18  
<https://doi.org/10.1186/s12052-019-0110-5>

Patrick D.  
Eric J. Val  
Sarah

Ongo  
of ASPM

COMMENTARY

Open Access

African Americans in evolutionary science:  
where we have been, and what's next

Joseph L. Graves Jr.\*

Nitzan Mekel-Bobrov,<sup>1</sup> Sandra L. Gilbert,<sup>1</sup> PATRICK D. Evans,<sup>1</sup>  
Eric J. Vallender,<sup>1,2</sup> Jeffrey R. Anderson,<sup>1</sup> Richard R. Hudson,<sup>3</sup>  
Sarah A. Tishkoff,<sup>4</sup> Bruce T. Lahn<sup>1\*</sup>

Evolution: Education and Outreach

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<https://doi.org/10.1038/s41588-022-01016-z>

 Check for updates

attainment  
genome-wide  
individuals



Michael Bennett<sup>1,3</sup>,  
oldman<sup>3</sup>,  
. Hinds<sup>1,5</sup>, Rafael Ahlskog<sup>6</sup>,  
the Campbell<sup>1,9,10</sup>,  
Arch Team\*, Social  
ala<sup>4</sup>, Dalton Conley<sup>14</sup>,  
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Jonathan P. Beauchamp<sup>25,198</sup>, Daniel J. Benjamin<sup>13,4,26,198</sup> and Alexander I. Young<sup>4,26,197,198</sup>

# Resources

Graves et al. 2019. African Americans in Evolutionary Science: where we have been and what's next.

<https://genestogenomes.org/wp-content/uploads/2020/06/TAGC-Eugenics-History-Workshop-%E2%80%94-June-2020-Resource-List.pdf>

<https://nm.pbslearningmedia.org/resource/58488eff-d80d-4468-b5fd-6820aeecc78cc/genetics-history-american-eugenics-movement-video-ken-burns-the-gene/>

<https://www.biointeractive.org/classroom-resources/biology-skin-color>

<https://youtu.be/4ebmHkpH-p4>