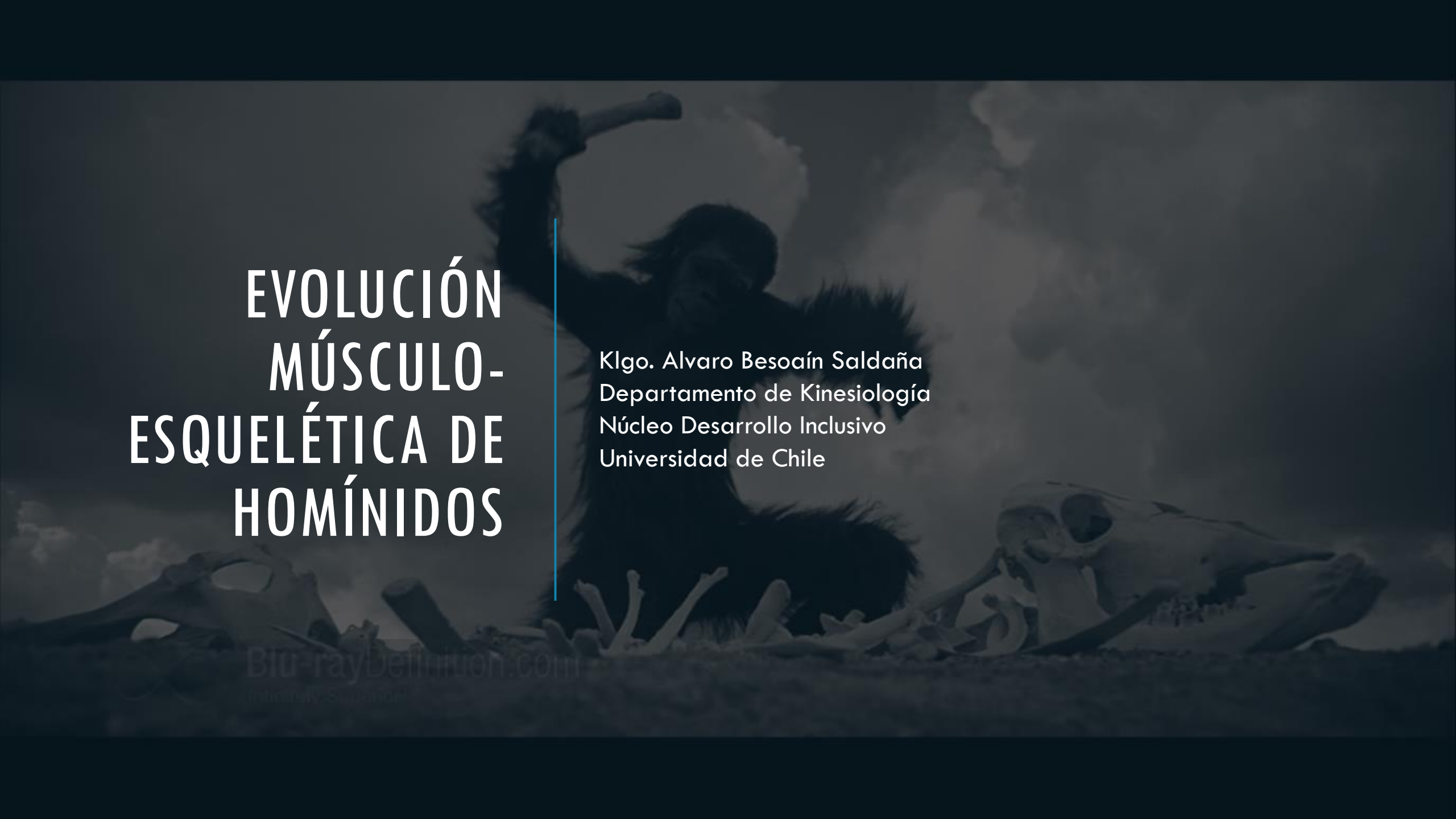




EVOLUCIÓN MÚSCULO- ESQUELÉTICA DE HOMÍNIDOS

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Universidad de Chile

Blu-rayDefinition.com
intendedly Superior

OBJETIVOS DE LA SESIÓN

Describir los principales hitos de la evolución de los homínidos, con especial énfasis en cambios anatomo-funcionales

Describir las distintas estrategias de locomoción desarrollada por primates

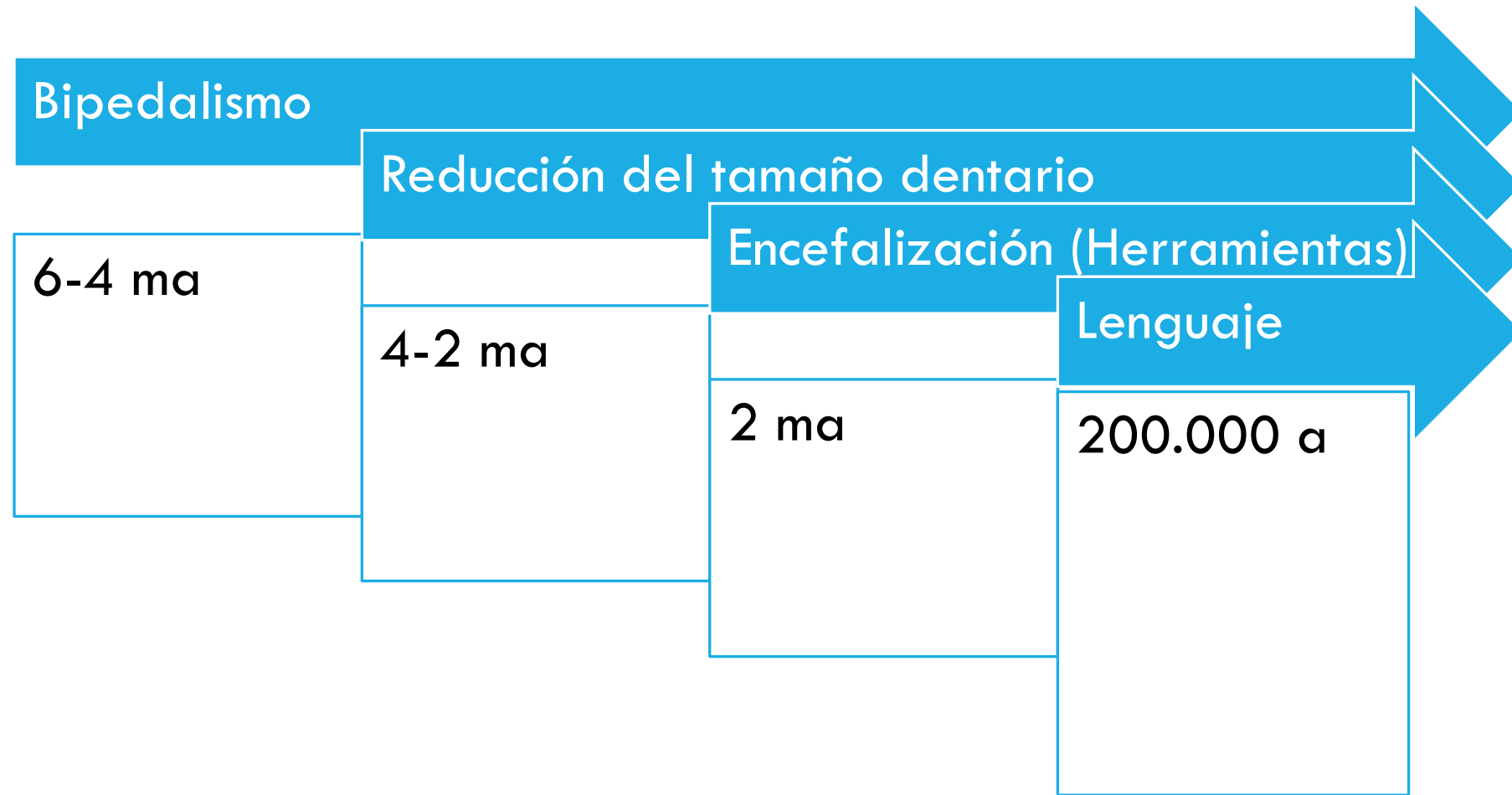
Analizar desde un enfoque filogenético el origen de las modificaciones músculo-esqueléticas que caracterizan el movimiento corporal de Homo sapiens, con énfasis en la postura ortógrada y la bipedestación obligada

Describir y contrastar hipótesis sobre el origen y proceso de bipedestación y marcha de Homo Sapiens



**¿POR QUÉ SE HABRÁ FAVORECIDO LA
BIPEDESTACIÓN EN NUESTRO LINAJE?**

NOVEDADES EVOLUTIVAS



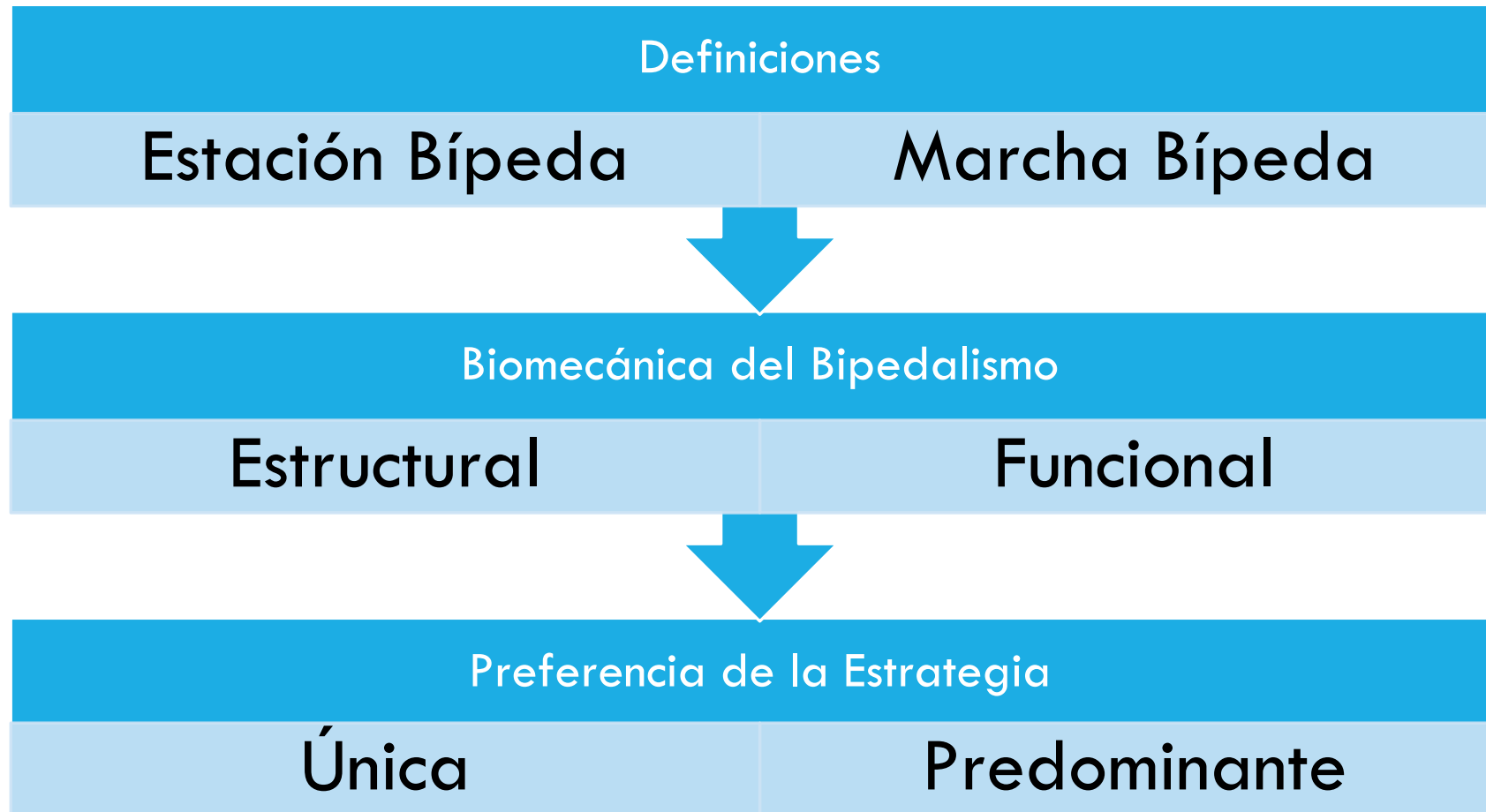


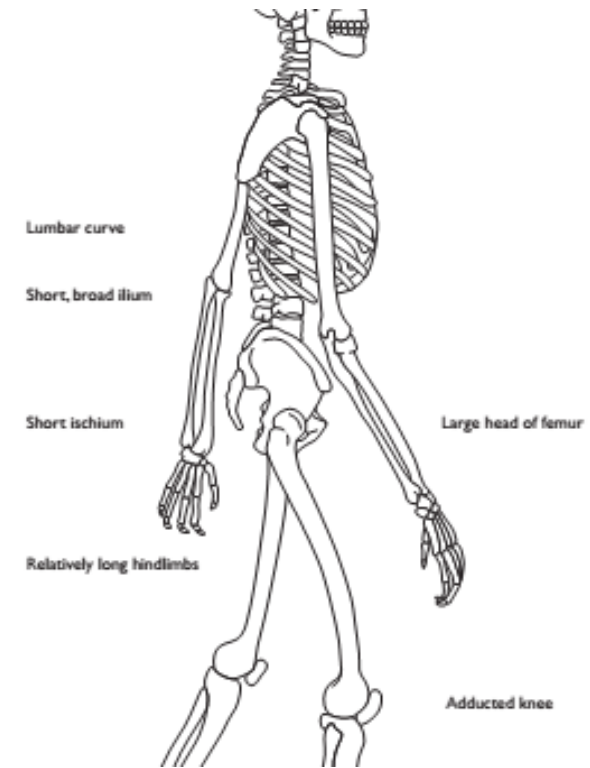
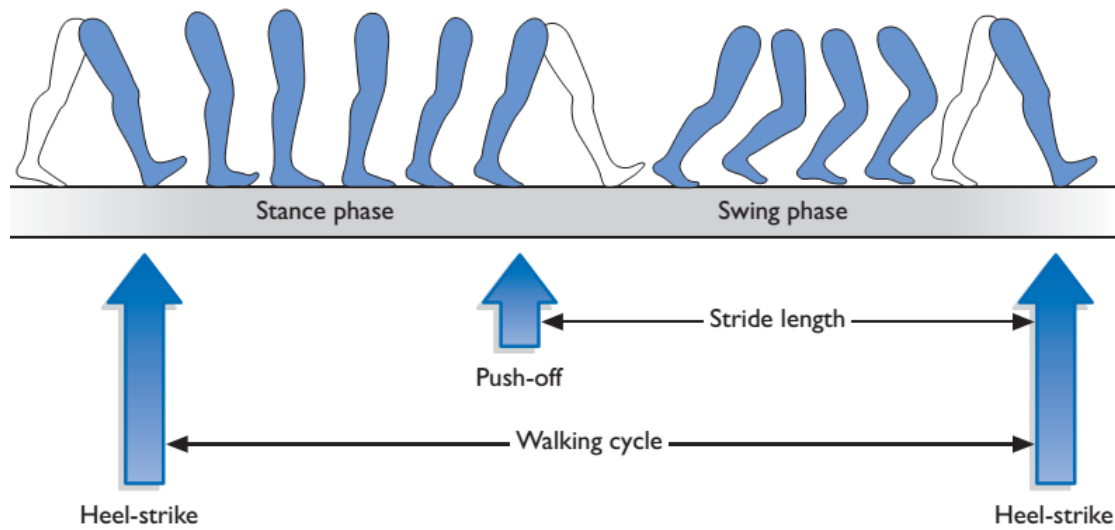
“... As soon as **some ancient member** in the great series of the **Primates came to be less arboreal**, **owing** to a change **in its manner of procuring subsistence**, or to some **change in the surrounding conditions**, its habitual manner of progression would have been modified: and thus **it would have been rendered more strictly quadrupedal or bipedal**. Baboons frequent hilly and rocky districts, and only from necessity climb high trees; and they have acquired almost the gait of a dog. **Man alone has become a biped**; and we can, I think, partly see how he has come to assume his erect attitude, which forms one of his most conspicuous characters. **Man could not have attained his present dominant position in the world without the use of his hands...**”

Darwin Ch. (1871) "The Descent of Man and Selection in Relation to Sex",
Murray (London), pag. 51. Revisado eL 4 Noviembre 2014.

<http://darwin-online.org.uk/content/frameset?itemID=F944&viewtype=text&pageseq=1>

BIPEDALISMO





ELEMENTOS ANATÓMICOS Y FUNCIONALES

COMPONENTES DEL MOVIMIENTO



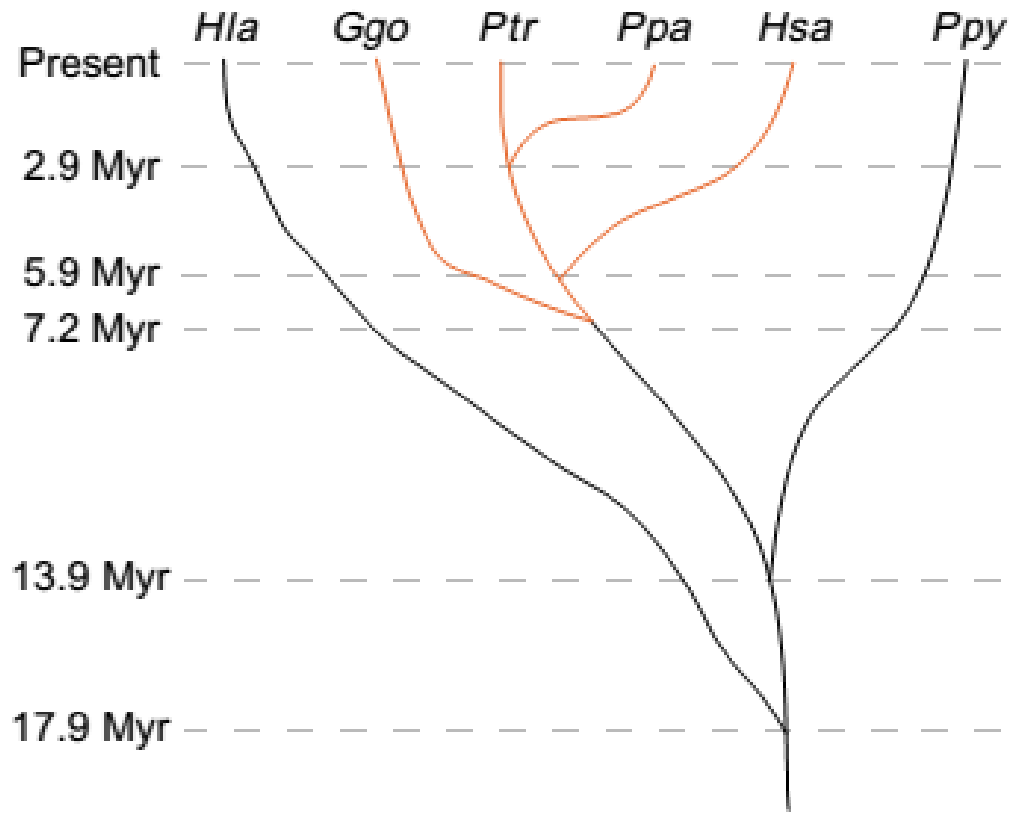
Base de Sustentación

Alineación

Secuencia de Movimientos

Estabilidad Movilidad

FILOGENIA PRIMATES



Hla: Hylobates

Ggo: Gorilla Gorilla

Ptr: Pan Troglodytes

Ppan: Pan Paniscus

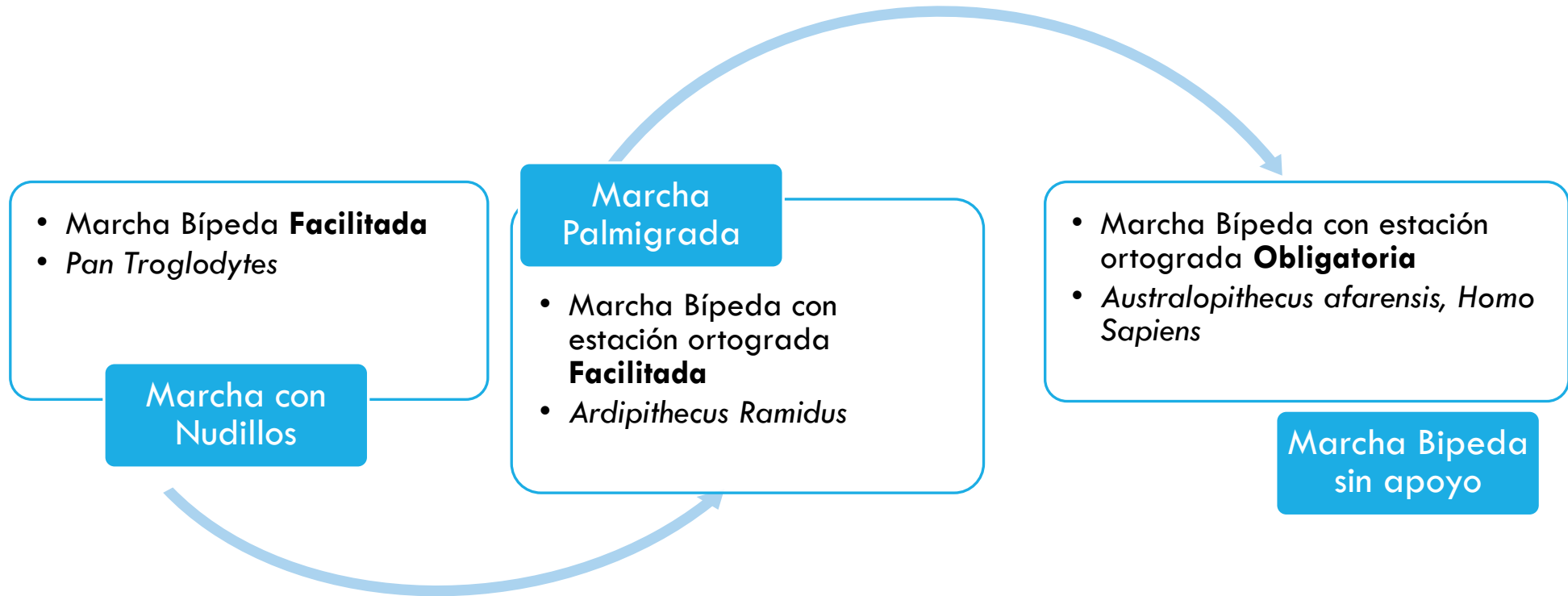
Hsa: Homo Sapiens

Ppy: Pongo Pygmeus

TRENDS in Genetics

Hacia J. (2001) Genome of the apes

DIFERENCIAS ENTRE LOS TIPOS DE BIPEDESTACIÓN



ESTRATEGIA DE LOCOMOCIÓN ENTRE PRIMATES

Six 'Baumuster
(specializations) :

(a) the quadrupedal
arborealist *Proconsul*;

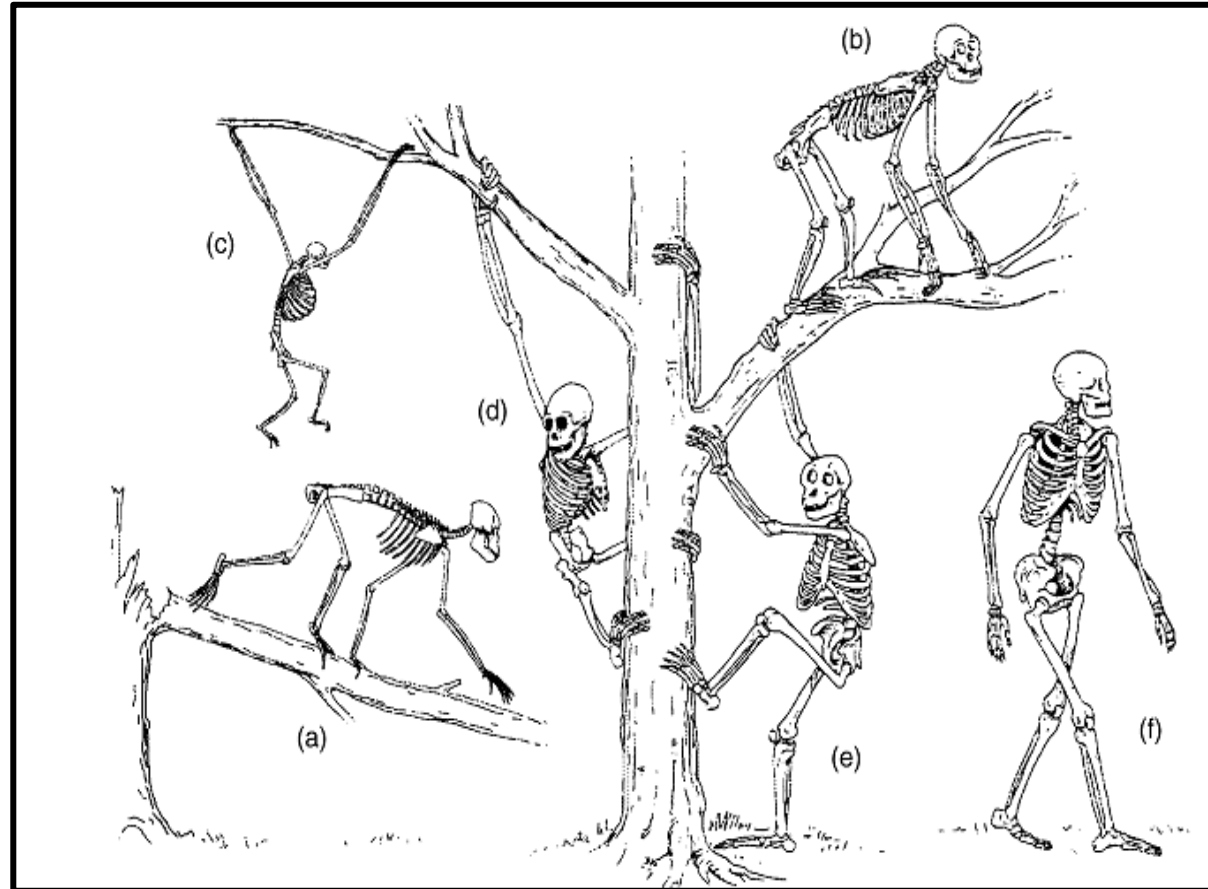
(b) chimpanzee,

(c) gibbon,

(d) orangutan and the similar
Oreopithecus,

(e) *Australopithecus*

(f) *Homo*



PREFERENCIA DE LA ESTRATEGIA

Sarringhaus et al (2014) Locomotor and postural development of chimpanzees

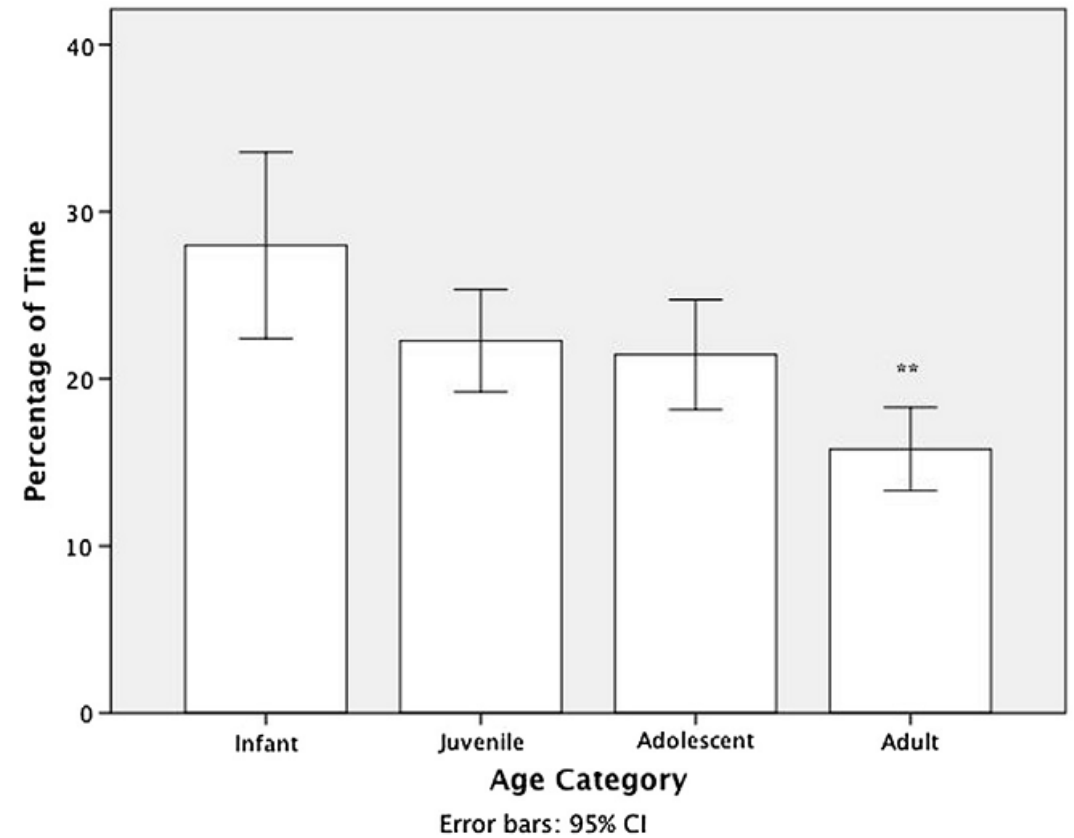


Figure 1. Percentage of overall time spent in locomotion for each age category. Adults are significantly less active compared with infants at the $p < 0.01$ level.

PREFERENCIA DE LA ESTRATEGIA

Sarringhaus et al (2014) Locomotor and postural development of chimpanzees

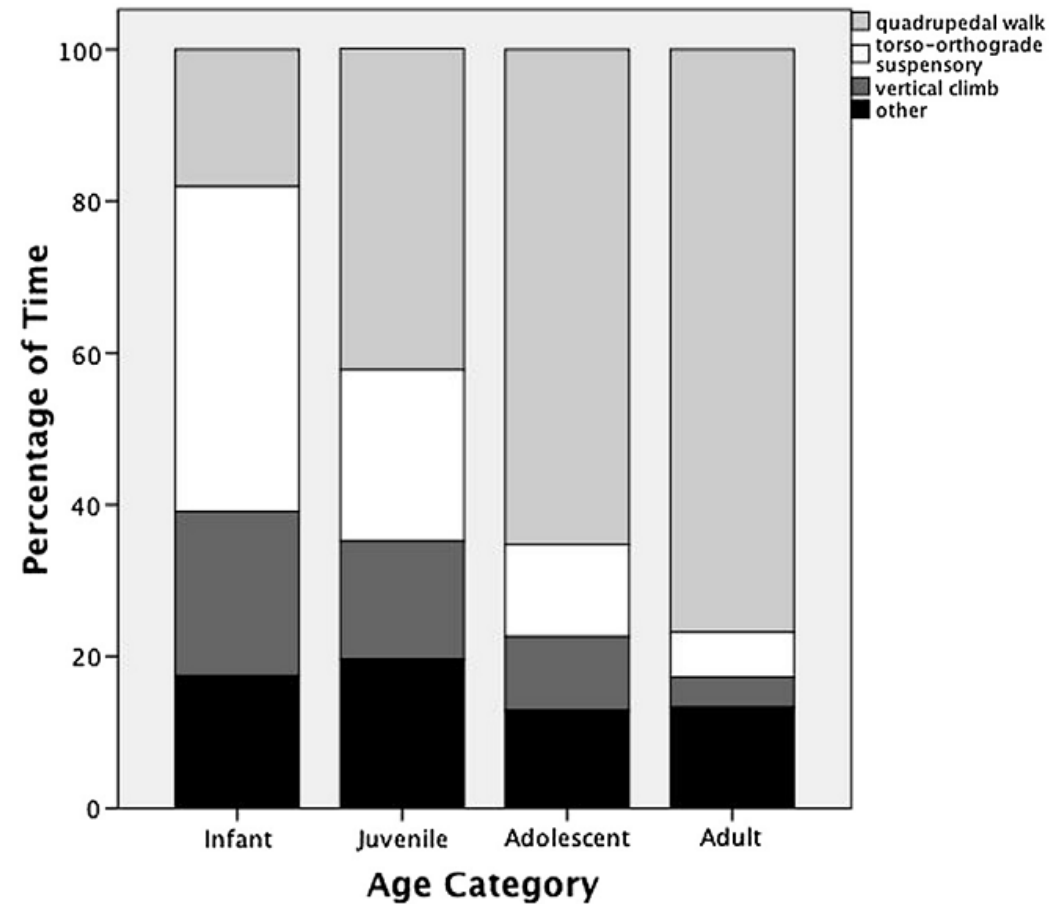


Figure 2. Percentage of locomotor time spent in each main mode for each age category of chimpanzee. ANOVA results: quadrupedal walk $F = 62.83$, $p < 0.001$; torso-orthograde suspensory $F = 34.92$, $p < 0.001$; vertical climb $F = 8.73$, $p < 0.001$.

EJEMPLOS DE TIPO DE LOCOMOCIÓN

Goriilla gorilla Walking (<https://www.youtube.com/watch?v=NqK-hplomEE>)

Pongo pygmaeus walking
(<https://www.youtube.com/watch?v=I81KyEX0WL8>)

Chimpanzee Walking (<https://www.youtube.com/watch?v=ycb8JBI9UK8>)

Hylobates (<https://www.youtube.com/watch?v=TjhLTY3sH3Q>)

ANTECEDENTES A LOS PROCESOS DE BIPEDESTACIÓN

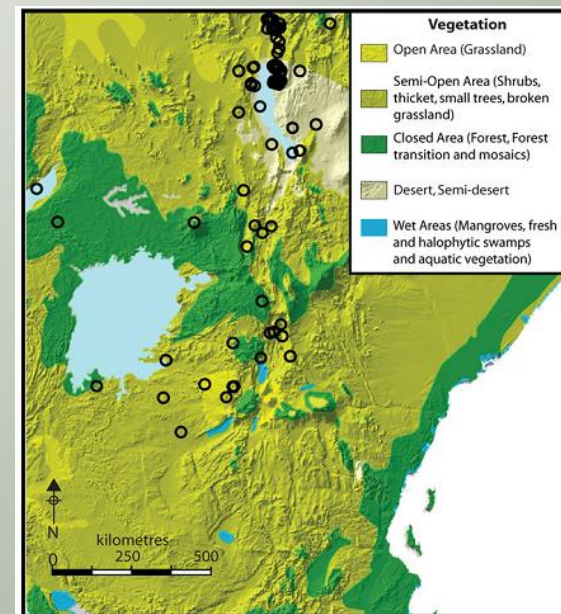
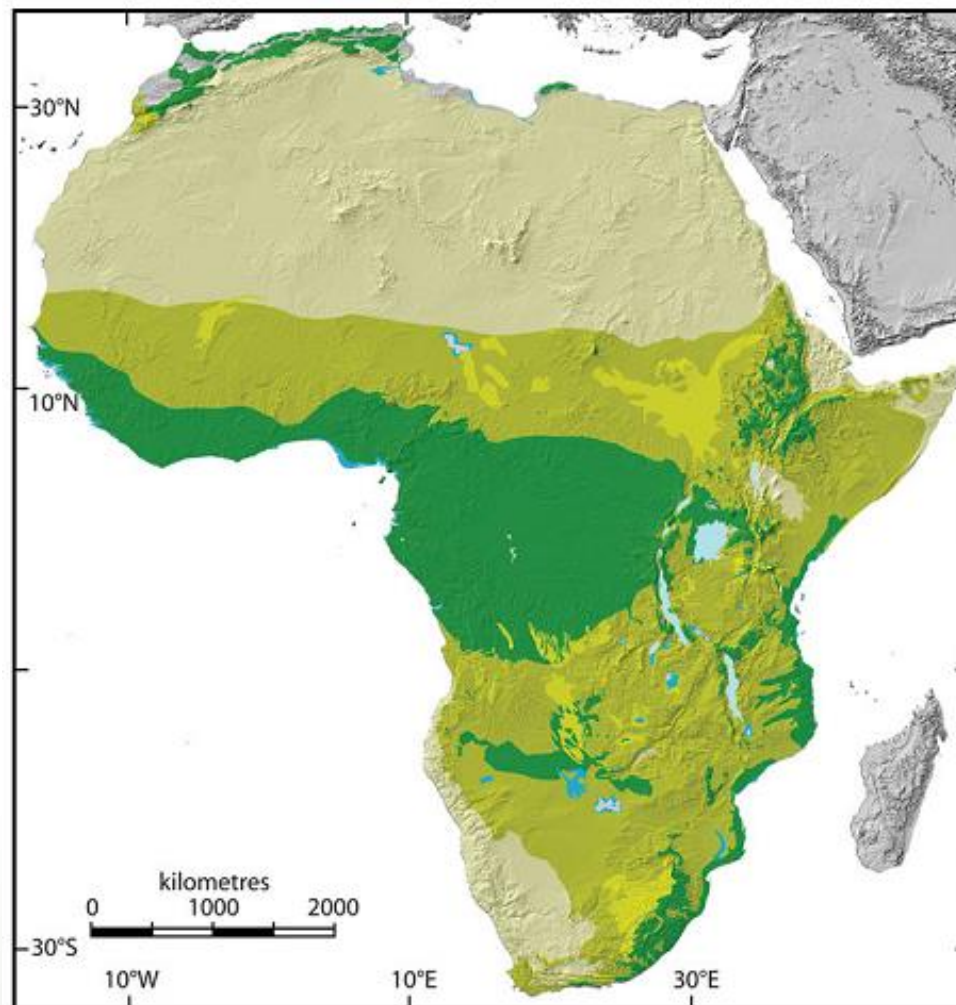
Cambios Climáticos

- Desertificación de África
- Modificación de vegetación

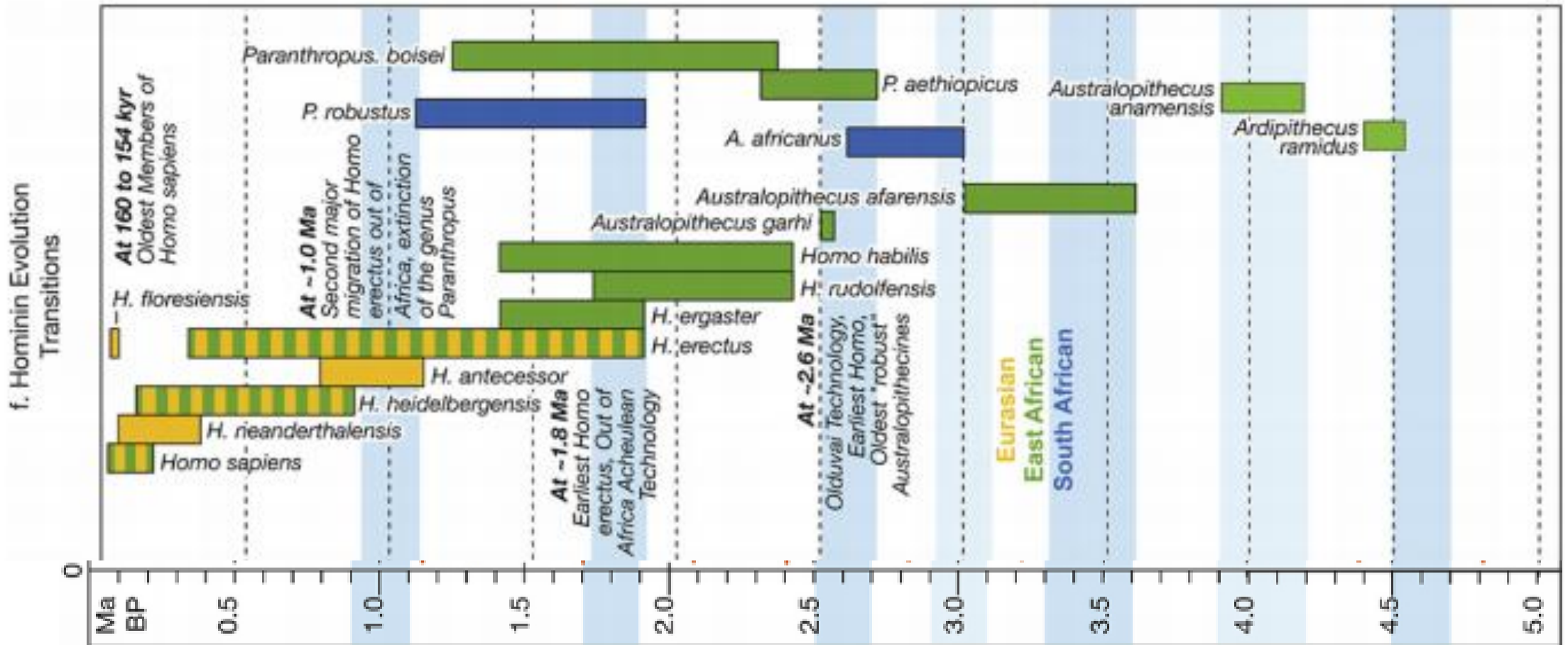
Cambios Geográficos

- Elevación de tierras tras grandes eras de actividad volcánica

CAMBIOS GEOGRÁFICOS



CAMBIOS CLIMÁTICOS

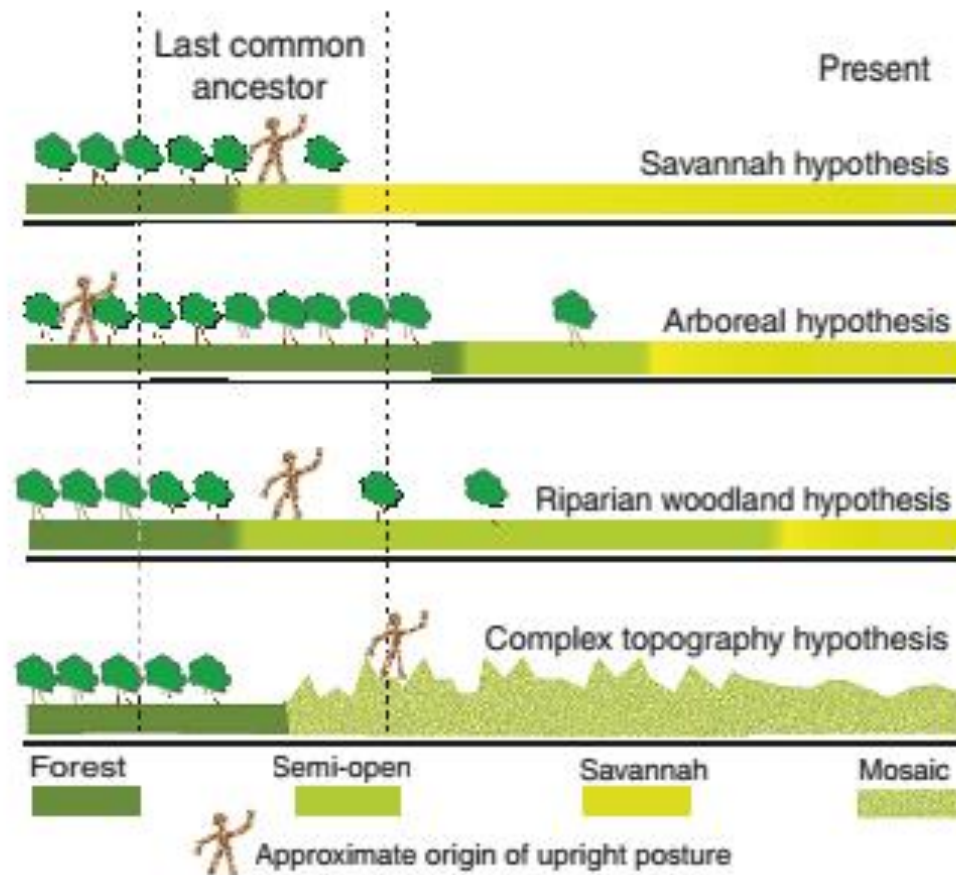


CAMBIOS CLIMÁTICOS

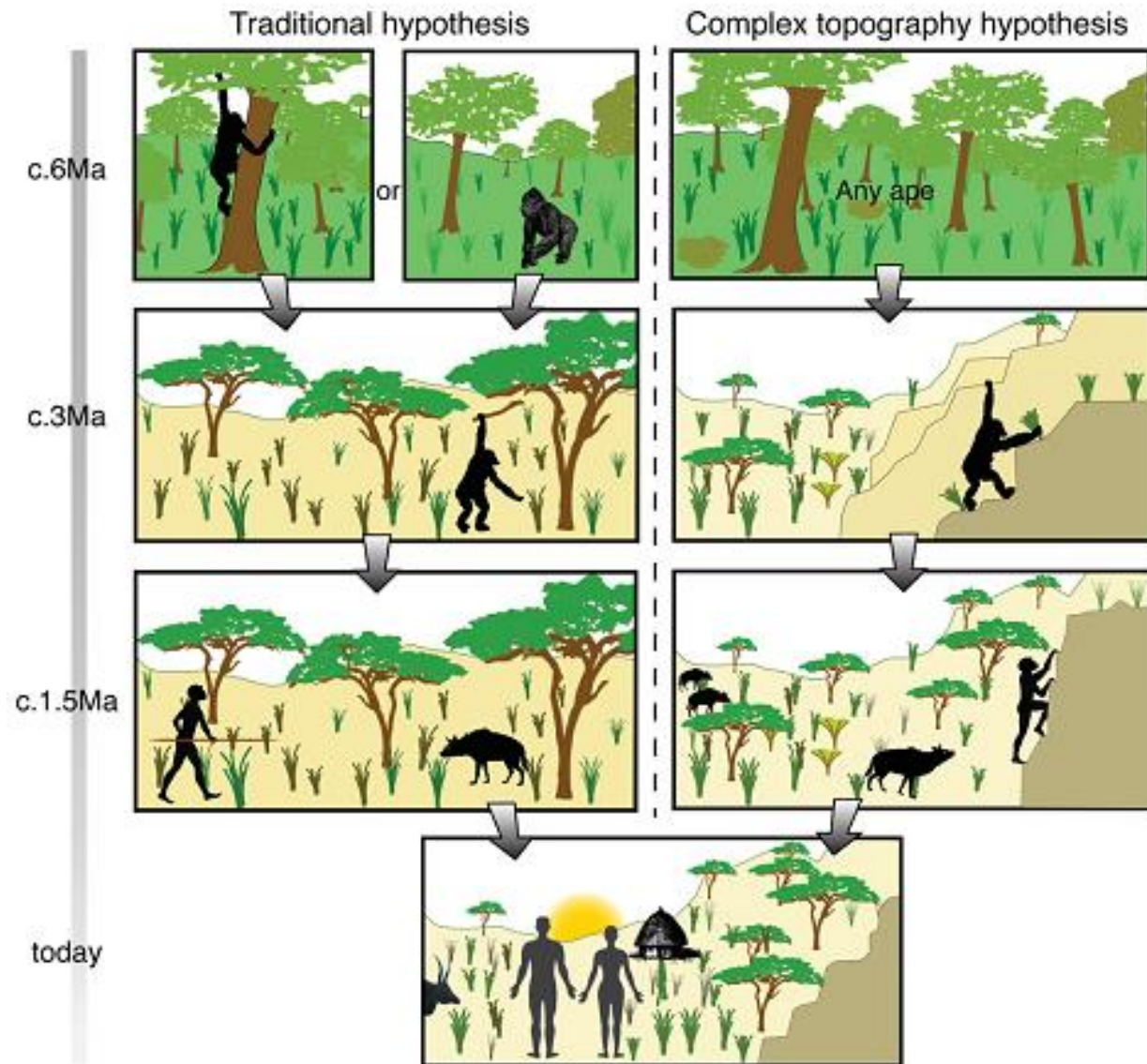
PRINCIPALES HIPÓTESIS DEL ORIGEN Y PROCESO DE LA EVOLUCIÓN MÚSCULO-ESQUELÉTICA



PRINCIPALES HIPÓTESIS DEL ORIGEN Y PROCESO DE LA EVOLUCIÓN MÚSCULO-ESQUELÉTICA



Winderet I al (2013) Complex topography and human evolution



Winderet I al (2013) Complex
topography and human
evolution

EVIDENCIAS DEL PROCESO DE BIPEDESTACIÓN

Energéticas

- Eficiencia Mecánica
- Estrategias utilizadas durante el día

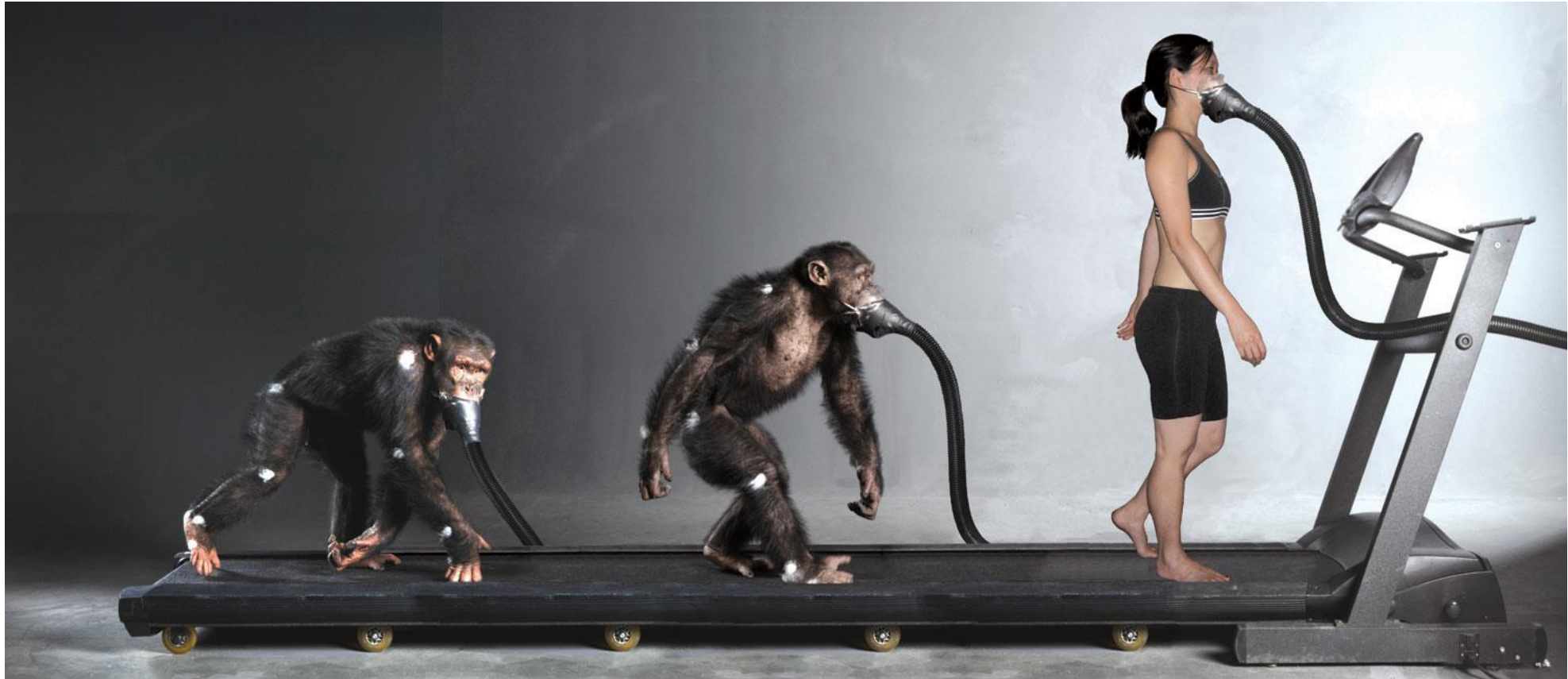
Anatomía Comparada

- Órganos Homólogos
- Estructura y Función

Hallazgos Bio-Arqueológicos

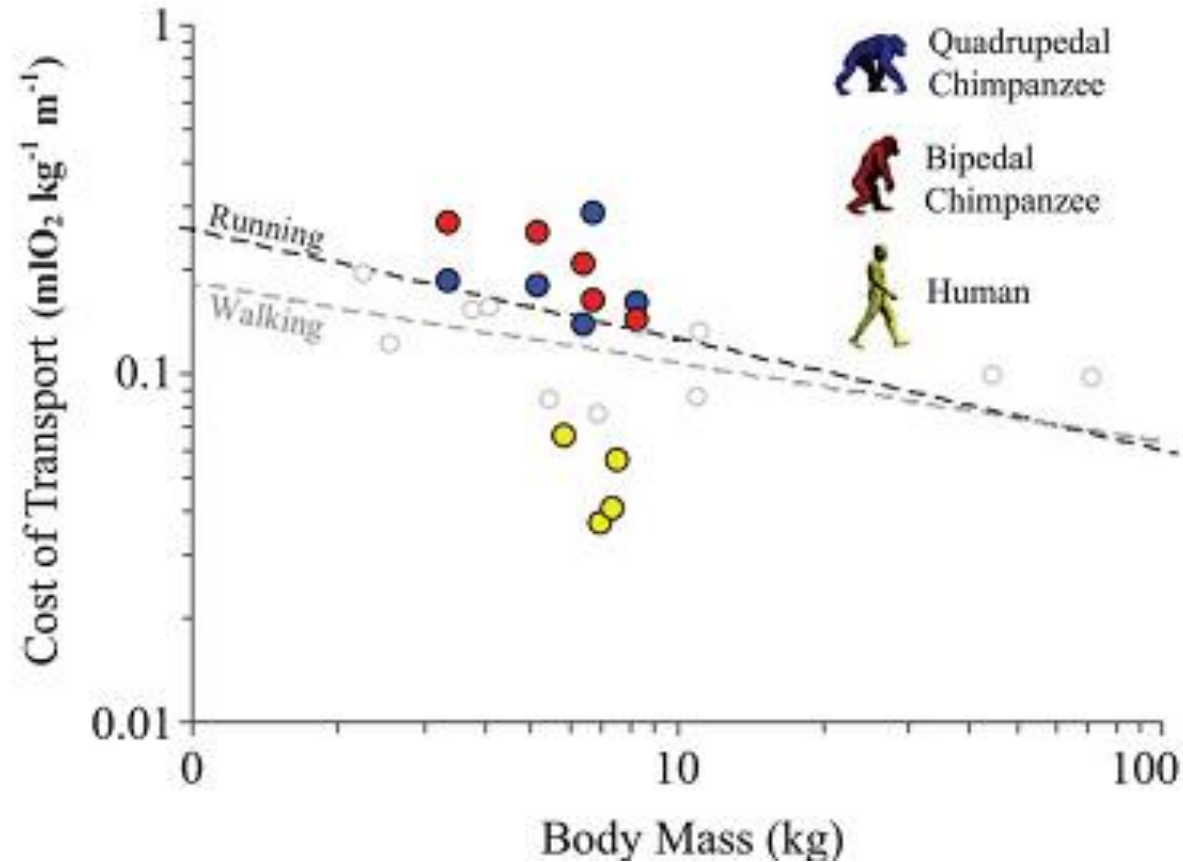
- Evidencia Ósea

EVIDENCIAS BIOENERGÉTICAS DE LA BIPEDESTACIÓN EN PRIMATES

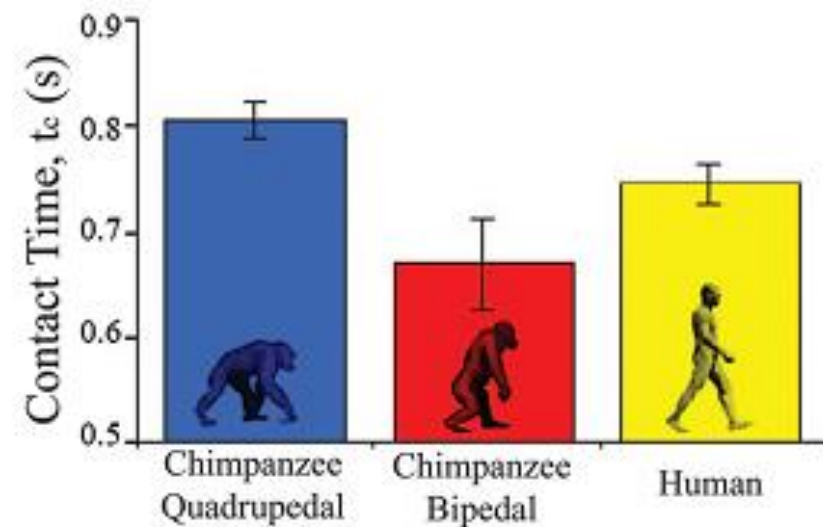
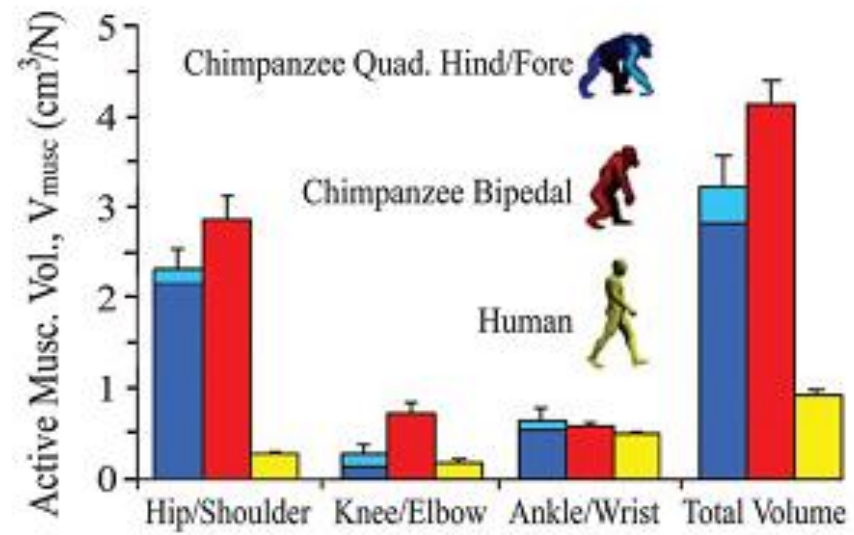


Pontzer H. et al (2007) Chimpanzee locomotor energetics and origin of bipedalism

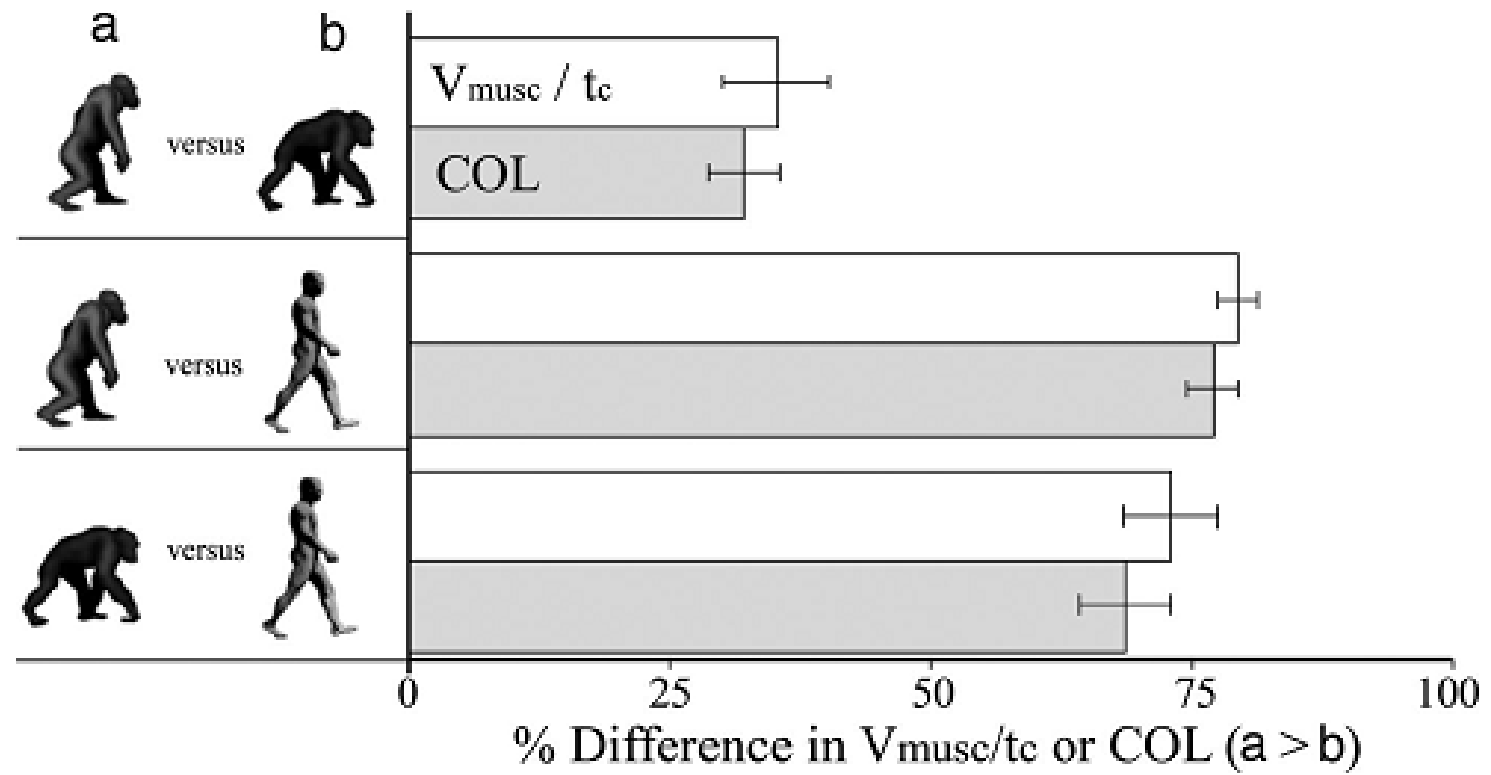
EVIDENCIAS BIOENERGÉTICAS DE LA BIPEDESTACIÓN EN PRIMATES



Pontzer H. et al (2007) Chimpanzee locomotor energetics and origin of bipedalism

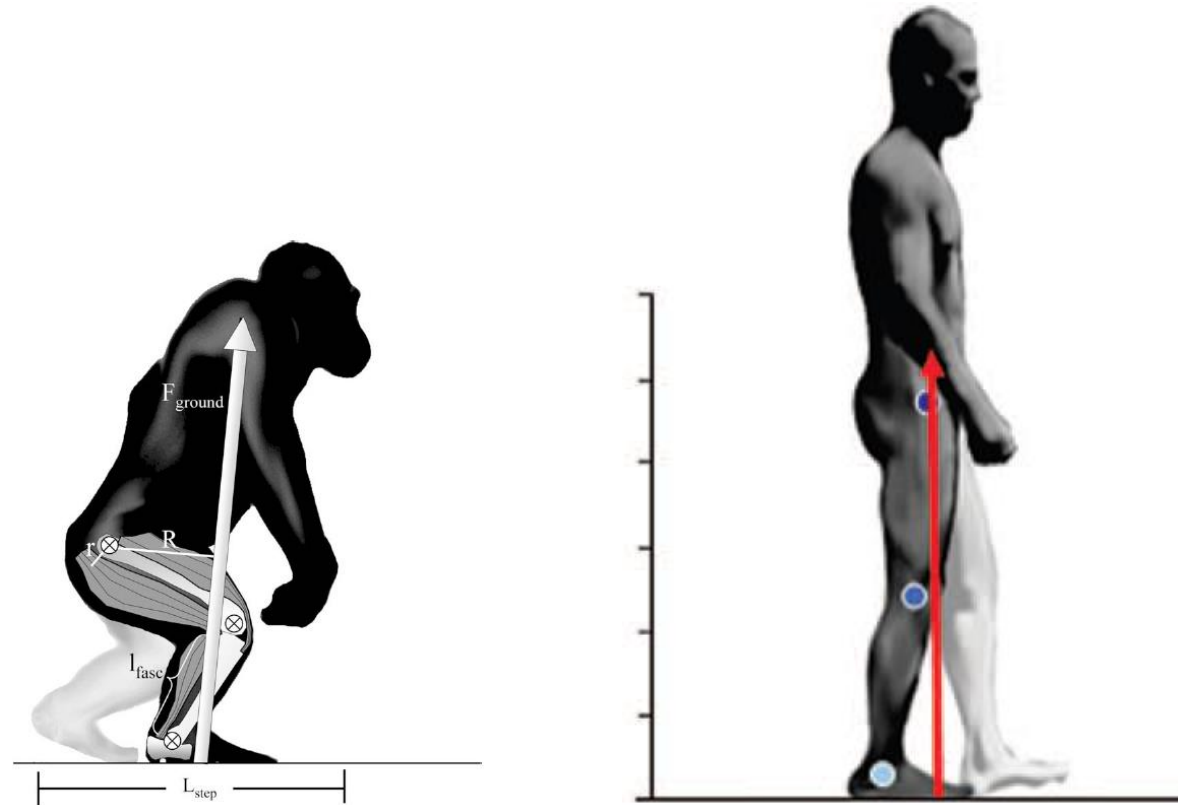


Pontzer H. et al (2007) Chimpanzee locomotor energetics and origin of bipedalism



Pontzer H. et al (2007) Chimpanzee locomotor energetics and origin of bipedalism

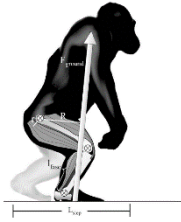
Rendimiento



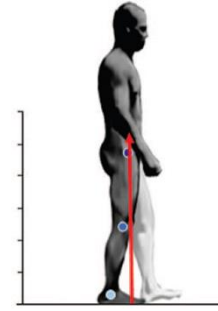
3 diferencias claves

Pontzer H. et al (2007) Chimpanzee locomotor energetics and origin of bipedalism

Rendimiento



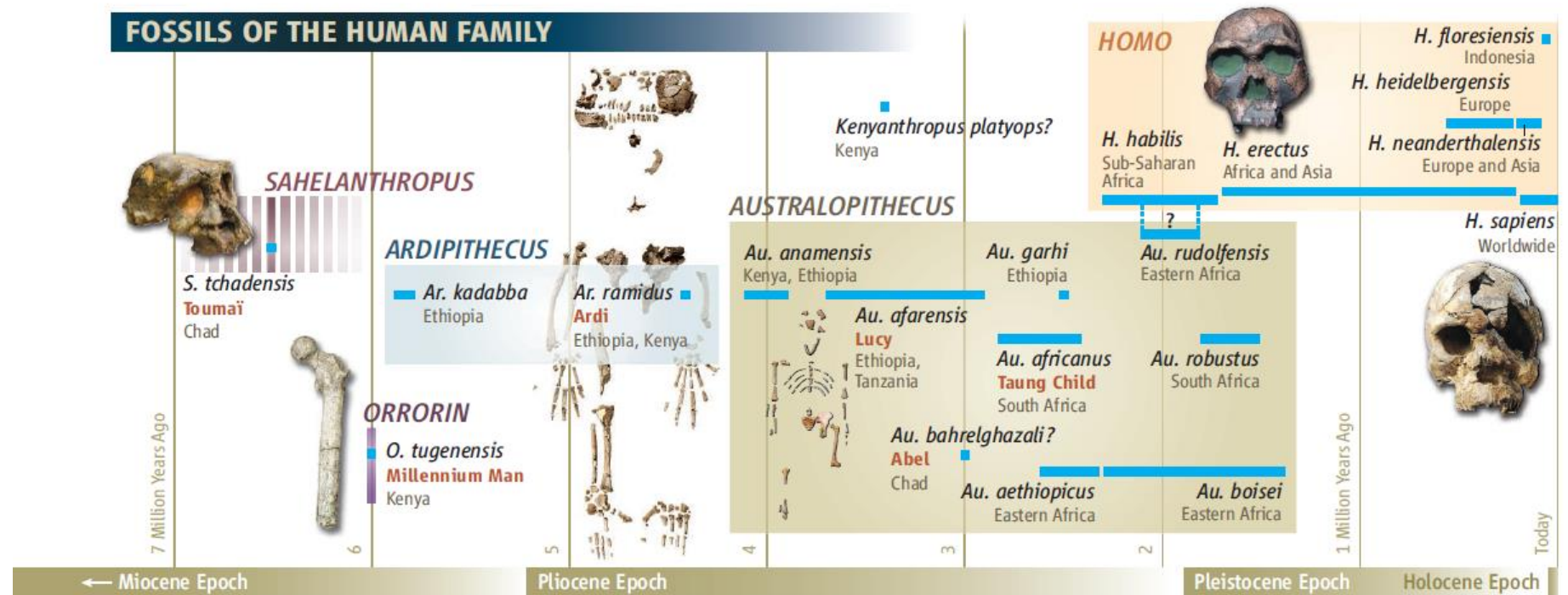
a) Los individuos de la especie *Pan Troglodytes* son incapaces de extender sus rodillas para desarrollar un alargamiento de la pierna durante la marcha bipeda.



b) Durante cada fase de balanceo, el centro de gravedad del cuerpo debe desplazarse en el sentido medio-lateral de una base de apoyo a otra. Sino, el individuo caería durante la marcha.

c) Los arcos transversos y longitudinales del pie humano entrega facilidades a la propulsion en el plano sagittal, en comparación al pie de “agarre” del *Pan Troglodytes* .

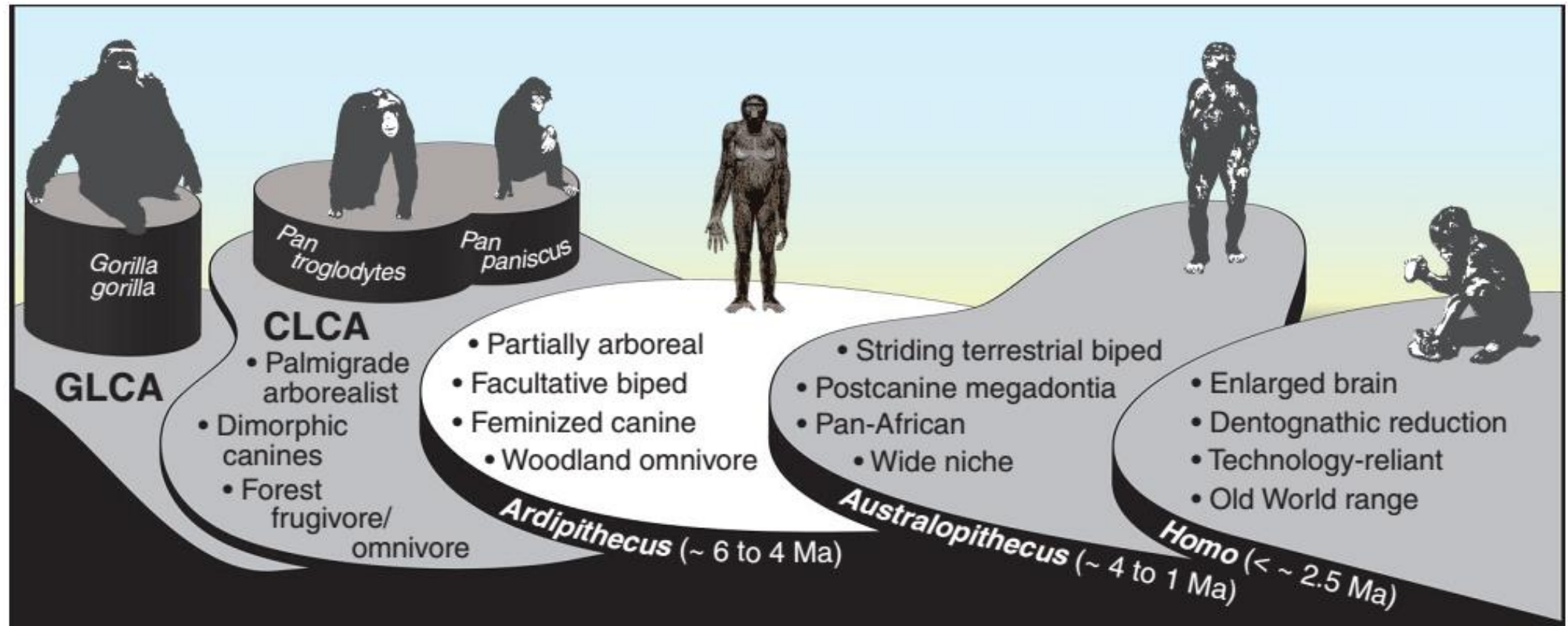
HALLAZGOS BIO-ARQUEOLÓGICOS RELEVANTES PARA LA BIPEDESTACIÓN



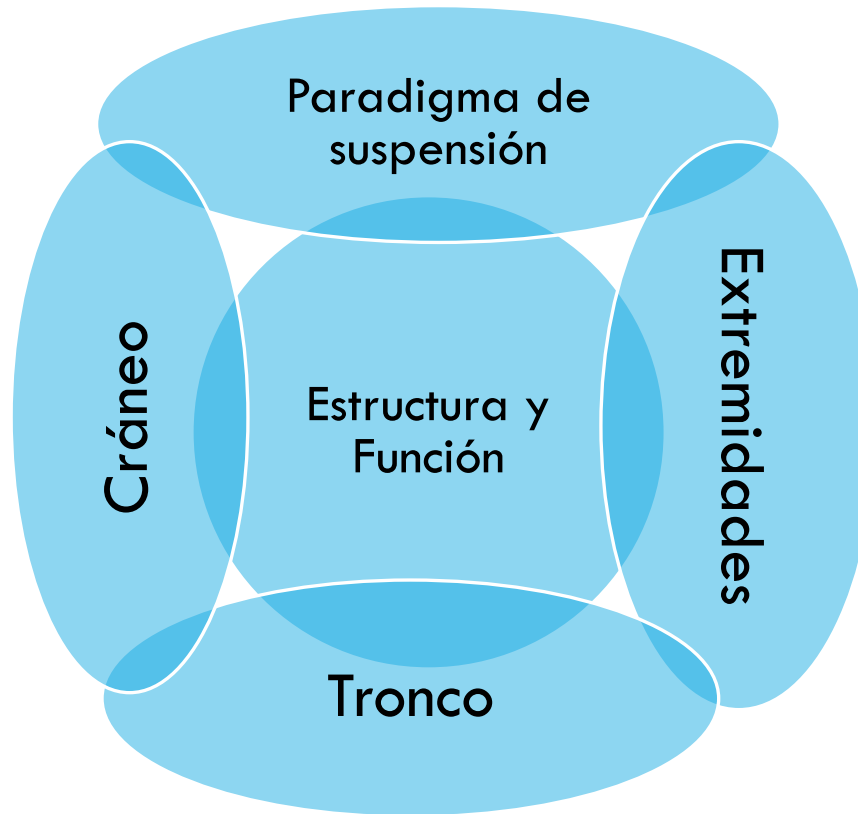
Filling a gap. *Ardipithecus* provides a link between earlier and later hominins, as seen in this timeline showing important hominin fossils and taxa.

White T. et al (2009) *Ardipithecus ramidus* and the Paleobiology of Early Hominids

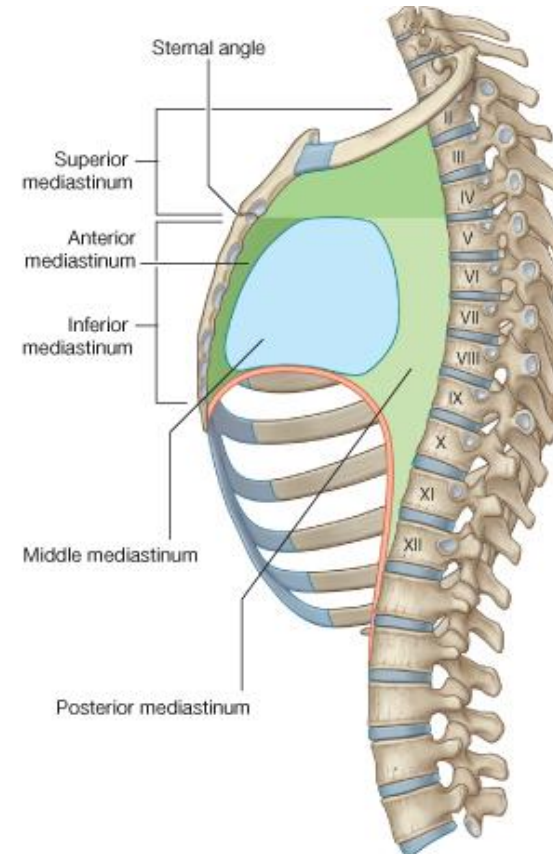
Hallazgos bio-arqueológicos relevantes para la bipedestación



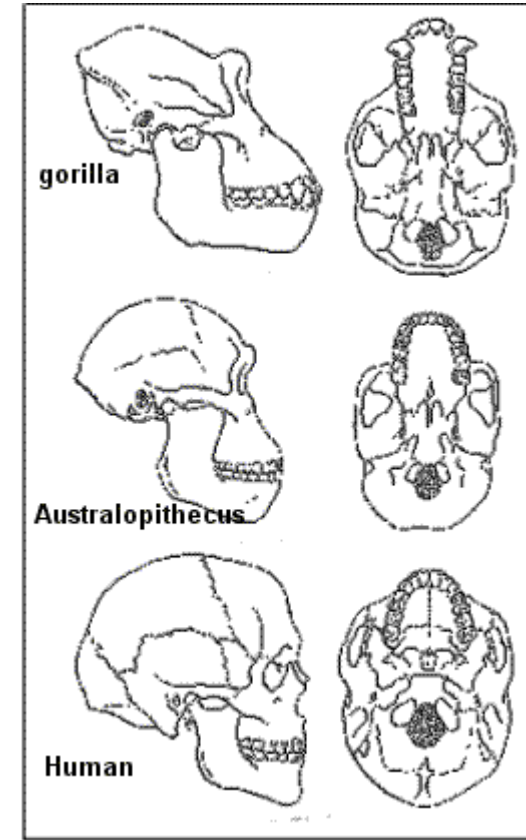
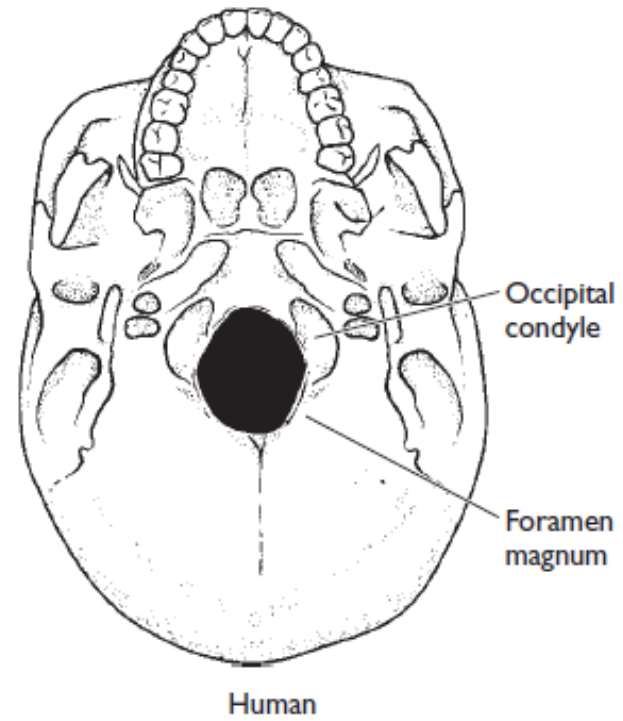
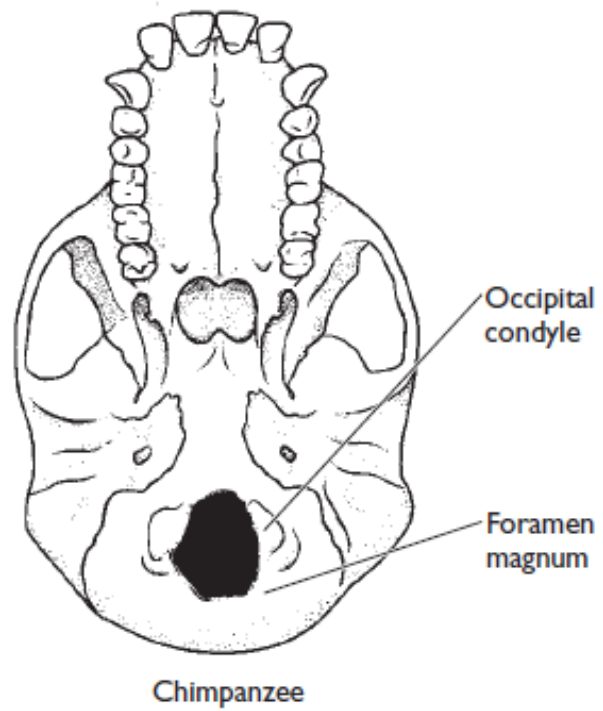
Modificación estructural y funcional



Paradigma de suspensión

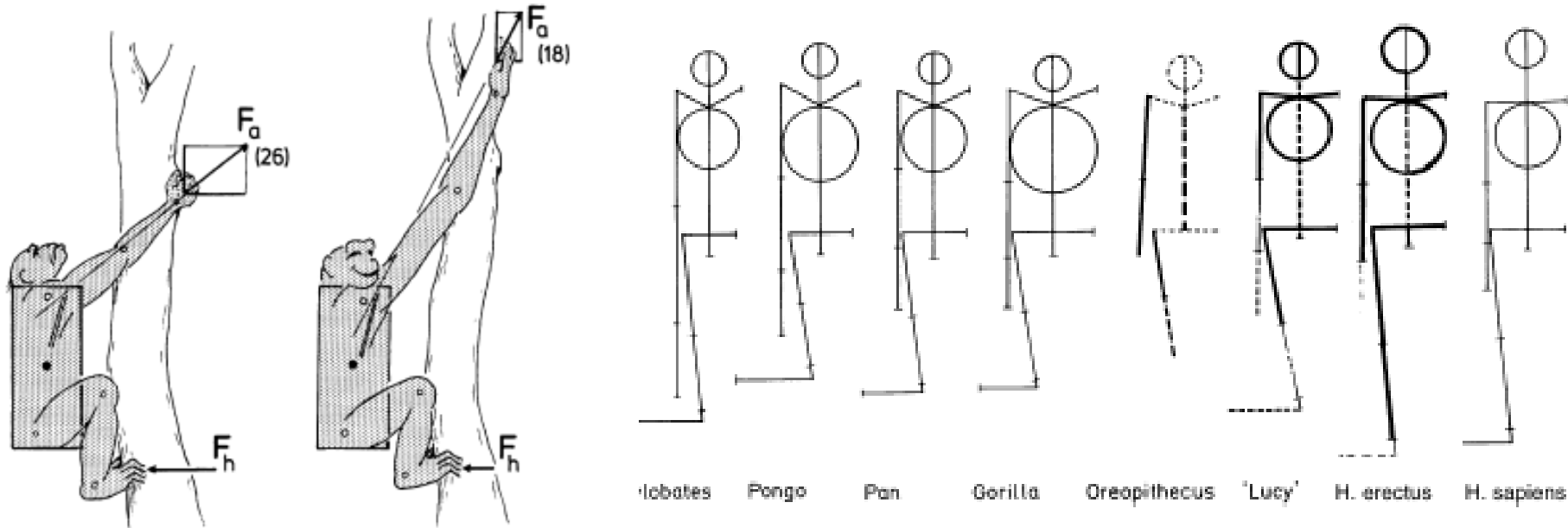


Cráneo

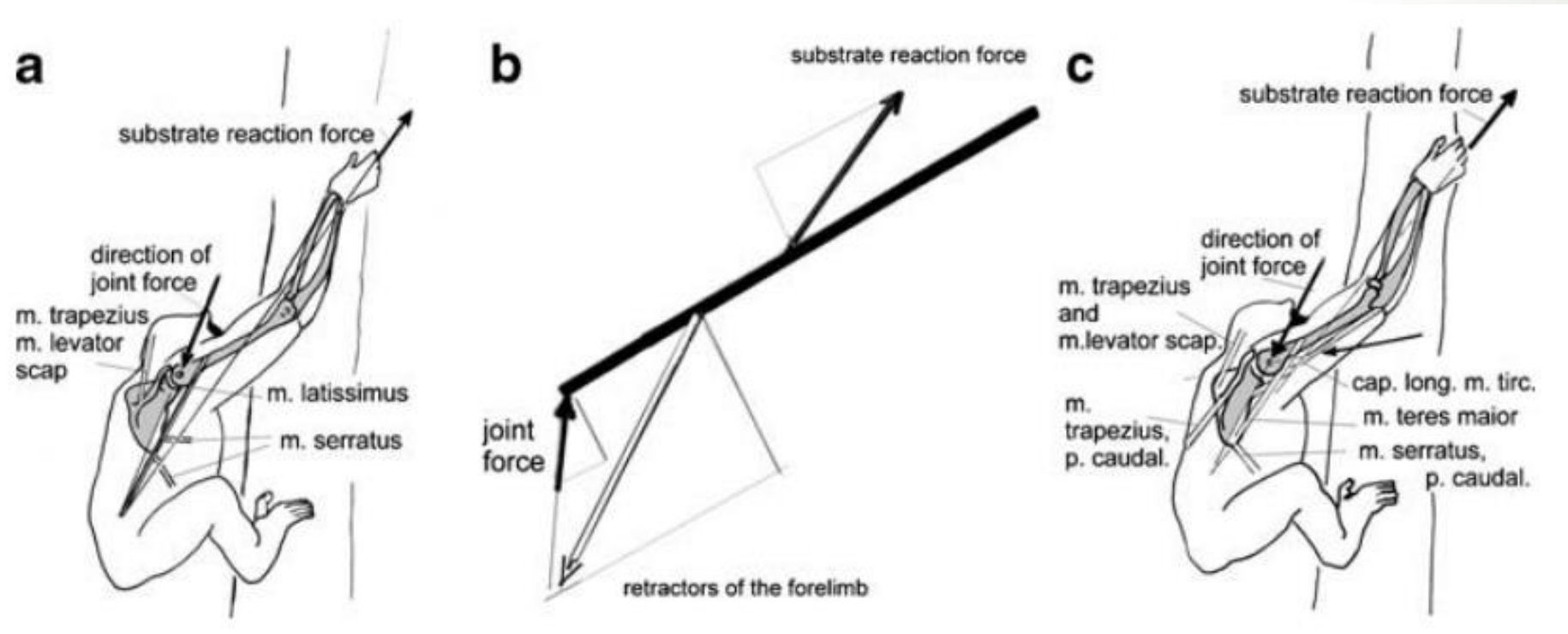


Extremidades

Miembro superior



IMI, LargoMS/LargoMI X100 : *Proconsul* > *Ardipithecus* > *Australopithecus* > *H. Sapiens*

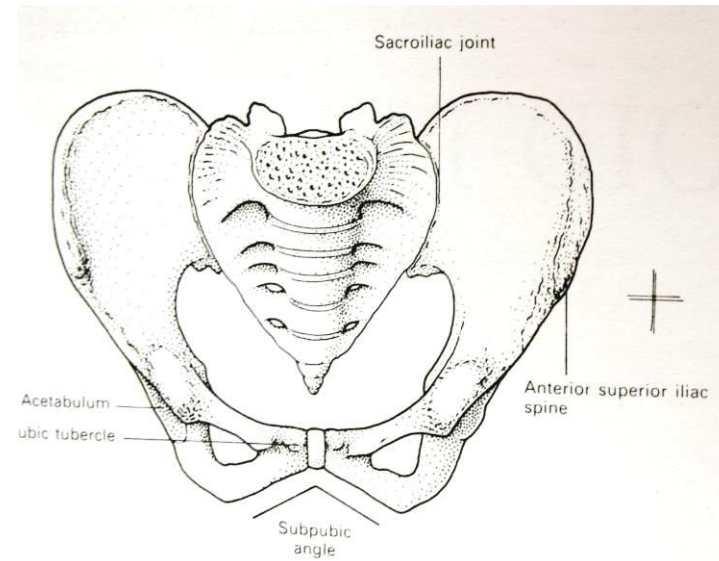


Preuschoft, H., Hohn, B., Scherf, H., Schmidt, M., Krause, C., & Witzel, U. (2010). Functional Analysis of the Primate Shoulder. *International journal of primatology*, 31(2), 301–320. doi:10.1007/s10764-010-9399-1

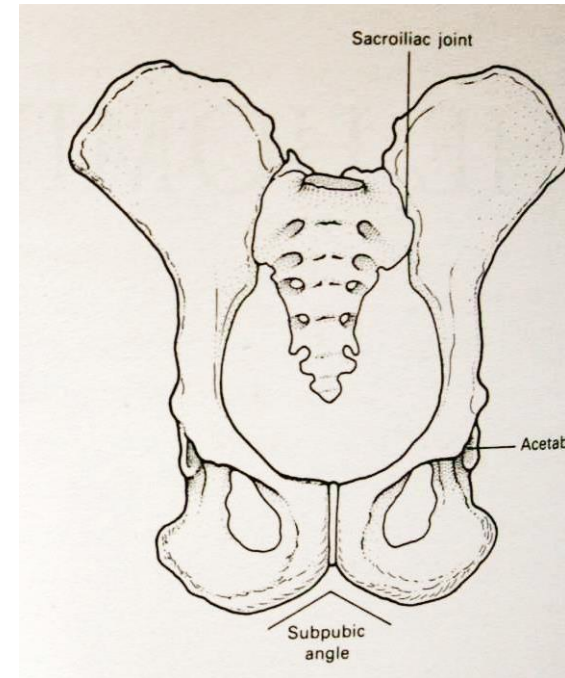
Extremidades

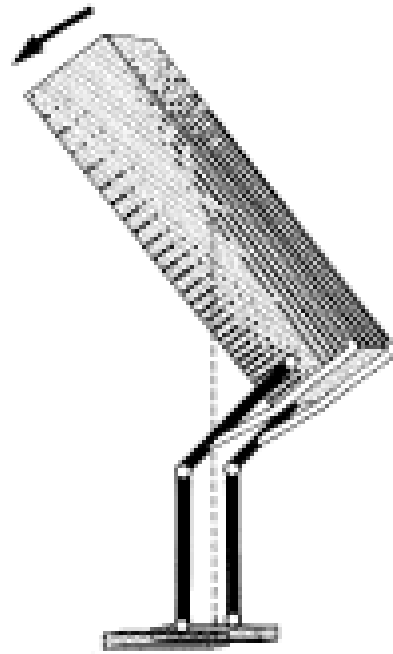
Miembro Inferior

Pelvis

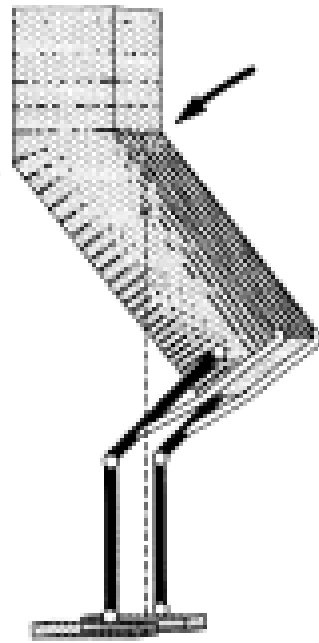


A

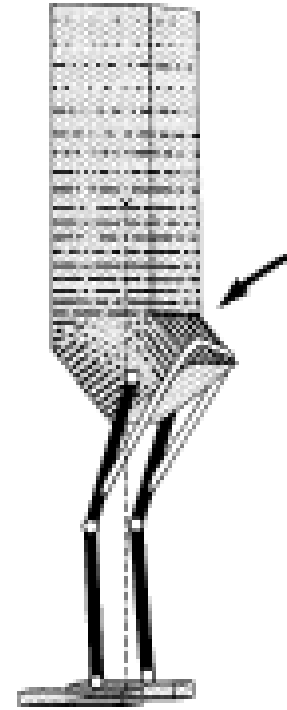




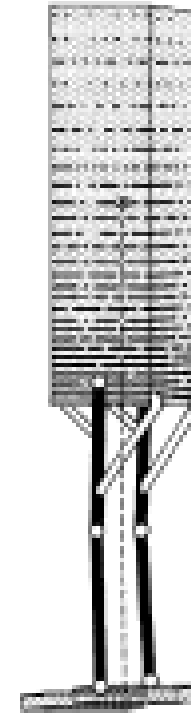
apes, monkeys
in bipedal posture



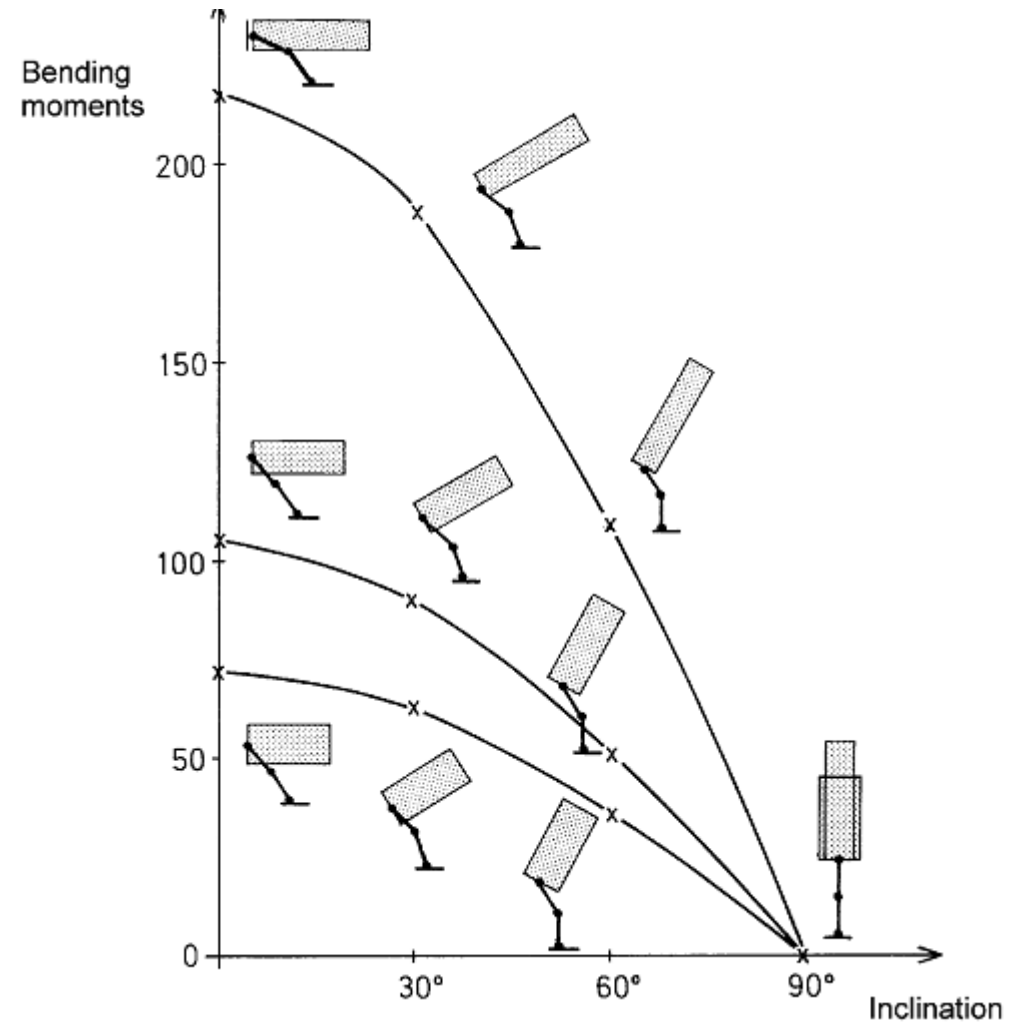
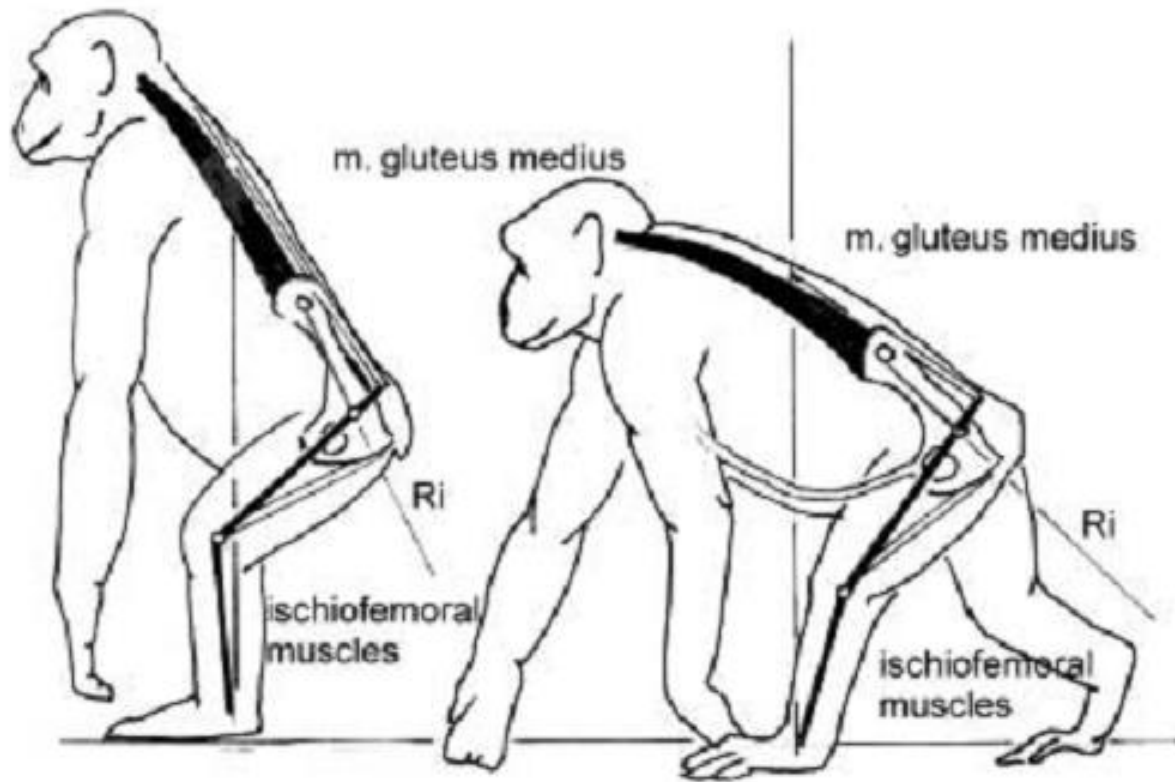
monkeys trained
in bipedality



hominids



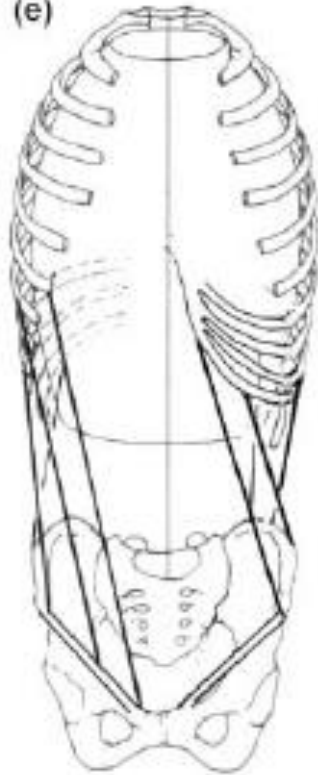
simplified human,
labile posture



The acquisition of bipedality (2004) H. Preuschoft

Tronco

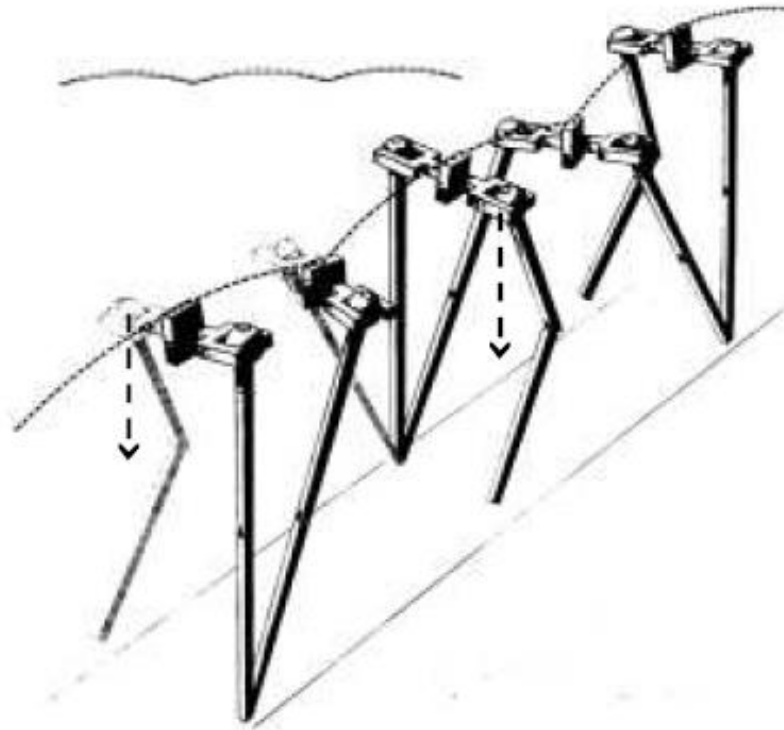
(e)

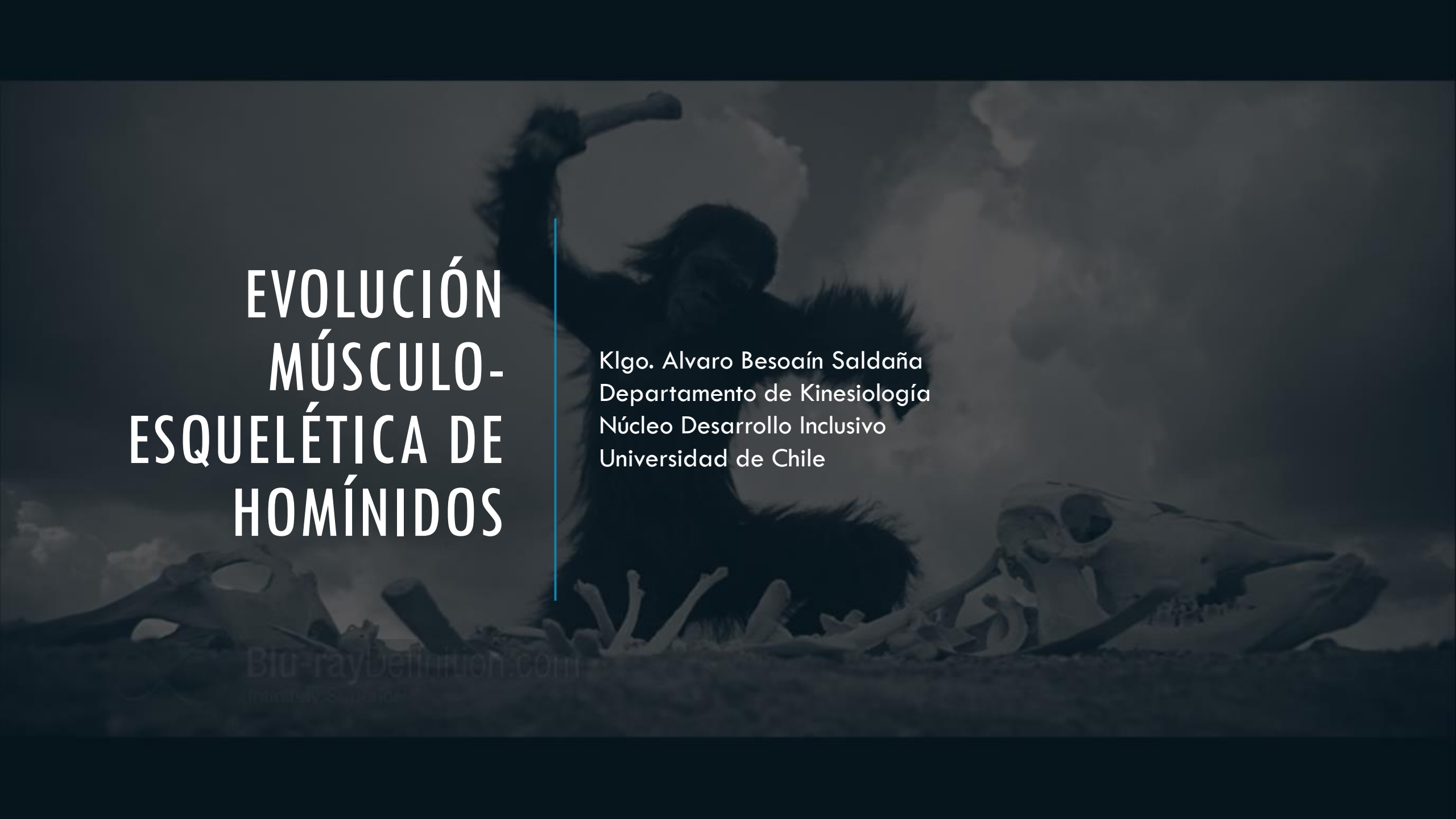


H. sapiens



Pan troglodytes





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