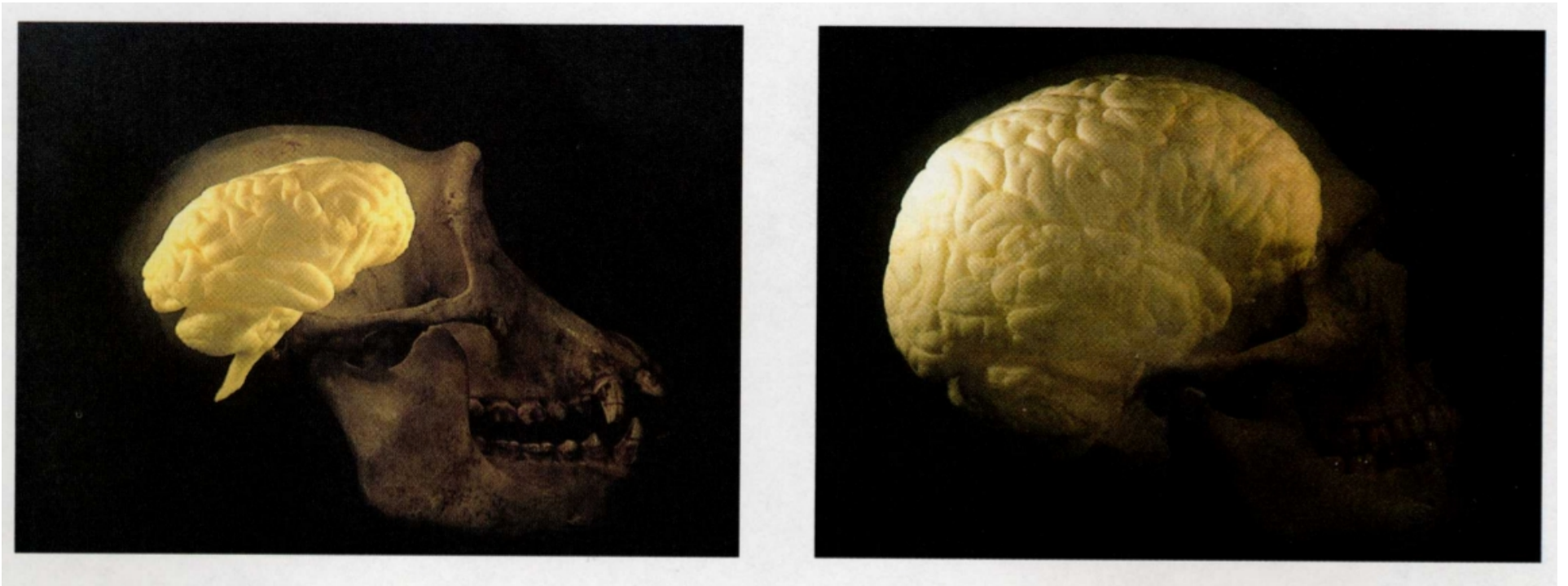


Evolução do Cérebro



Grupo Ic-Complex



[Home](#) [Membros](#) [Disciplinas](#) [Apresentações](#) [Pesquisa](#) [Publicações](#)

[Eventos](#)

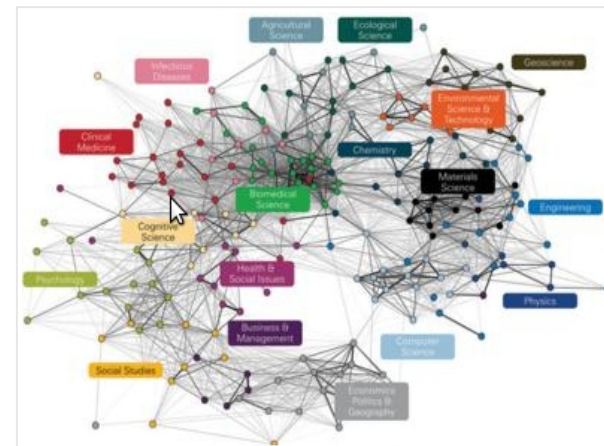
Home [Coordenador](#) [Contato](#)

IC-COMPLEX

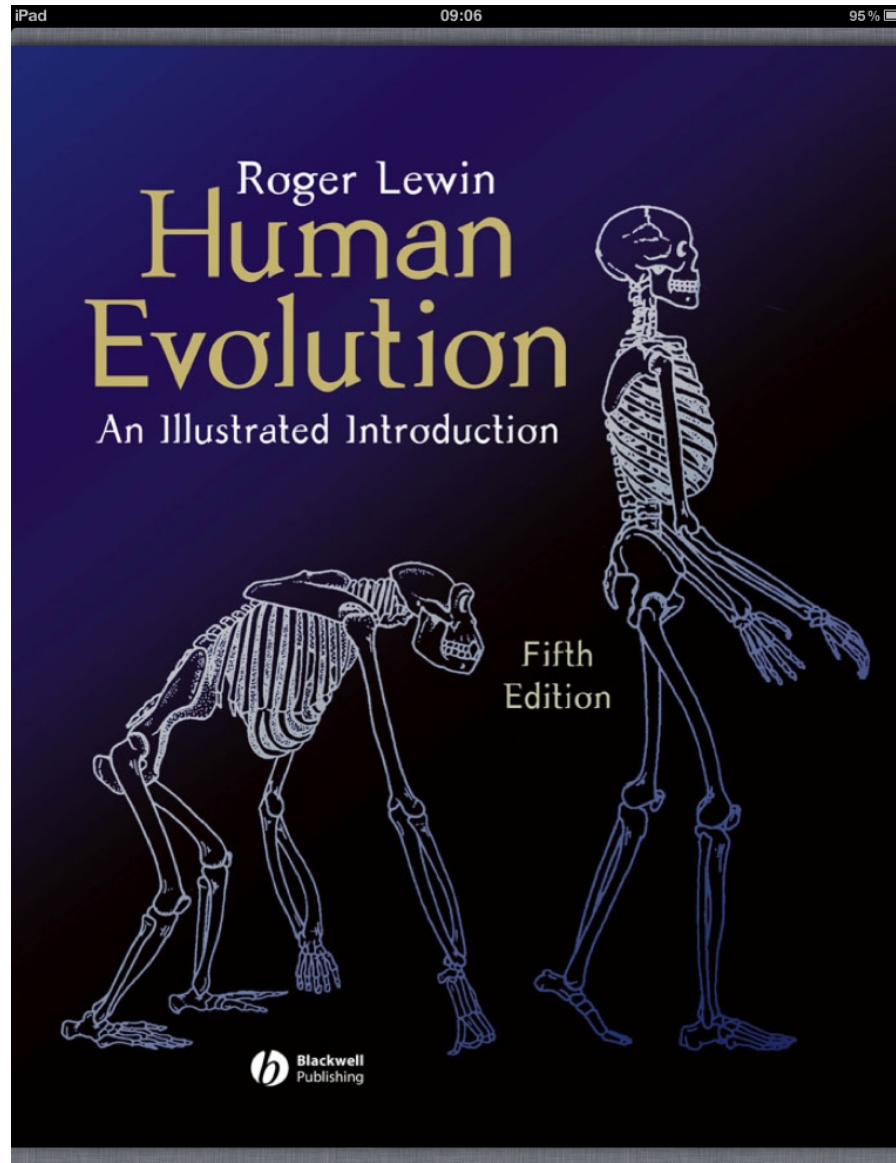
O IC-complex é um grupo de pesquisa formado por pesquisadores e estudantes de diferentes áreas do conhecimento. O objetivo principal do grupo é a aplicação de técnicas matemáticas e computacionais para o estudo de sistemas físicos, biológicos, sociais, entre outros.

Entre os estudos em desenvolvimento, podemos destacar:

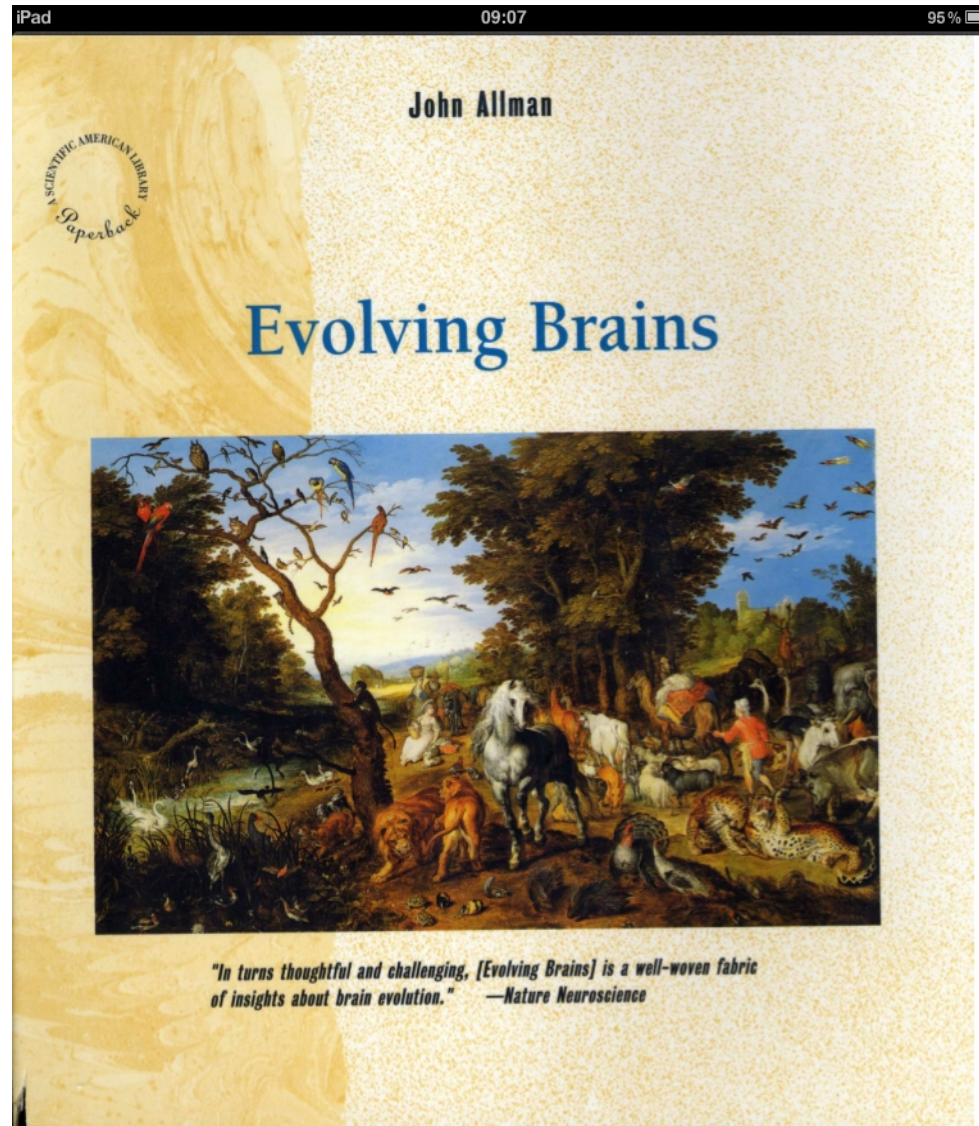
- Modelos de evolução social;
- Modelos de emergência de Linguagem;
- Redes Neurais e evolução do Cérebro;
- Dinâmica de Populações.



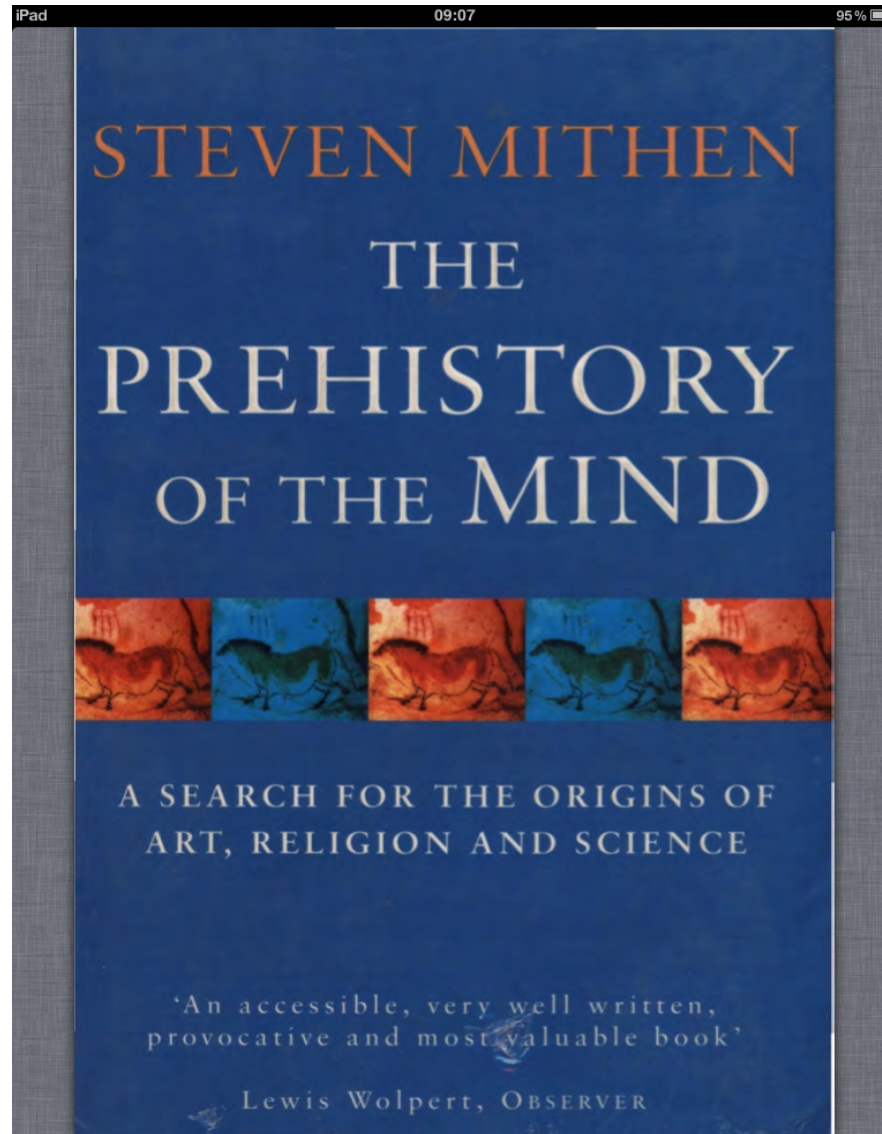
Bibliografia



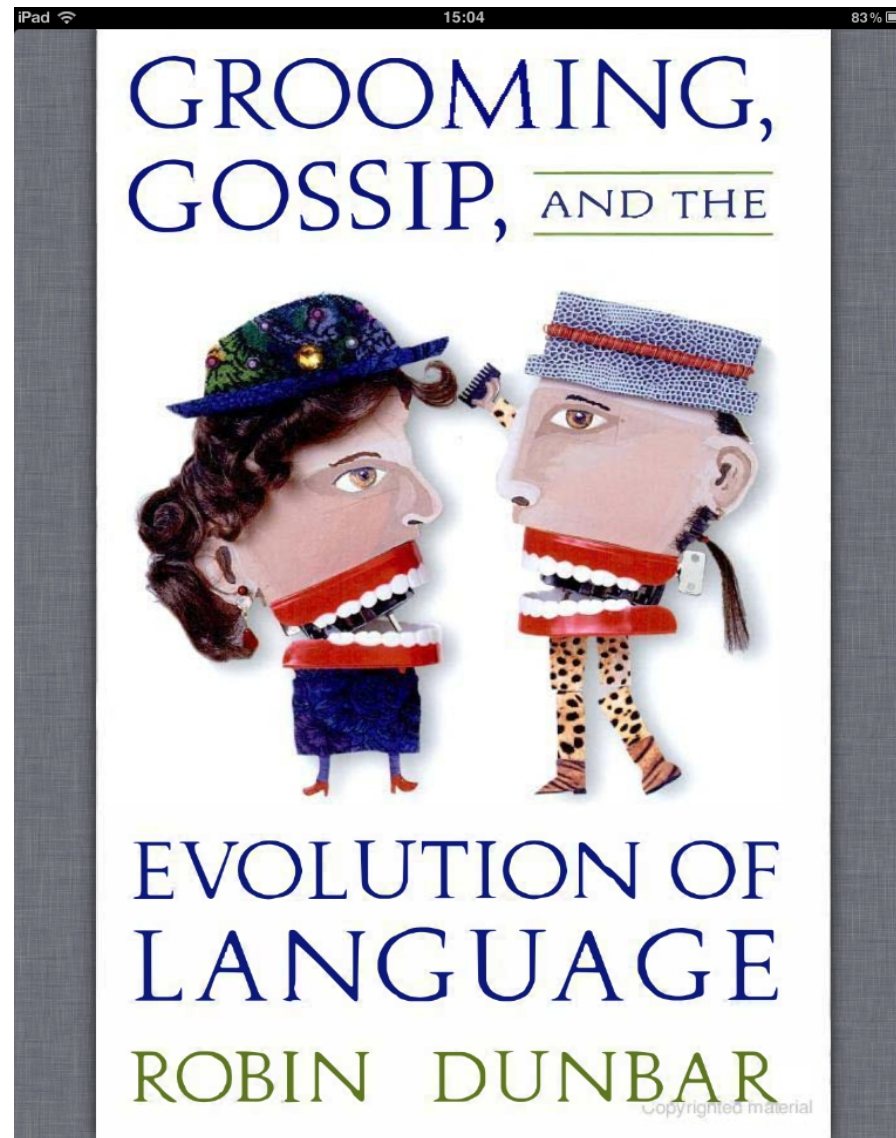
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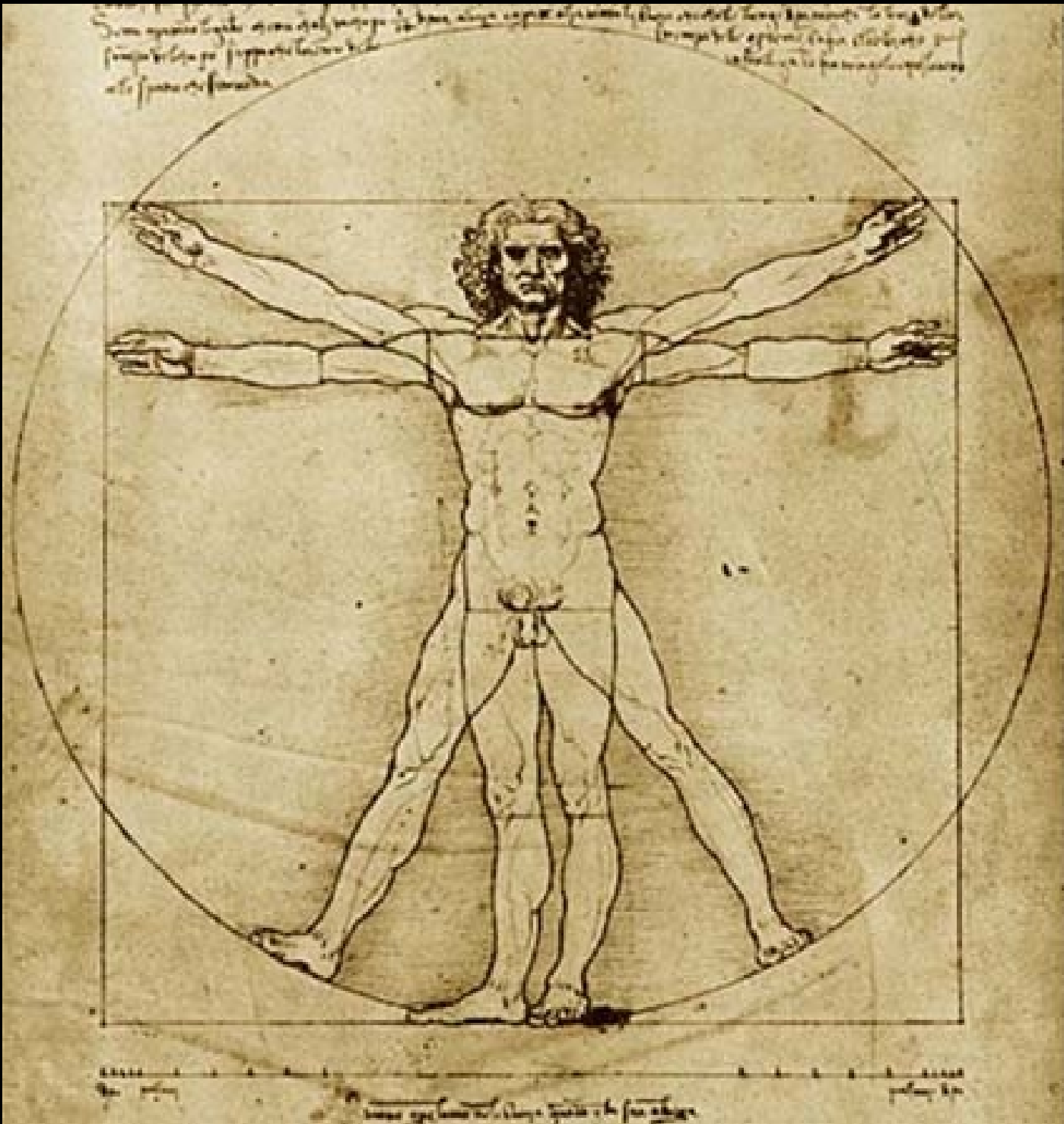
Bibliografia



Bibliografia

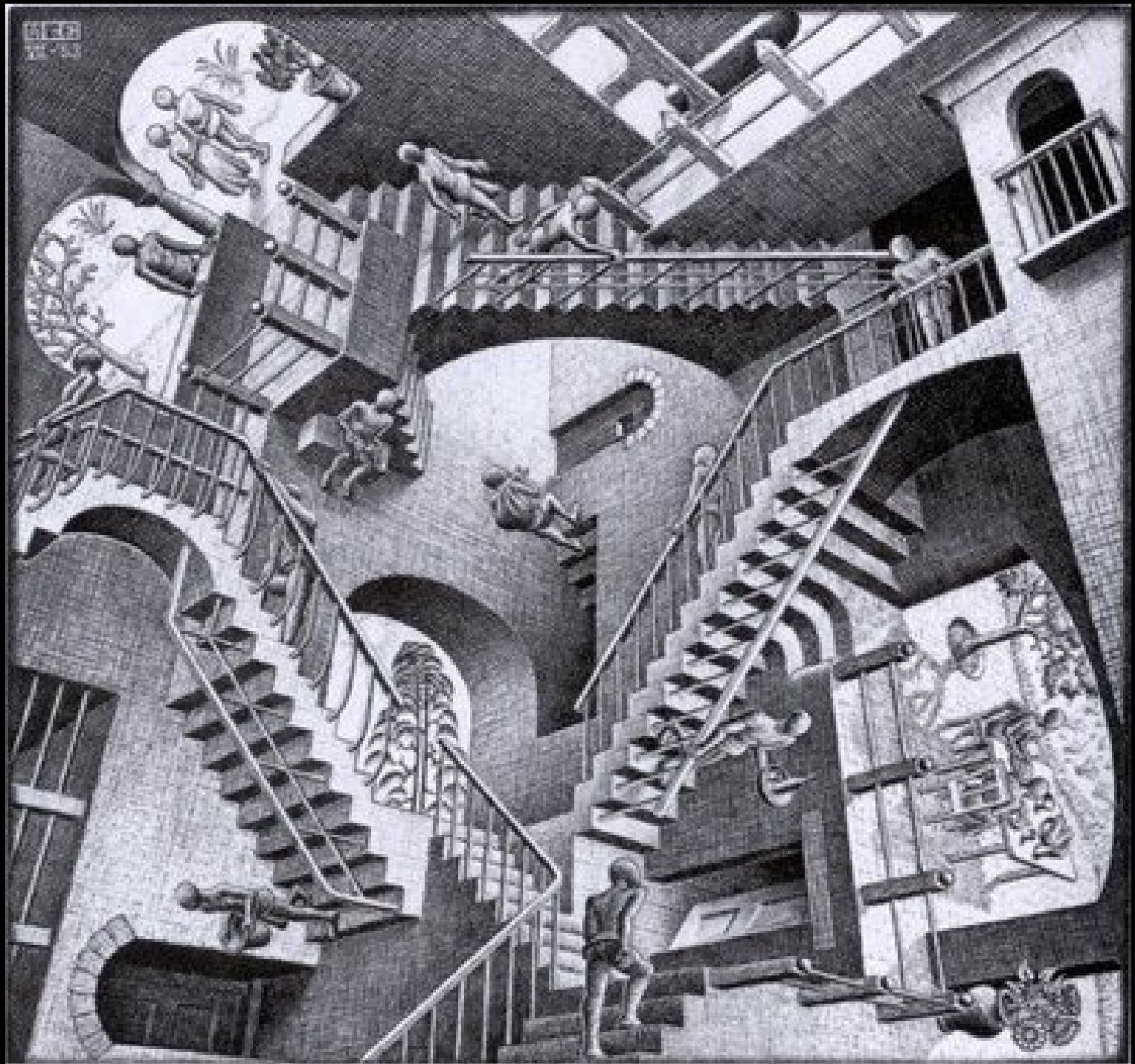


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Summa quatuordecim mensuris in quibus dicitur quod quatuordecim sunt mensurae in quibus
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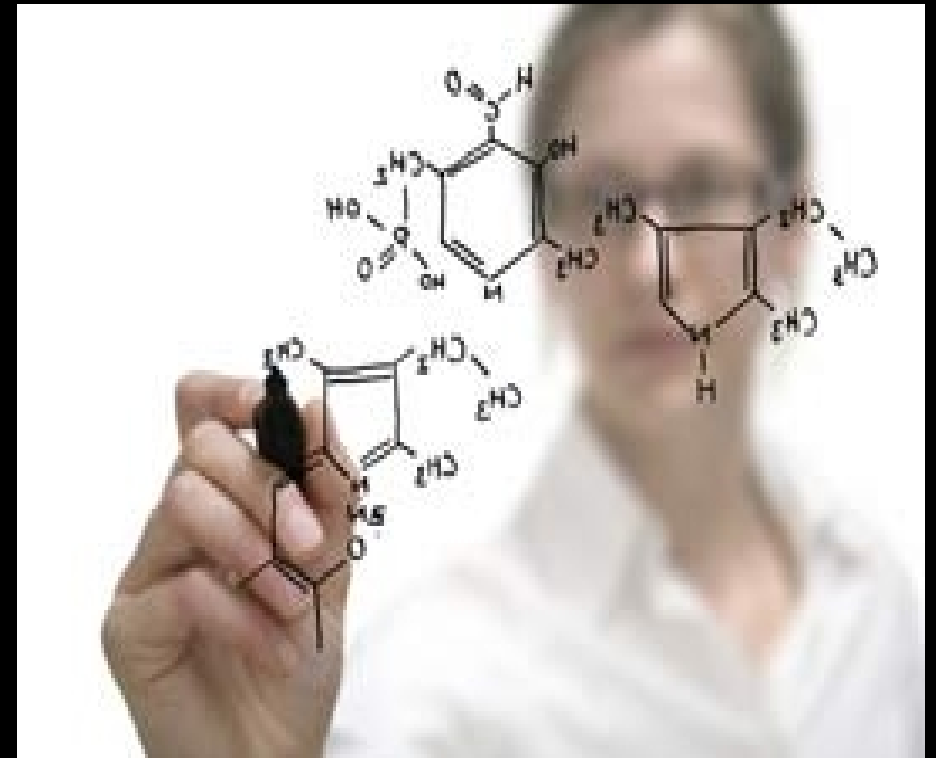








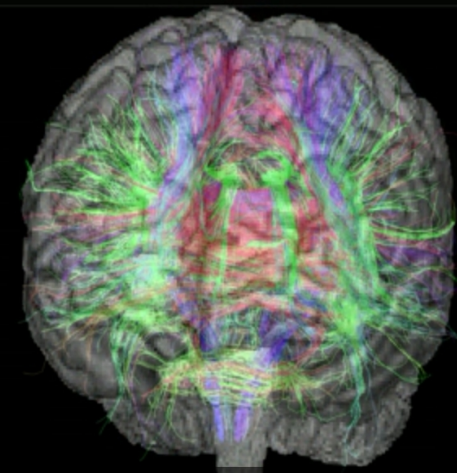
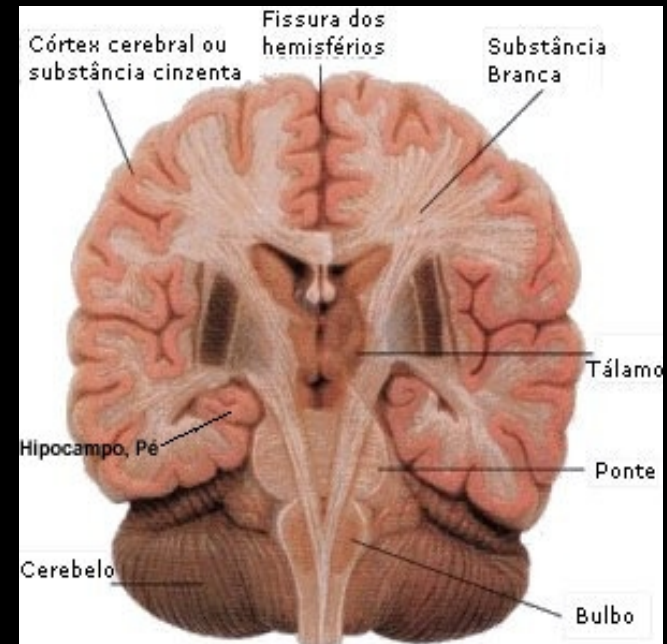
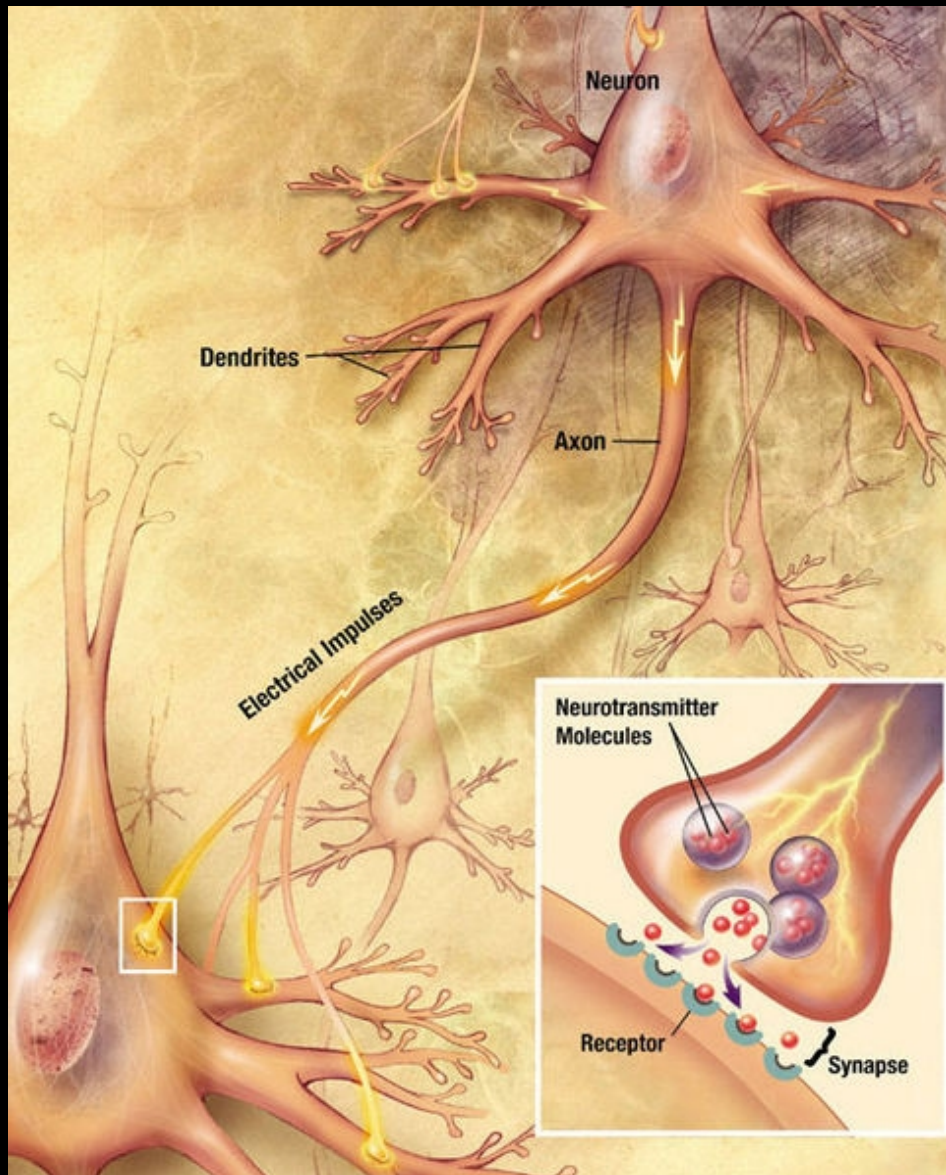




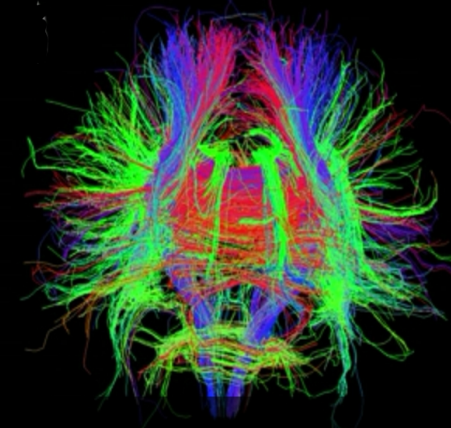
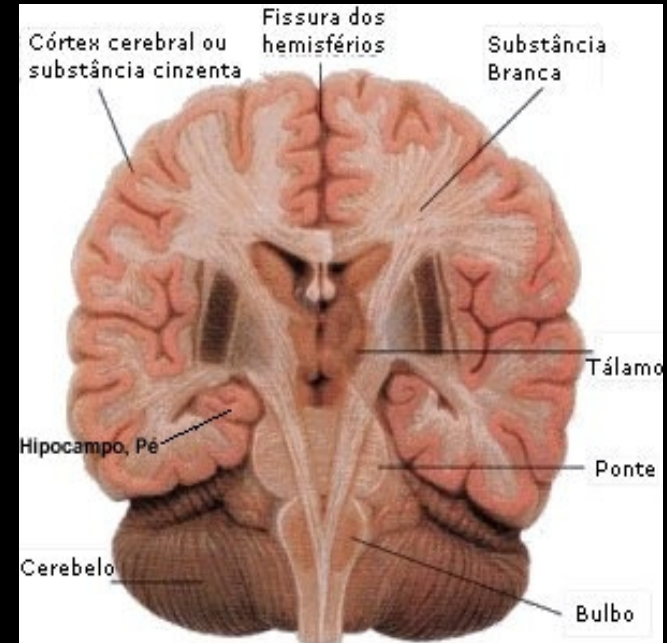
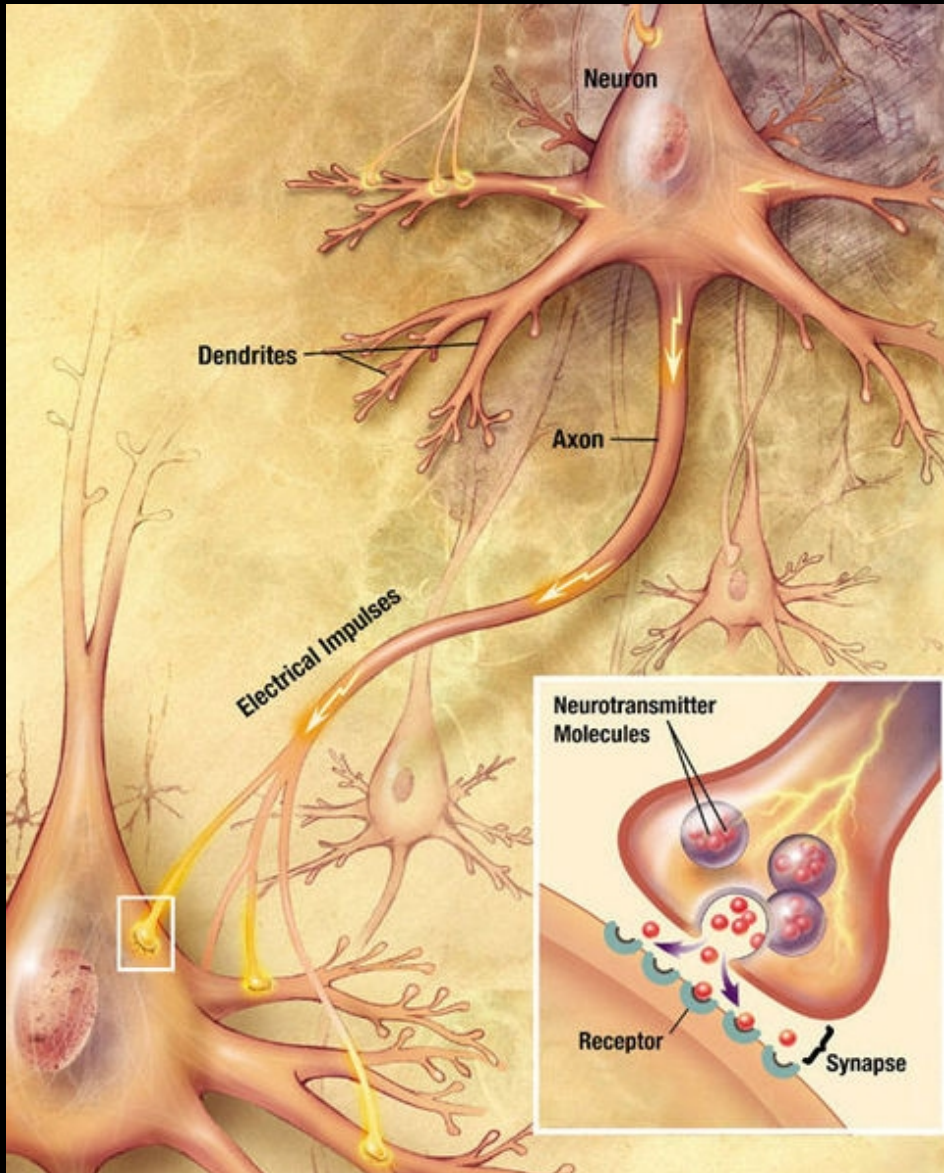


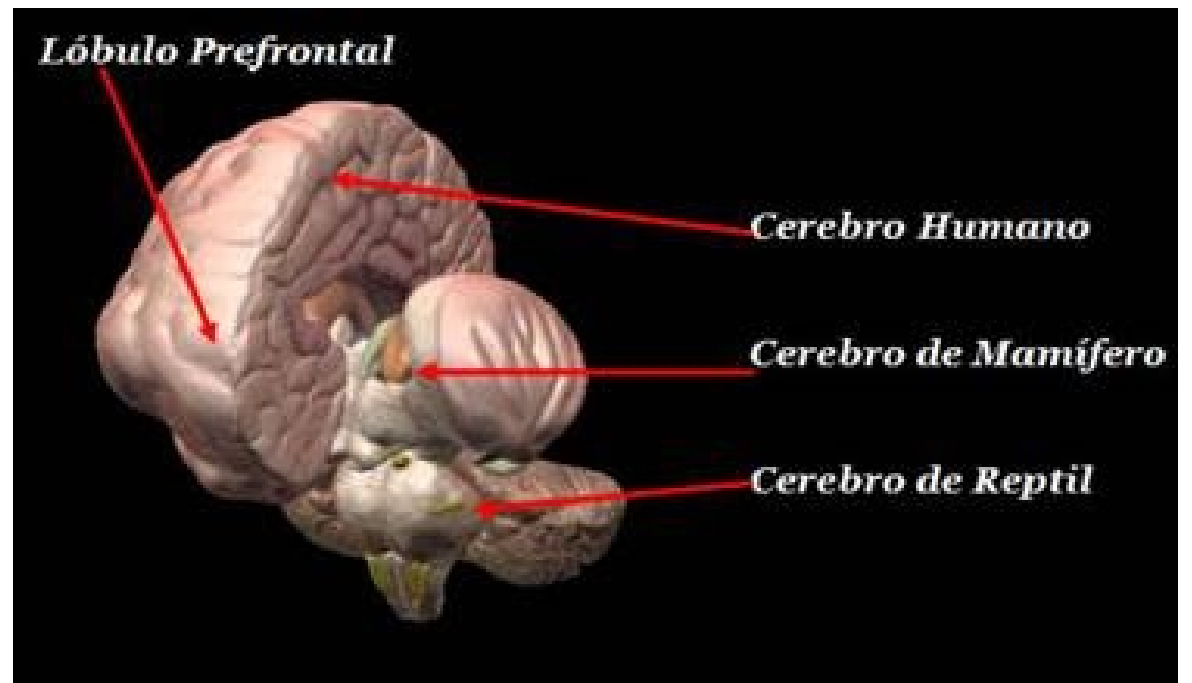
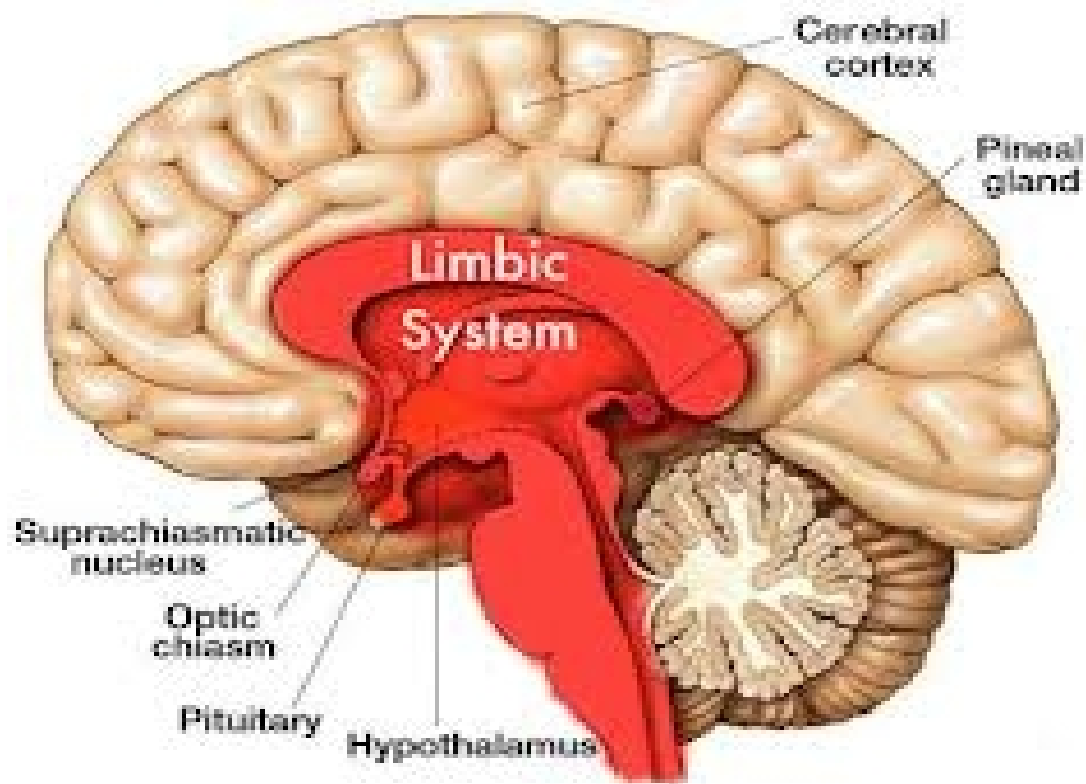


Neurônios e o Cérebro



Neurônios e o Cérebro





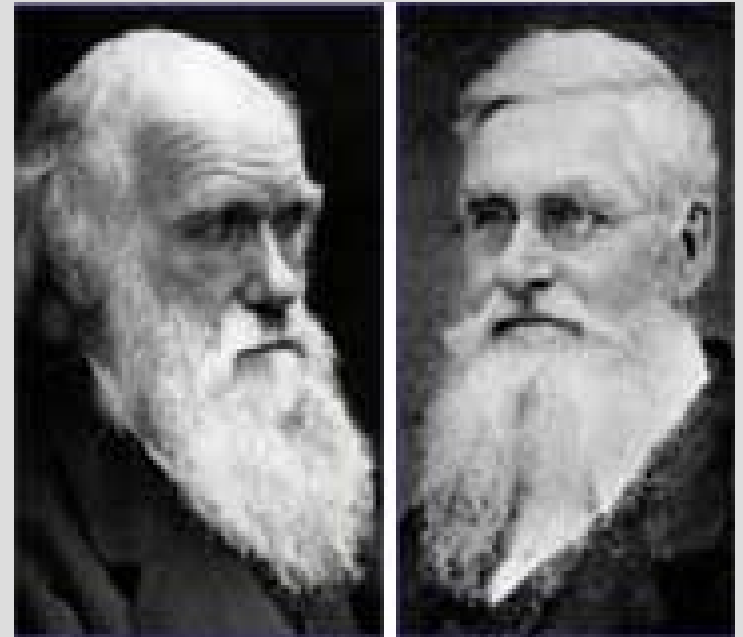
Sumário

- Evolução Biológica e Seleção Natural;
- Lei do expoente $\frac{3}{4}$ e consequências para tamanho do cérebro;
- Cérebro Social ;
- Dados Experimentais

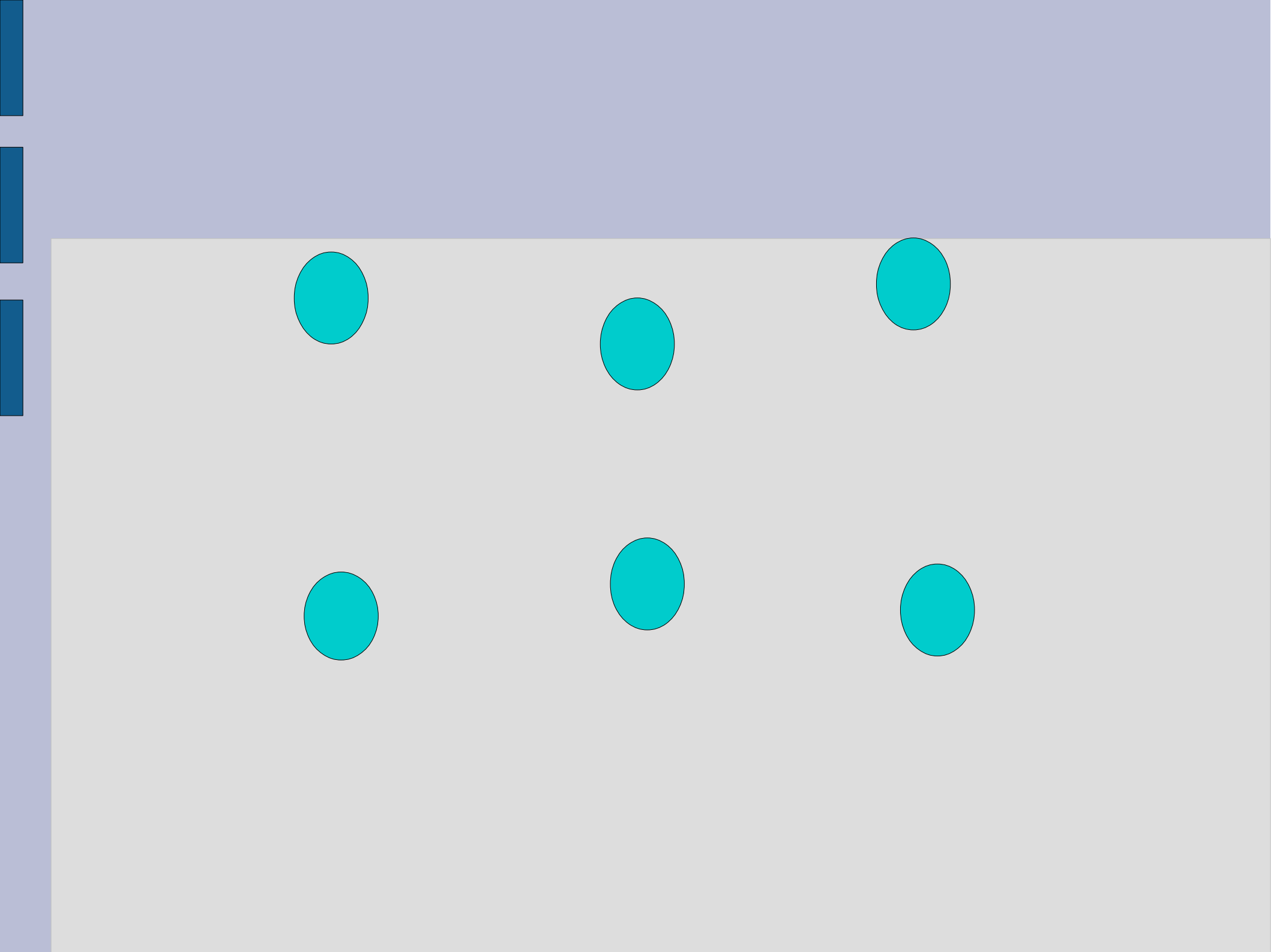
Evolução Biológica

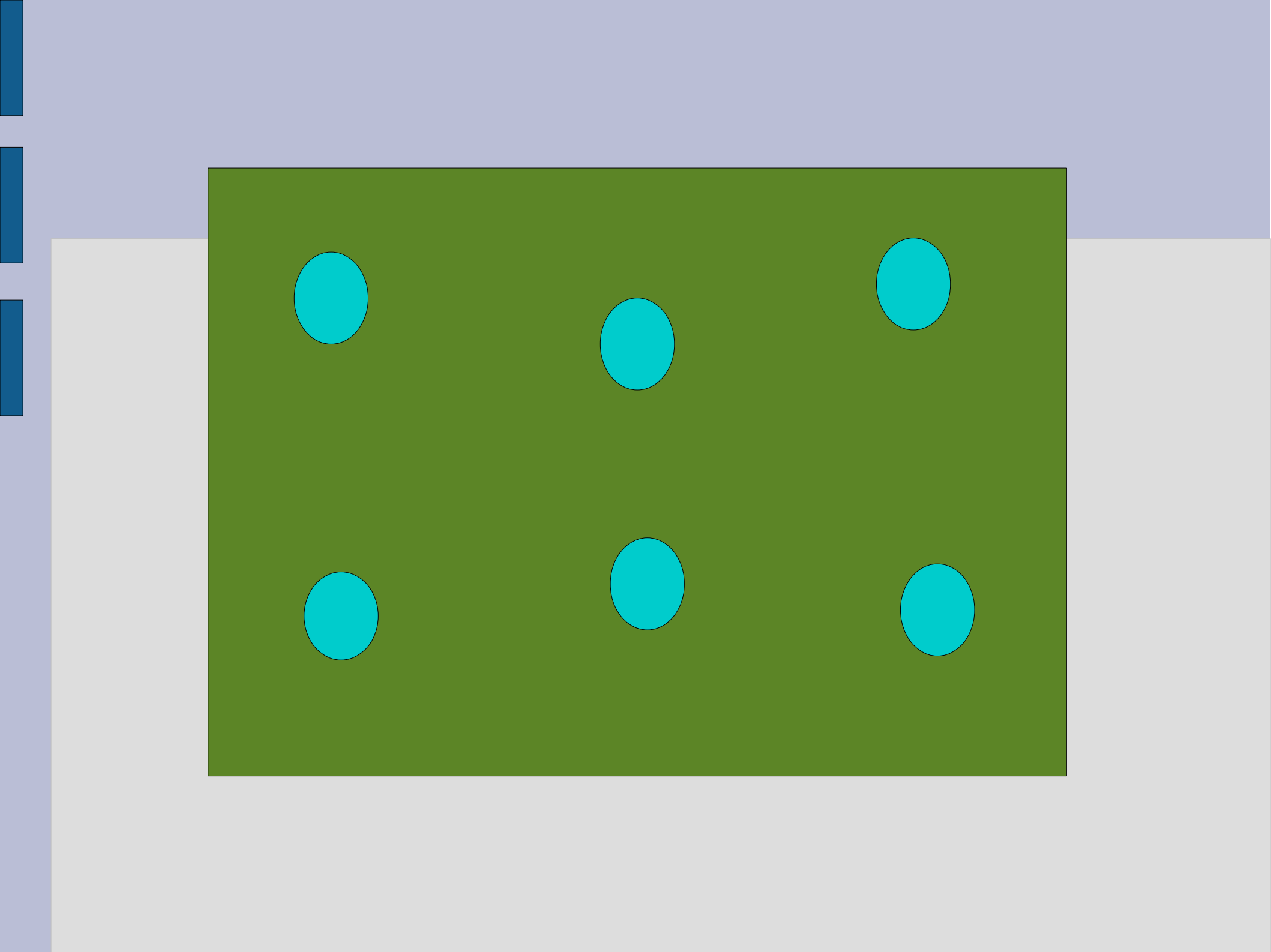
Para que aconteça evolução dos indivíduos em uma população é preciso:

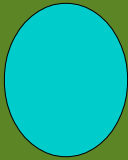
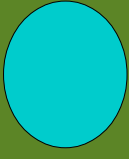
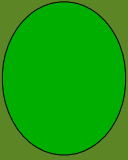
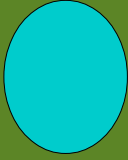
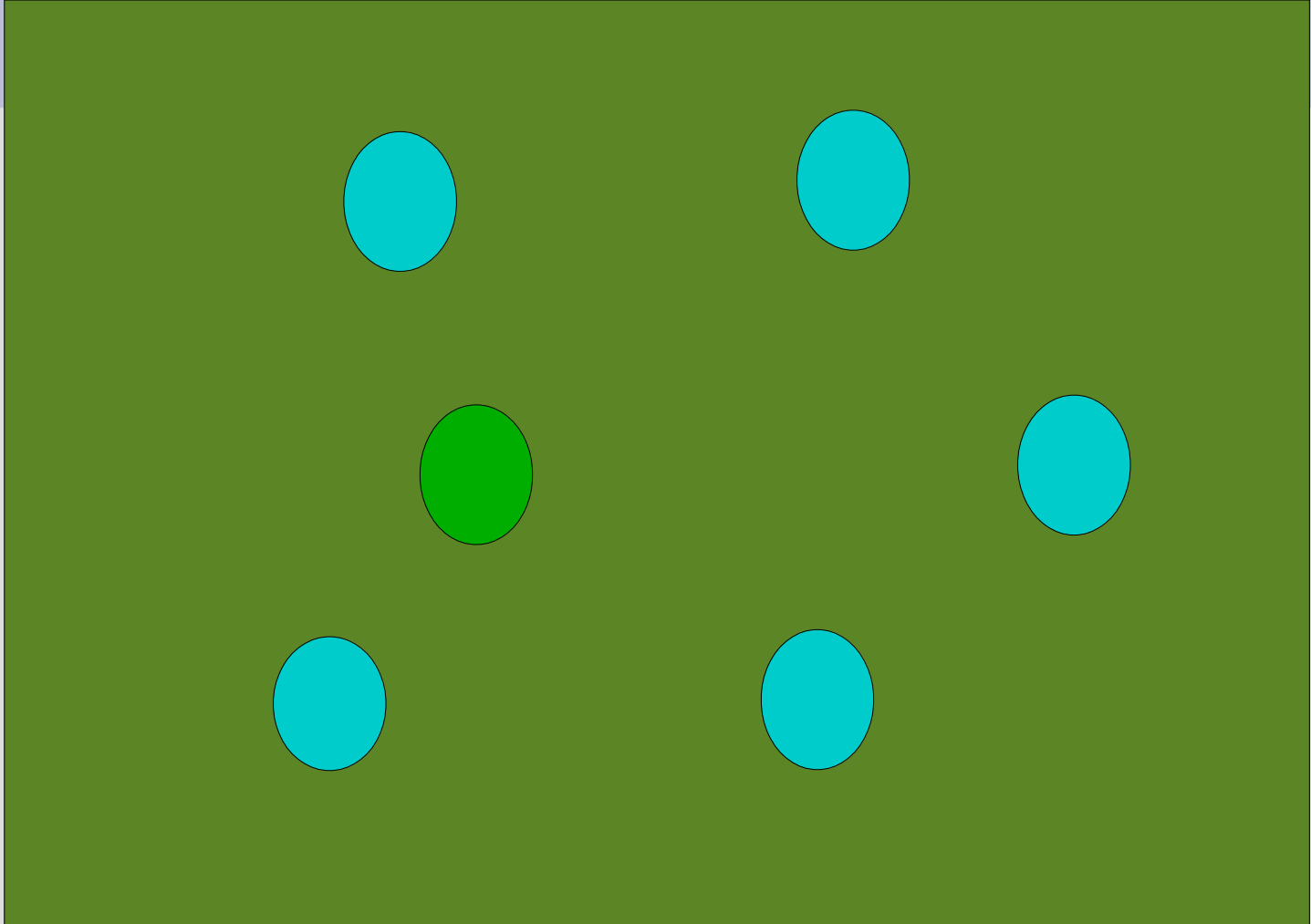
- hereditariedade;
- mudanças aleatórias;
- seleção natural.

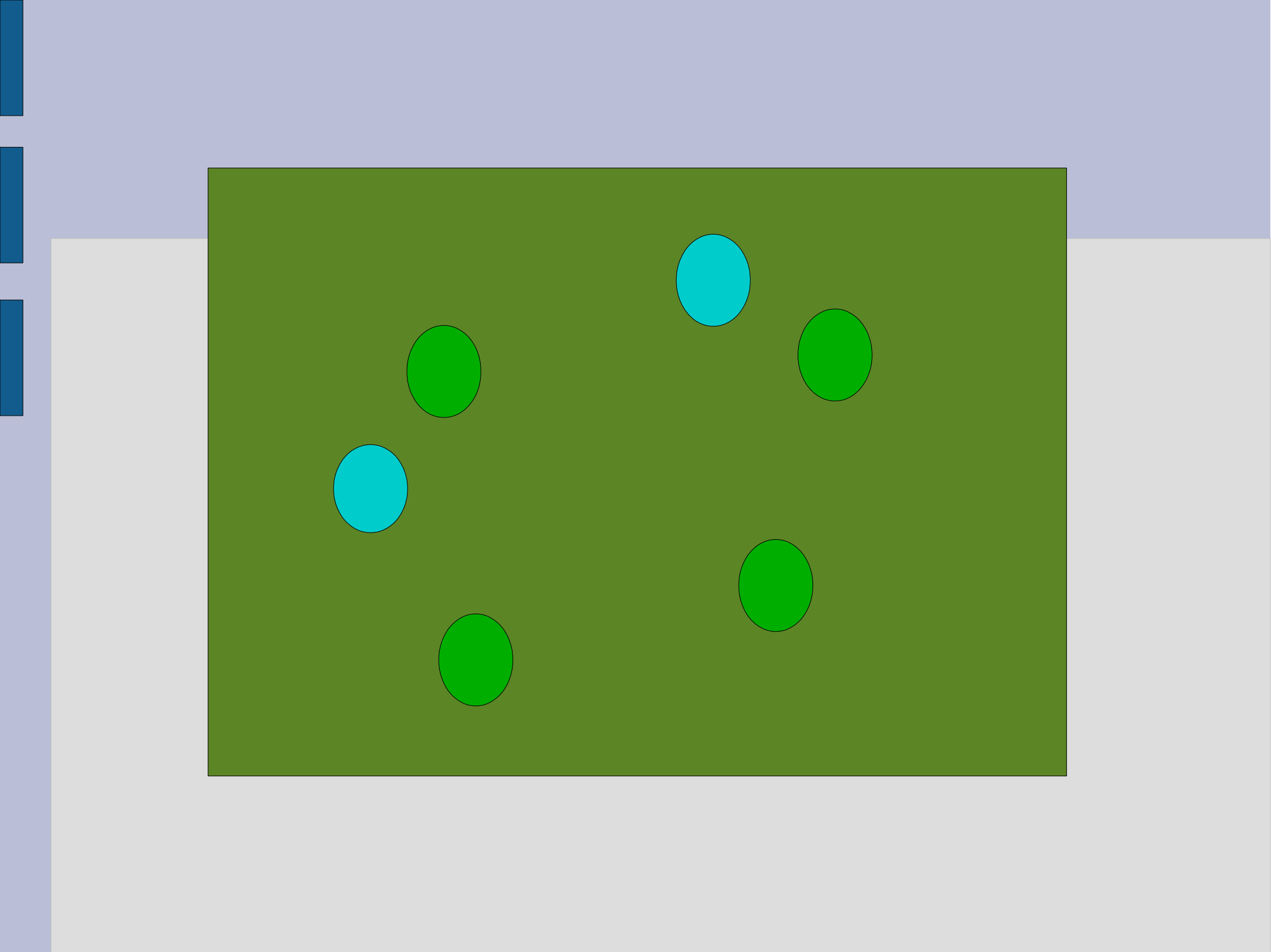


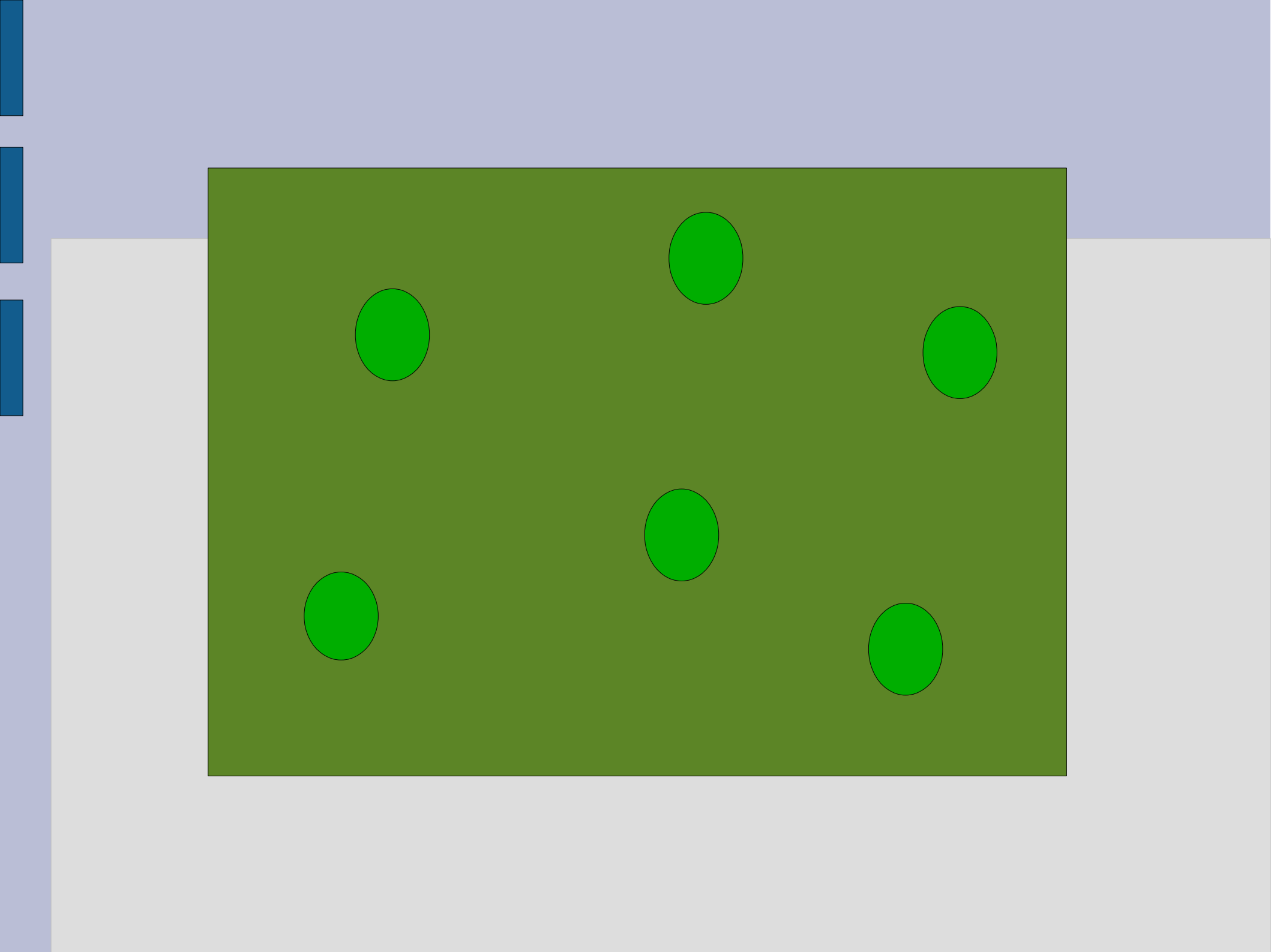
Darwin e Wallace

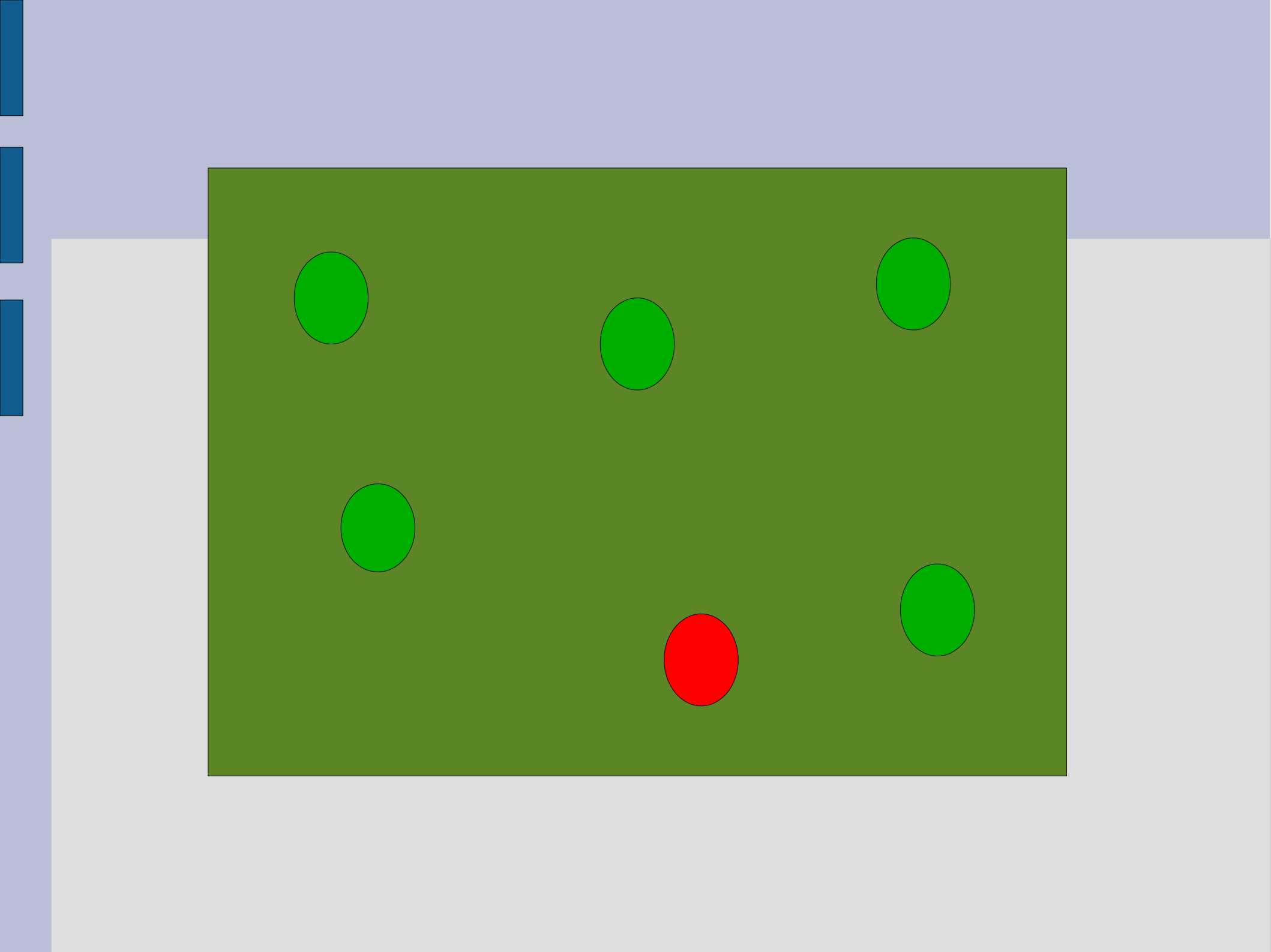


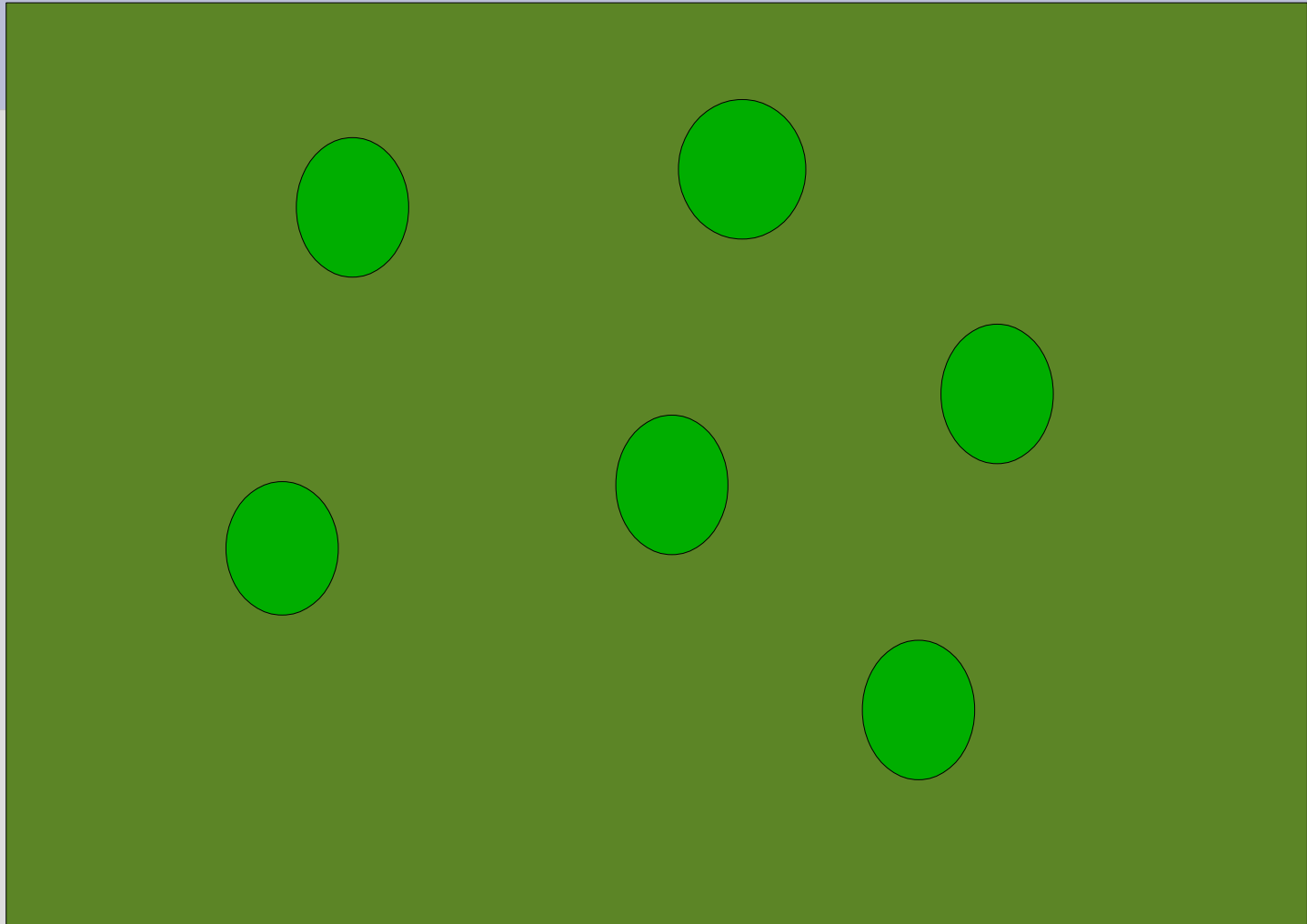


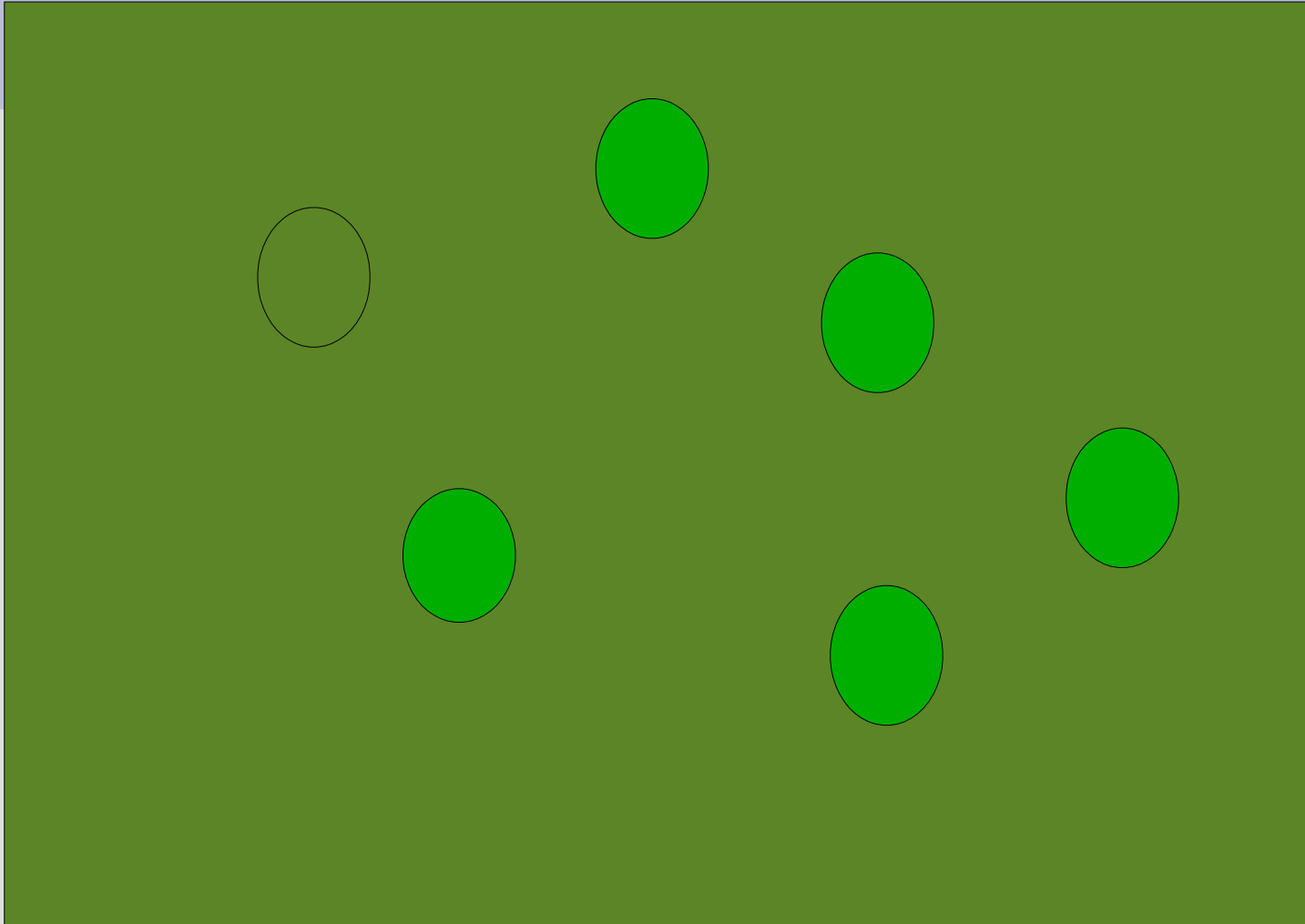


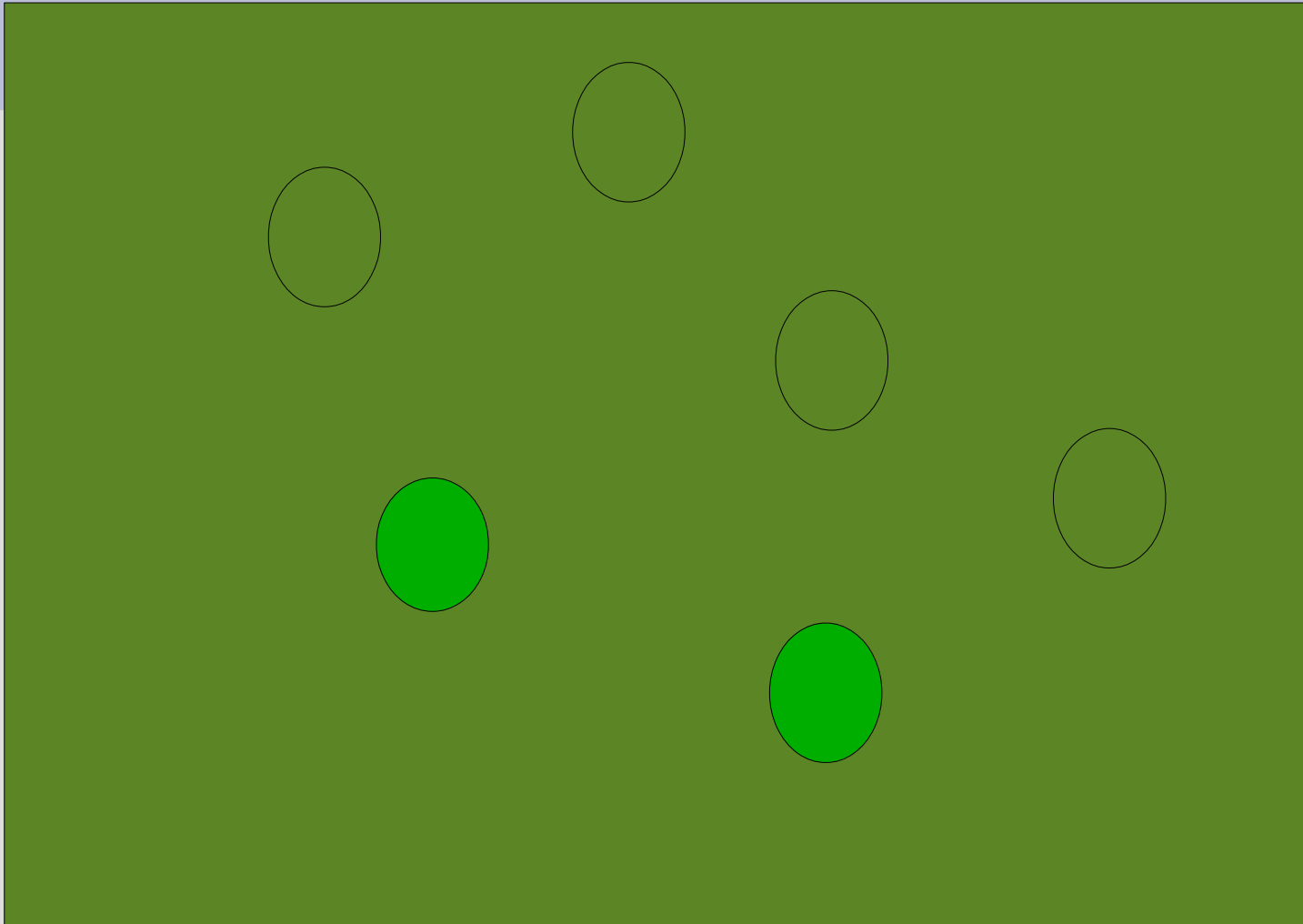


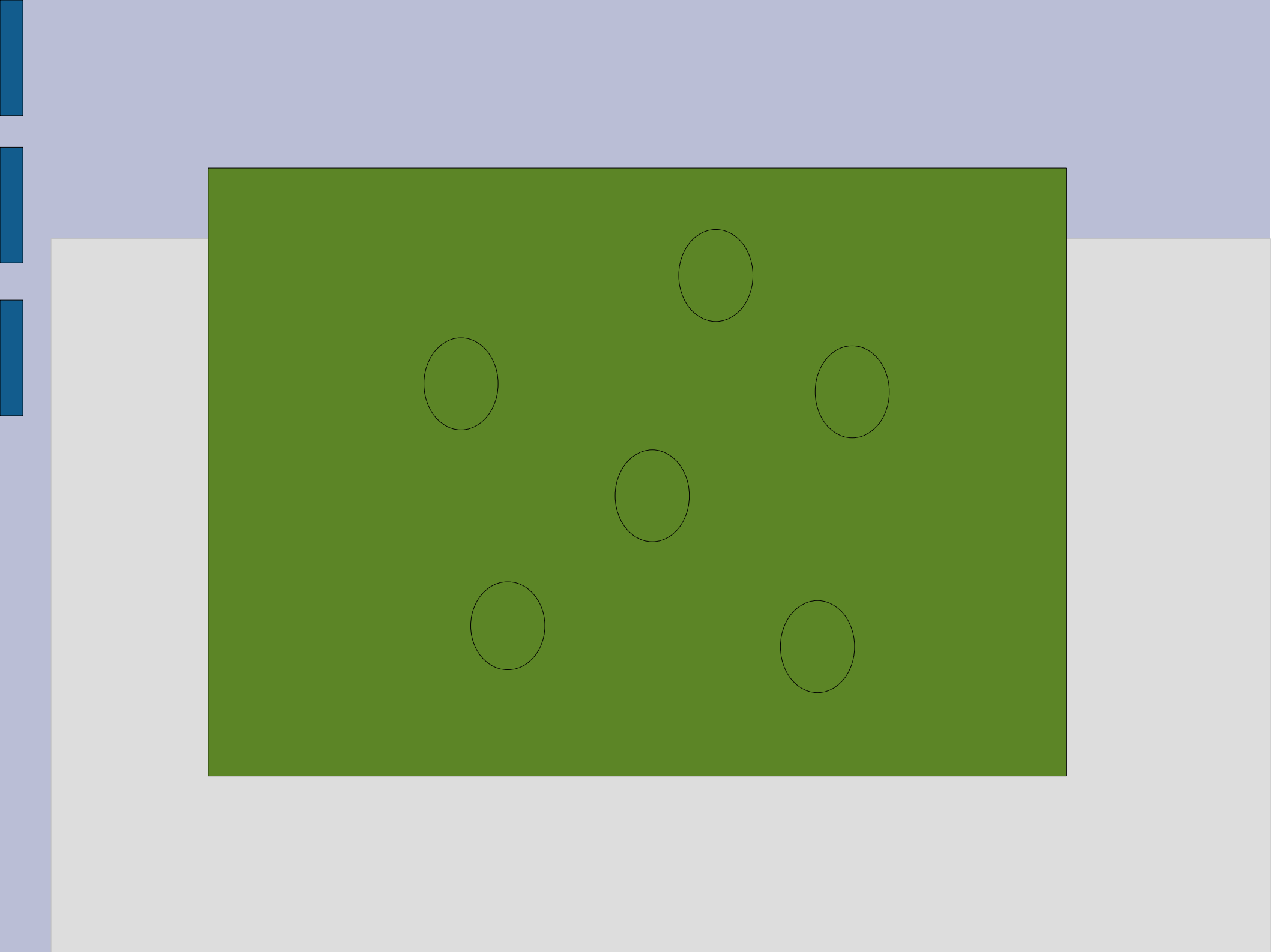














Bicho-Folha



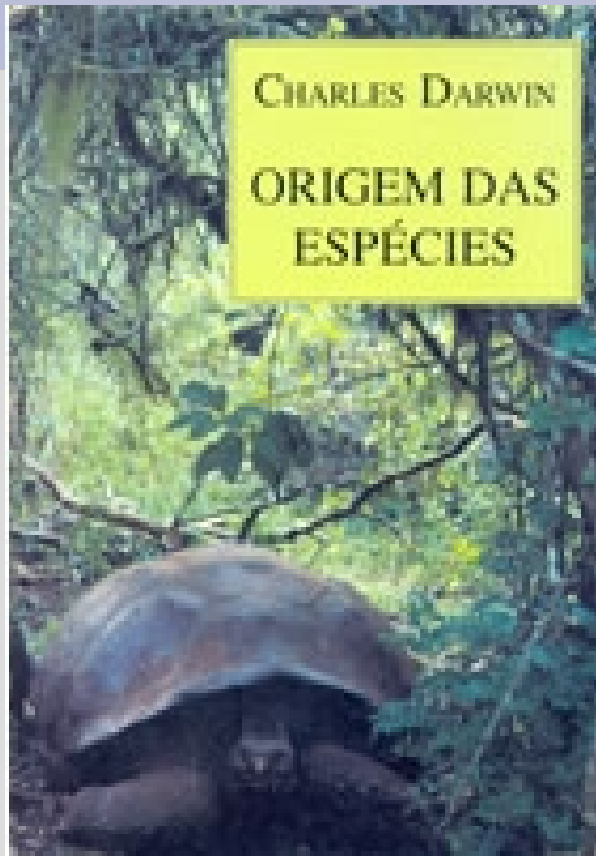
Bicho-Pau



Bicho-Folha



Bicho-Pau



Devido a esta luta (a luta pela sobrevivência), as variações, por mais fracas que sejam e seja qual for a causa de onde provenham, tendem a preservar os indivíduos de uma espécie e transmitem-se à descendência logo que sejam úteis a esses indivíduos. (...)

Os descendentes terão, por si mesmos, em virtude disso, maior probabilidade de sobrevivência; (...)

Denominei este princípio, pelo qual cada variação diminuta, se útil, é preservada, com o termo Seleção Natural, com a finalidade de salientar sua relação com o poder humano de seleção.

Darwin, A Origem das Espécies, cap III

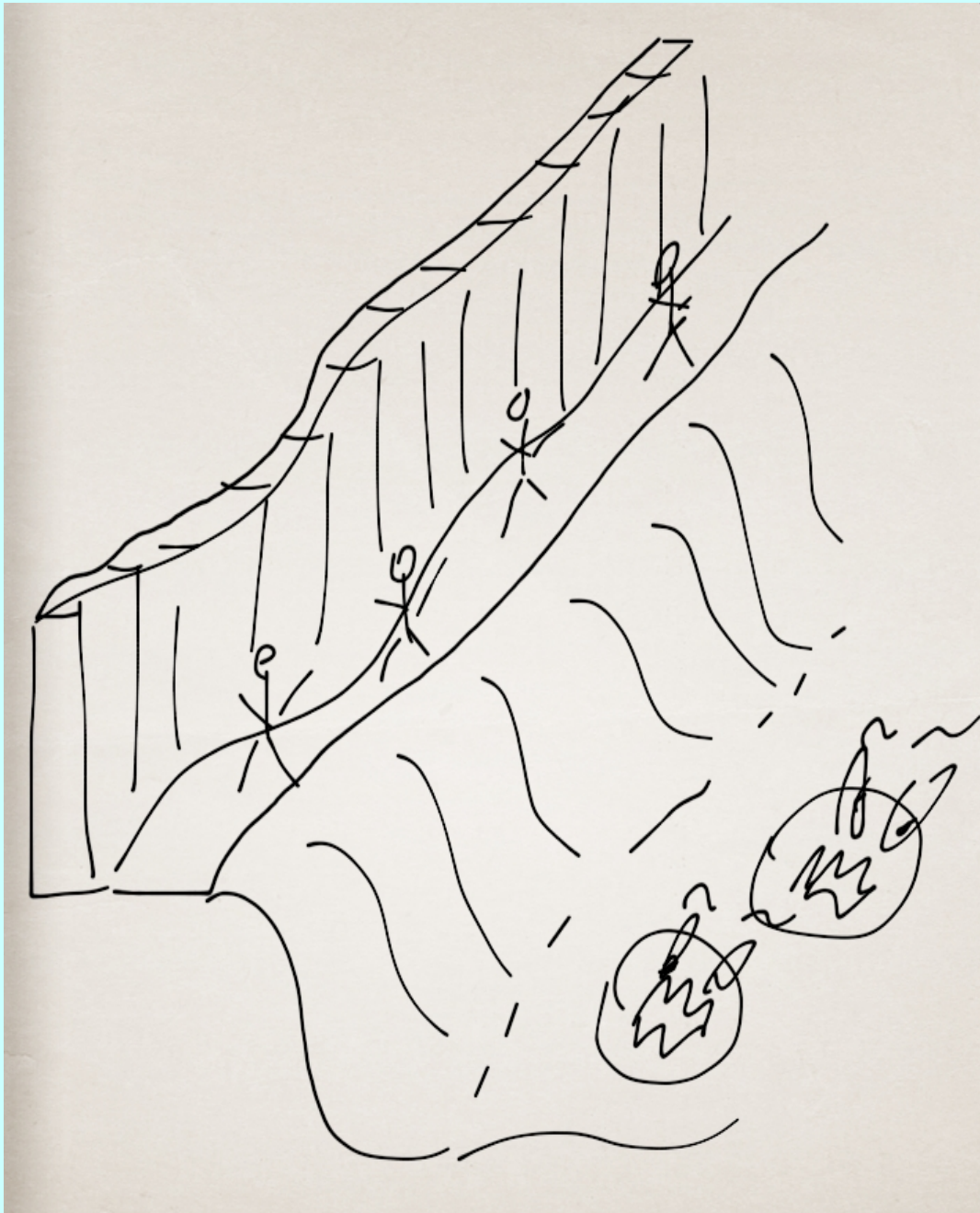
Níveis de Evolução

- Gene;
- Indivíduo;
- Grupo.





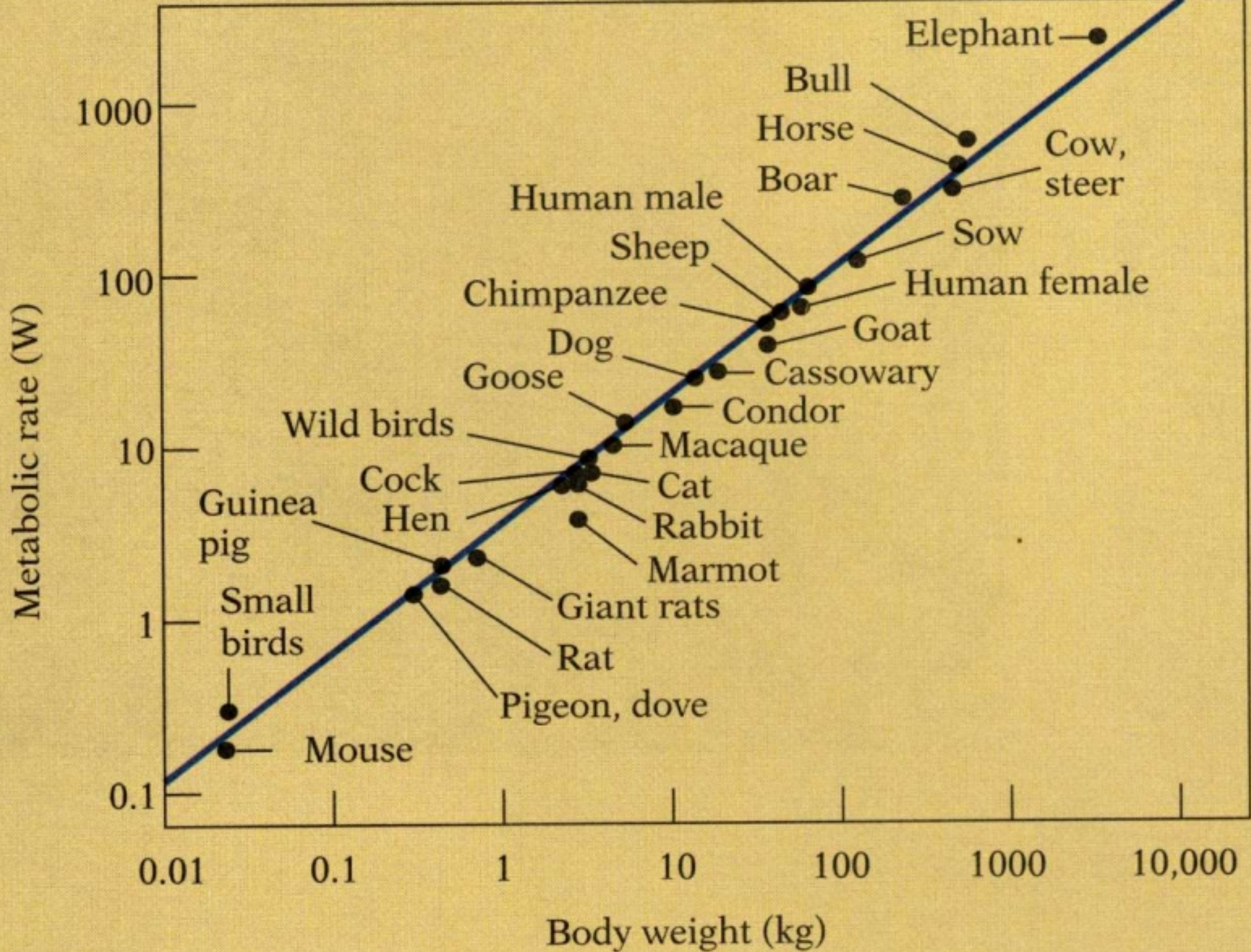
YAHOO



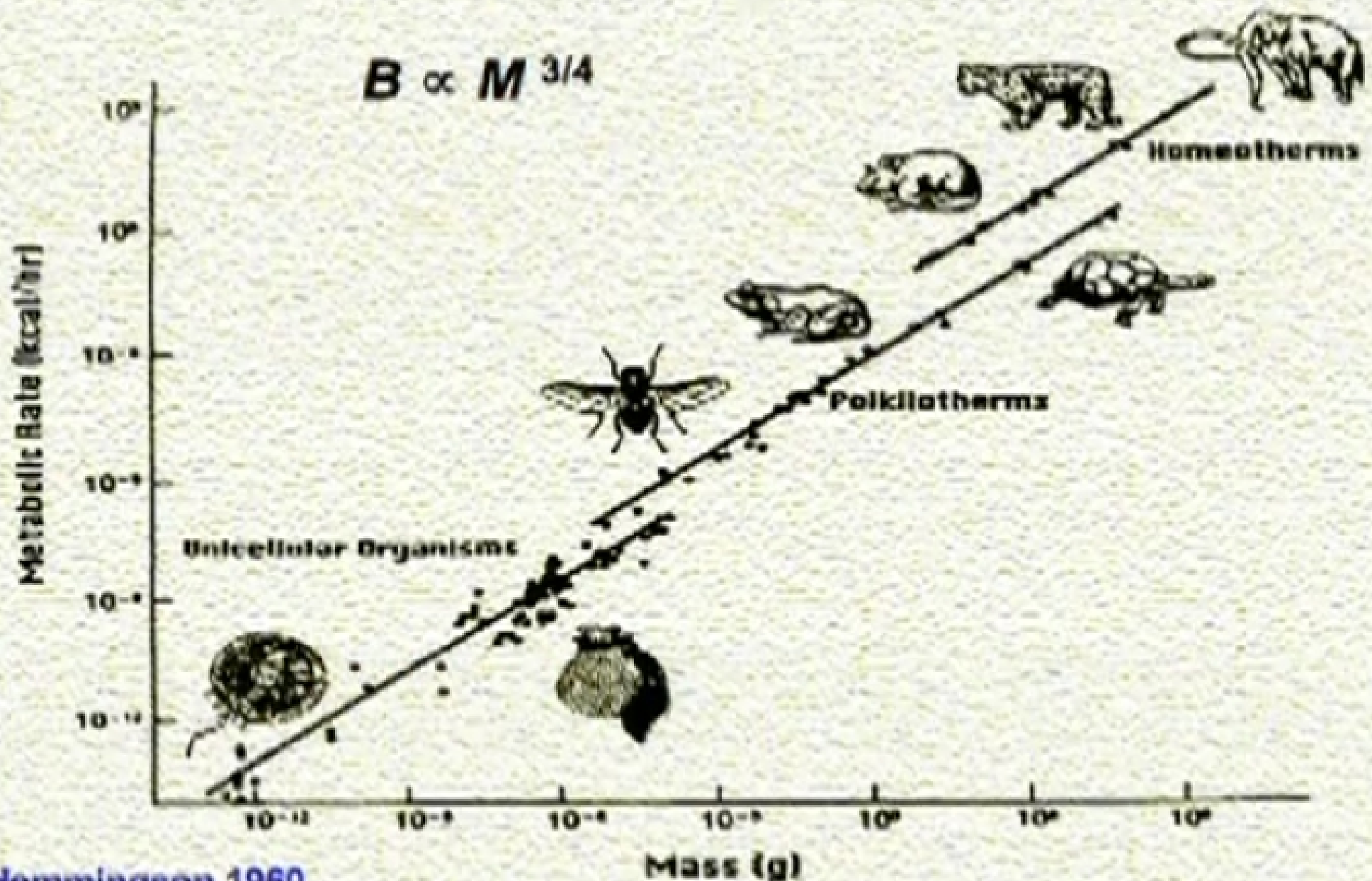
Muro: Limite imposto pelas
Leis da Física;

Meninos: espécies biológicas;

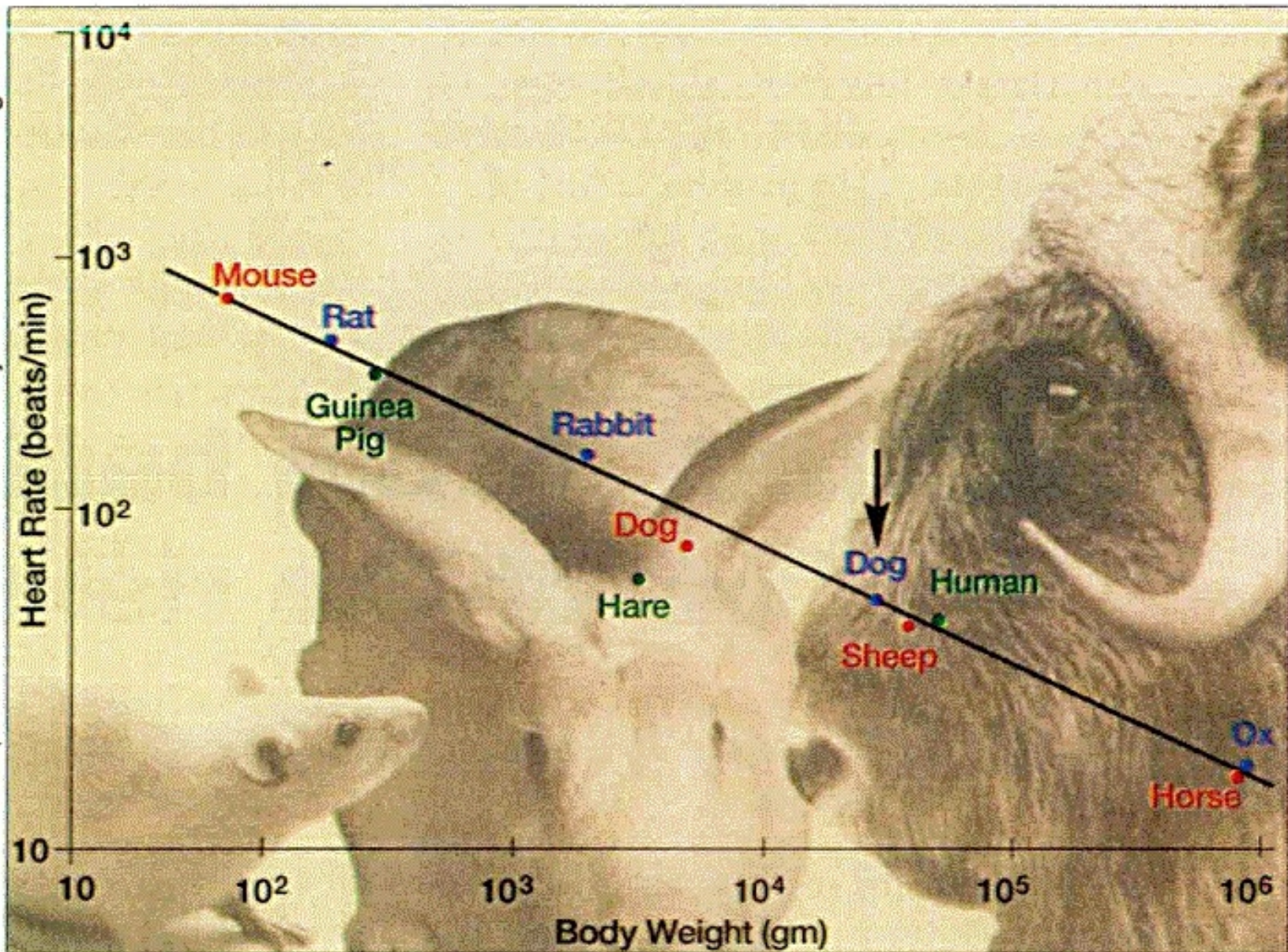
Monstros: Seleção Natural;



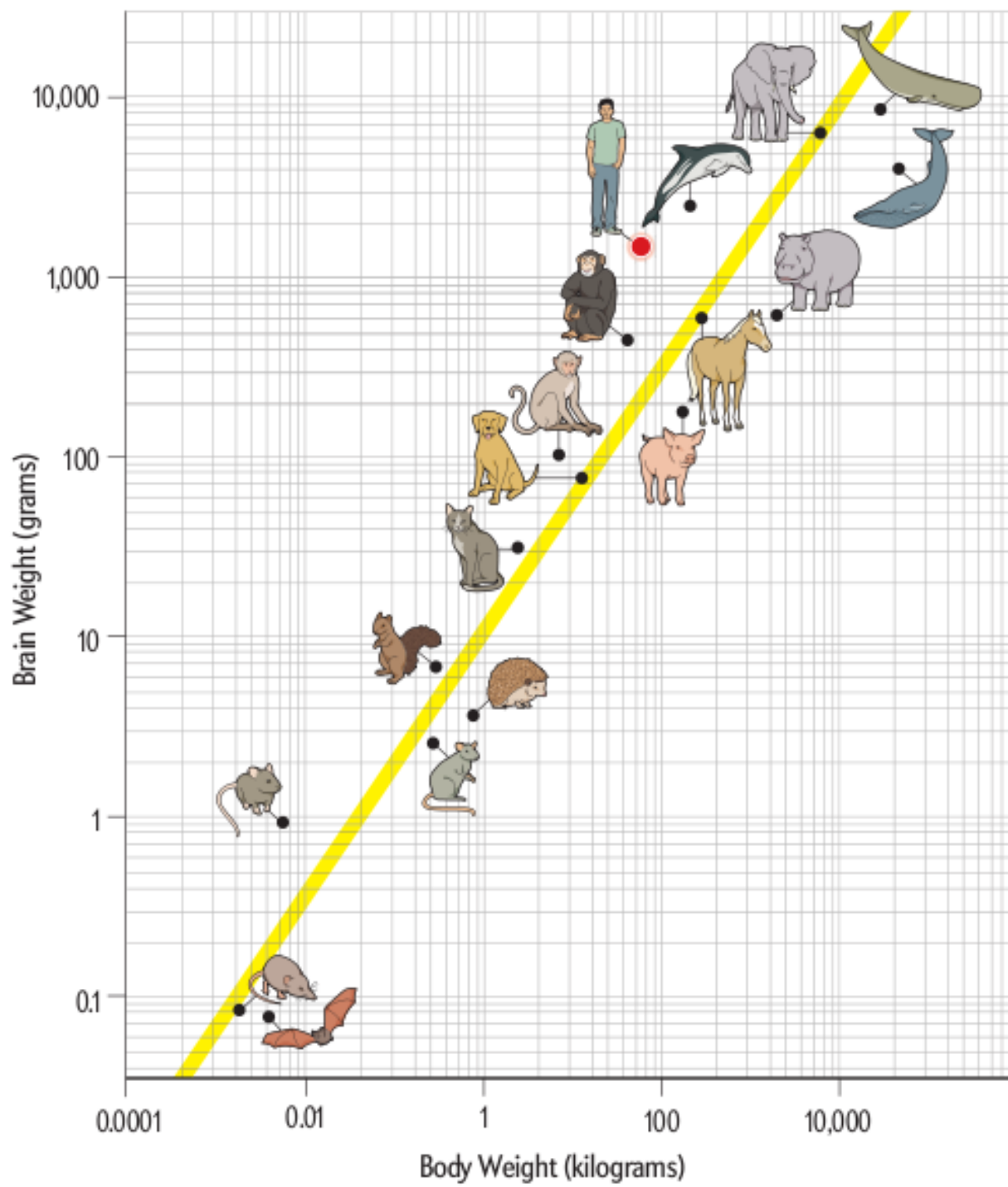
Whole-organism metabolic rate (B) scales as the $3/4$ power of body mass (M)

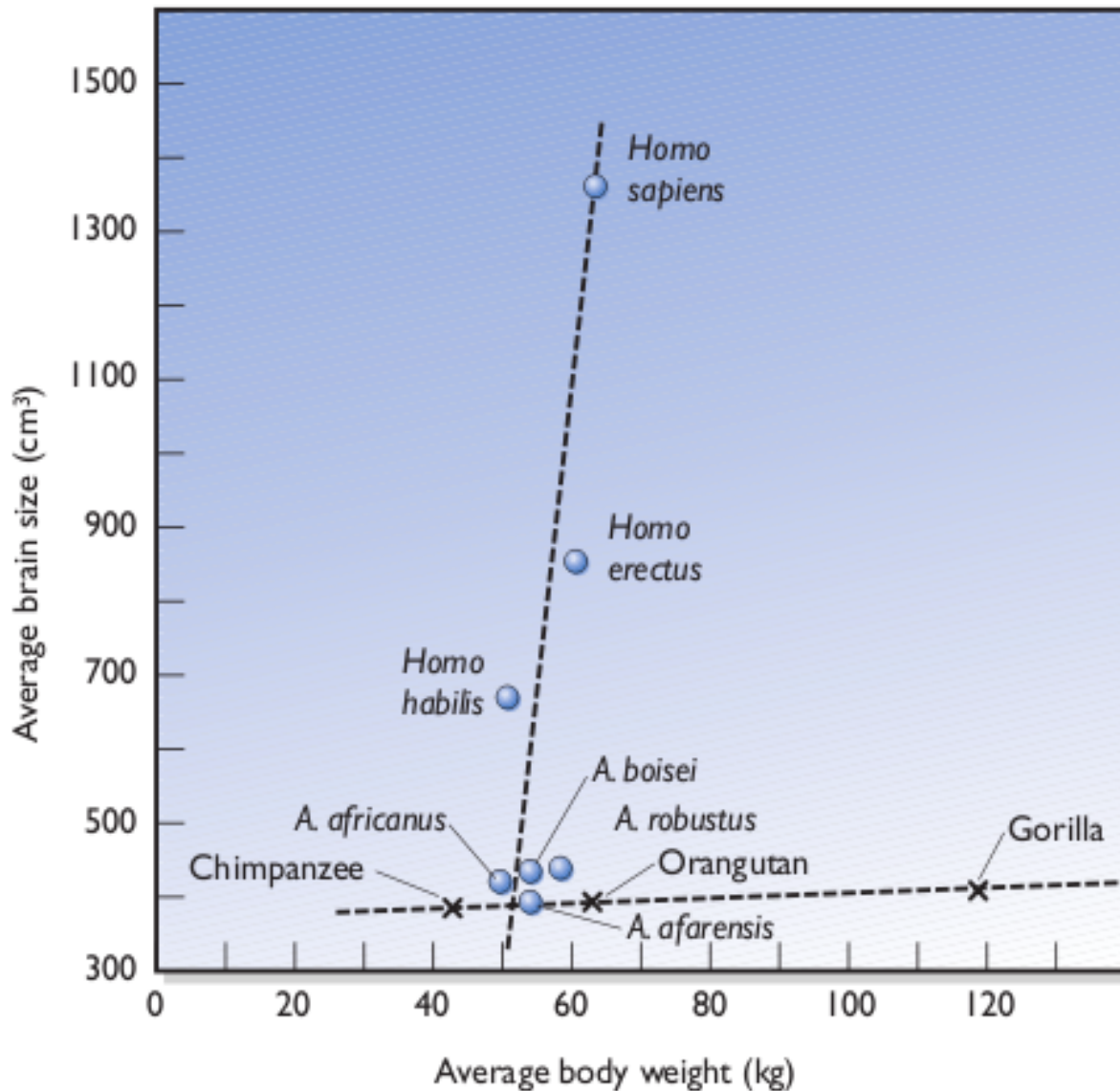


Adapted from: American Society of Mechanical Engineers



Small mammals live fast and die young compared to big ones. Because heart rate tracks weight by a 1/4-power law, a dog (arrow) about 1/16 as heavy as a horse has a pulse about twice as fast as the horse's, not 16 times faster.



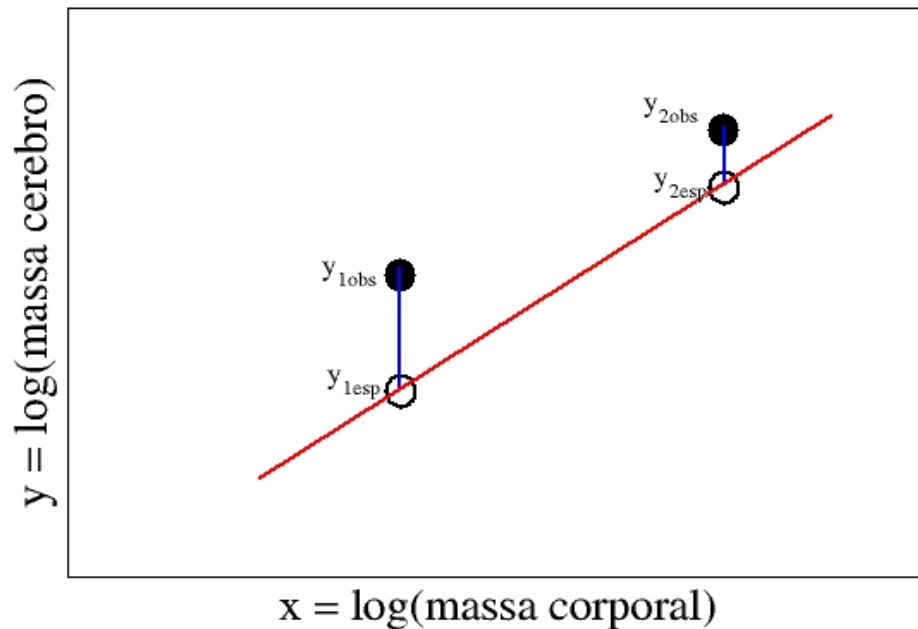


Cérebro Humano é:

- 4 vezes maior que a de um primata típico;
- 9 vezes maior que a de um mamífero típico.

FIGURE 31.2 Brains and bodies: Even though a dramatic increase in body size did not occur in the *Homo* lineage, absolute (and therefore relative) brain size expanded significantly from *habilis* to *erectus* to *sapiens*. Brain size did not change significantly among the australopithecines or the modern apes, despite a large body size difference in the latter.

Coeficiente de Encefalização



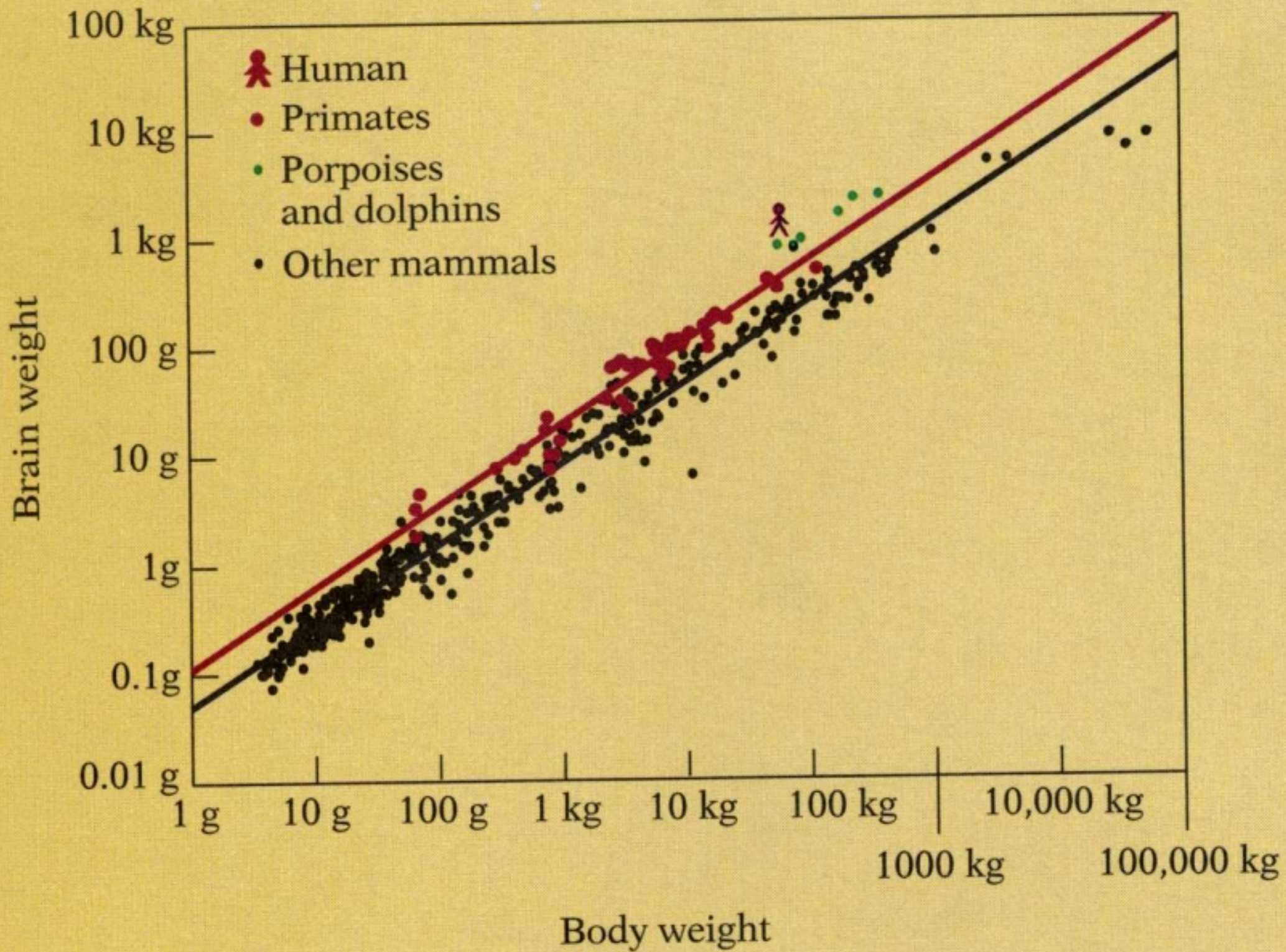
m_c : massa cerebral;

$$y_{obs} = \log(m_{c,obs});$$

$$y_{esp} = \log(m_{c,esp});$$

$\Delta y = y_{obs} - y_{esp}$: Coeficiente de Encefalizaçao;

$$\therefore \Delta y = \log(m_{c,obs}) - \log(m_{c,esp})$$



Cérebro Consome muita Energia

- Tipicamente:
 - Cérebro apresenta 2% da massa total.
Mas consome 20 % da Energia total;
 - Tecido Cerebral consome 22 vezes mais energia que
uma quantidade equivalente de
tecido muscular em repouso;
- Portanto, é muito caro ter um cérebro grande!



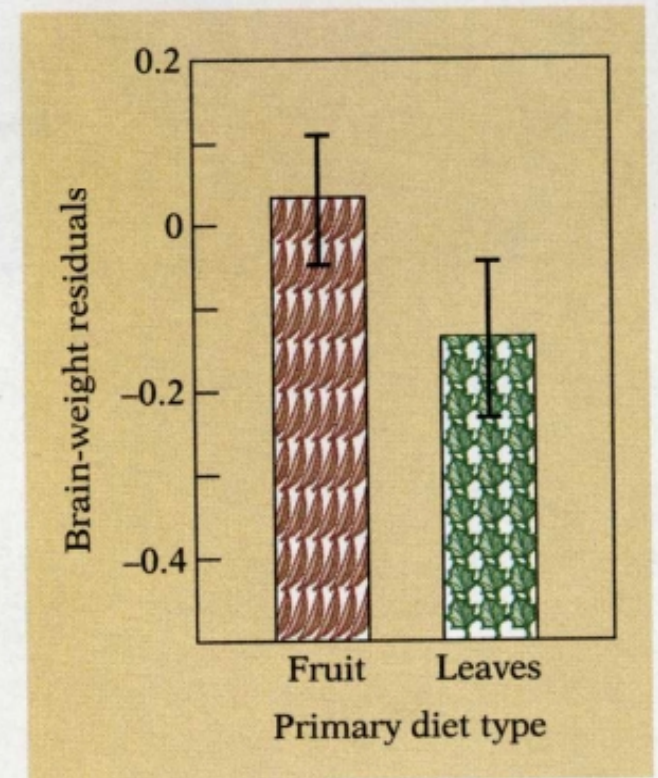
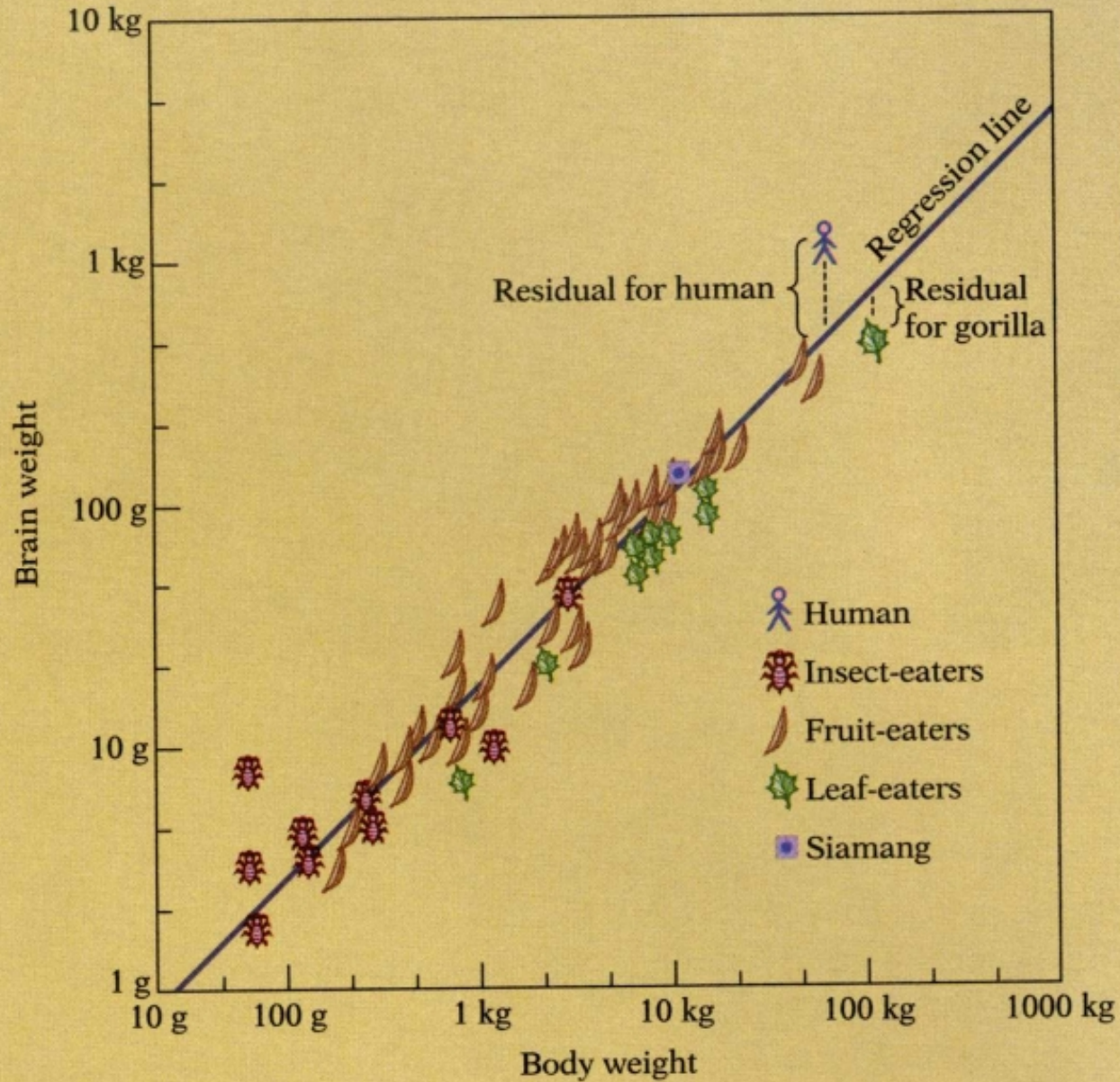
Cérebro Consome muita Energia

- Tipicamente:
 - Cérebro apresenta 2% da massa total.
Mas consome 20 % da Energia total;
 - Tecido Cerebral consome 22 vezes mais energia que uma quantidade equivalente de tecido muscular em repouso;
- Portanto, é muito caro ter um cérebro grande!



Então, por que Primatas tem Cérebros Grandes?

Dieta Primata

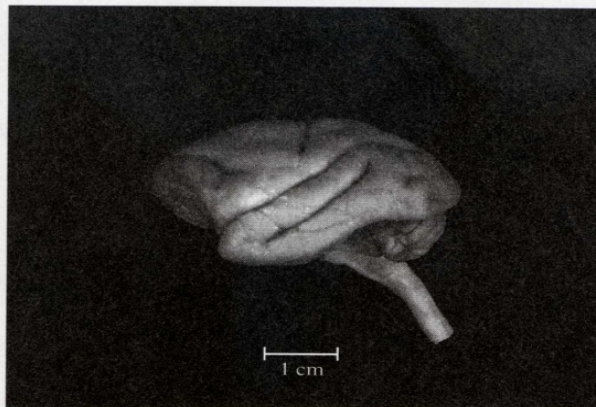
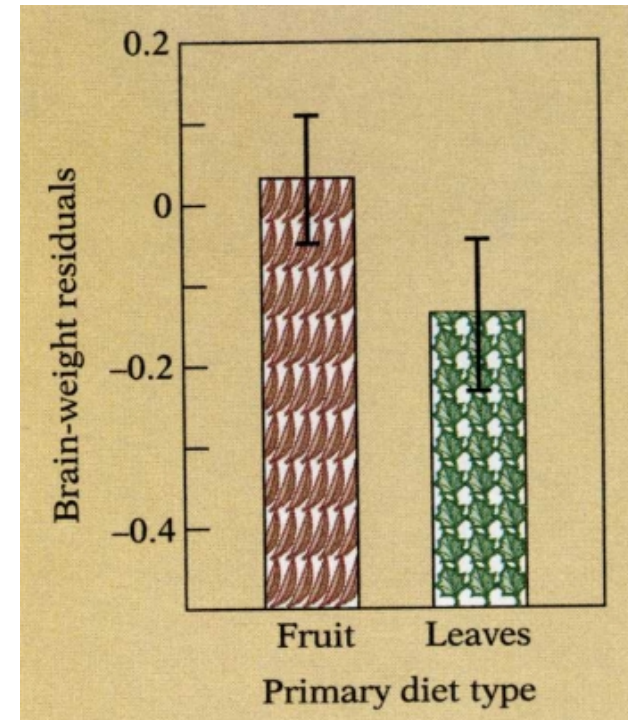


Primatas consumidores de Frutas possuem cérebros maiores que os consumidores de folhas

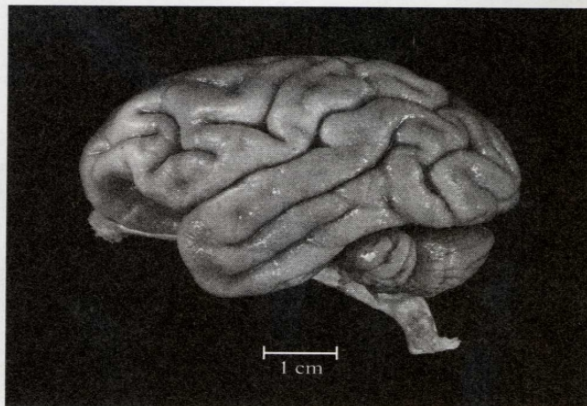


animal's energy budget between watts devoted to digestion and watts devoted to brain metabolism. On the one hand, the animal

A howler monkey chewing leaves; a spider monkey eating fruit.



Howler monkey



Spider monkey

Dilema Primata I: Alimentação

- Alimentar-se de Folhas

Benefício: abundancia de alimentos;

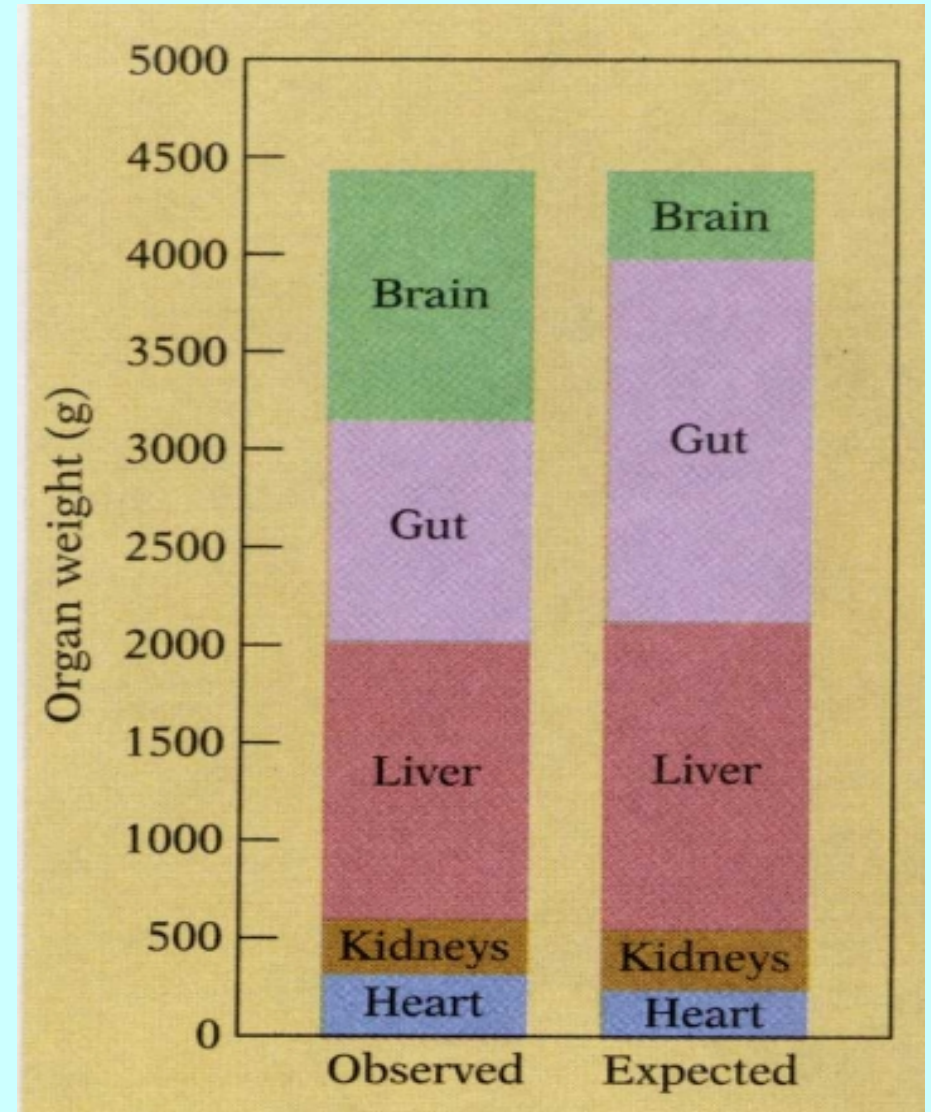
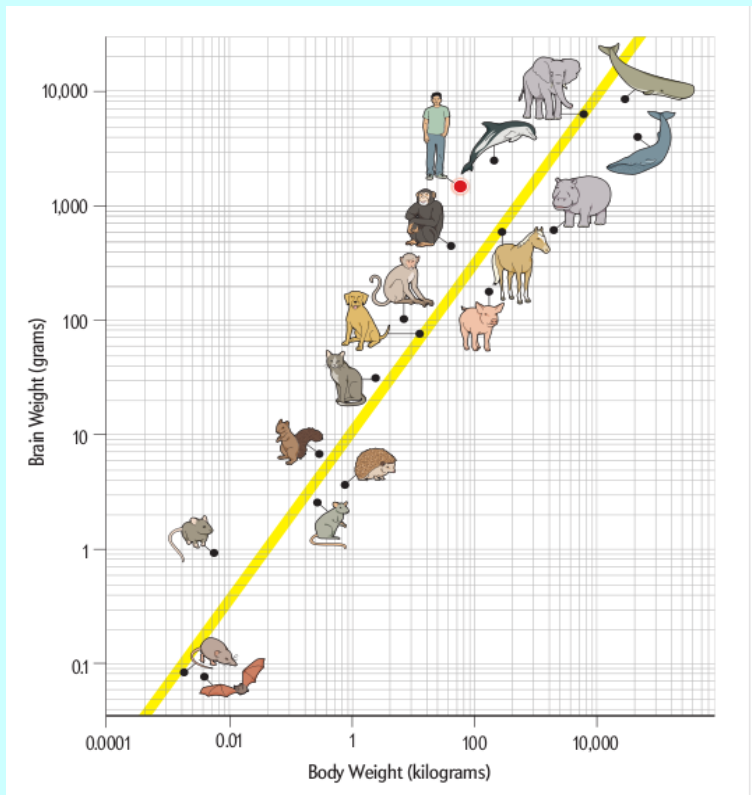
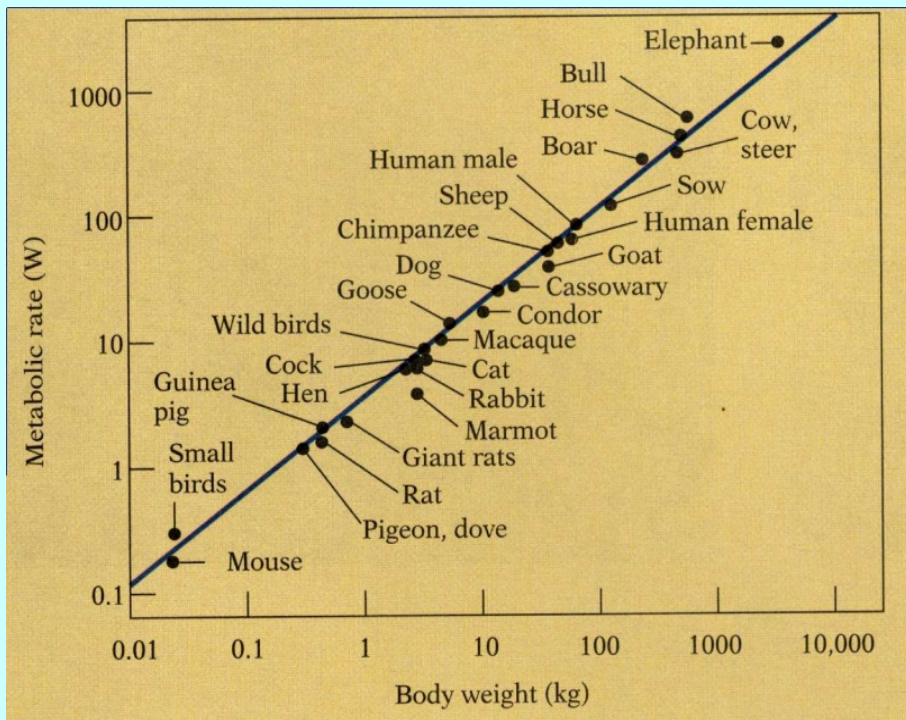
Preço: alto custo da digestão.

- Alimentar-se de Frutas

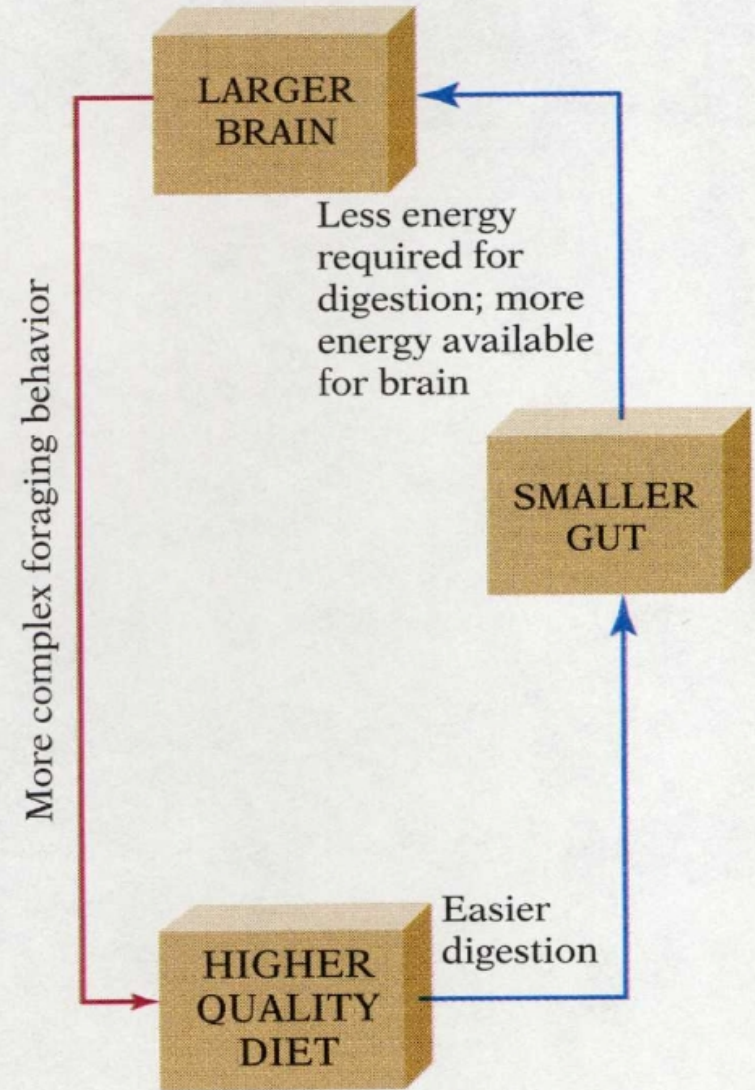
Beneficio: baixo custo de digestão;

Preço : Memorização da distribuição espacial e temporal dos alimentos.

Dilema Humano



Dilema Humano



A model for evolutionary changes in diet, brain, and gut in hominids proposed by Leslie Aiello and Peter Wheeler. An important aspect of the more complex foraging behavior was the development of cooperative hunting techniques.

Dilema Primata II: Habitat

- Adotar Vida Arbórea;

benefício : menor exposição à predação;

Preço : restrição de nicho;

- Adotar vida terrestre;

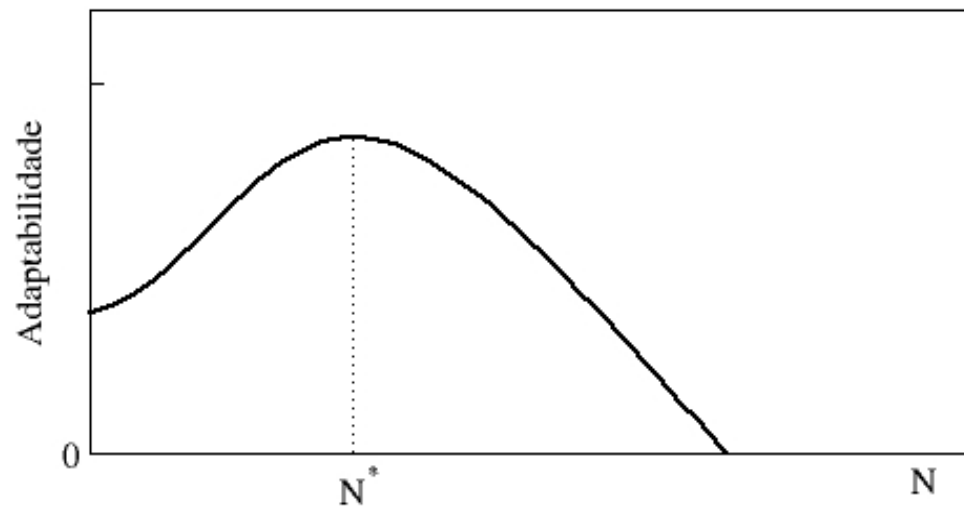
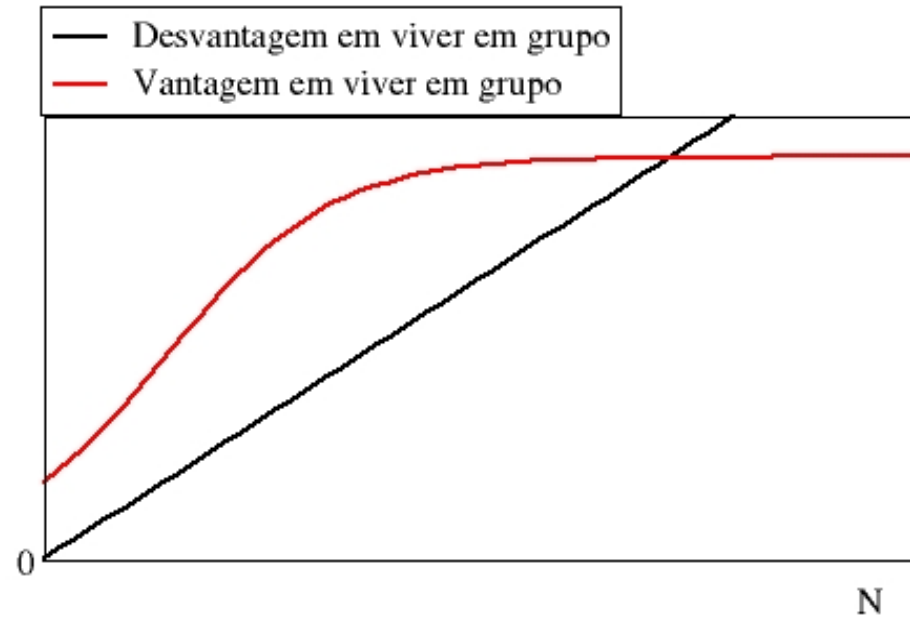
benefício : acesso a novos nichos;

Preço : maior exposição a predação.

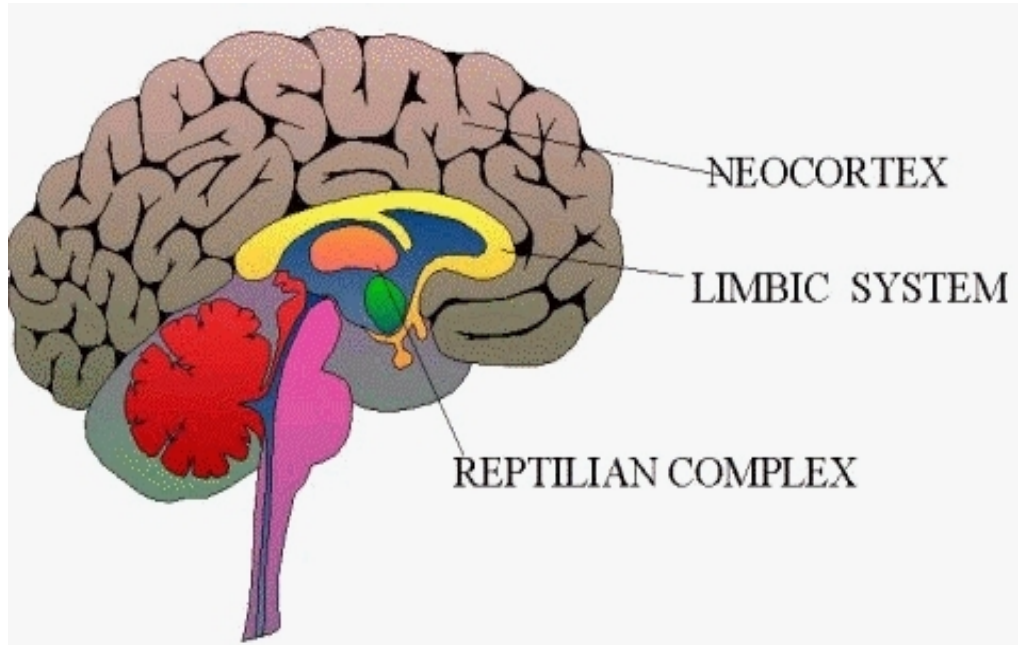
Resposta Evolutiva frente a predadores:

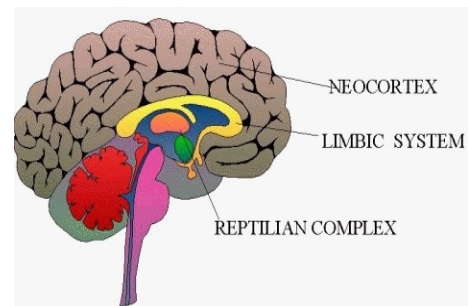
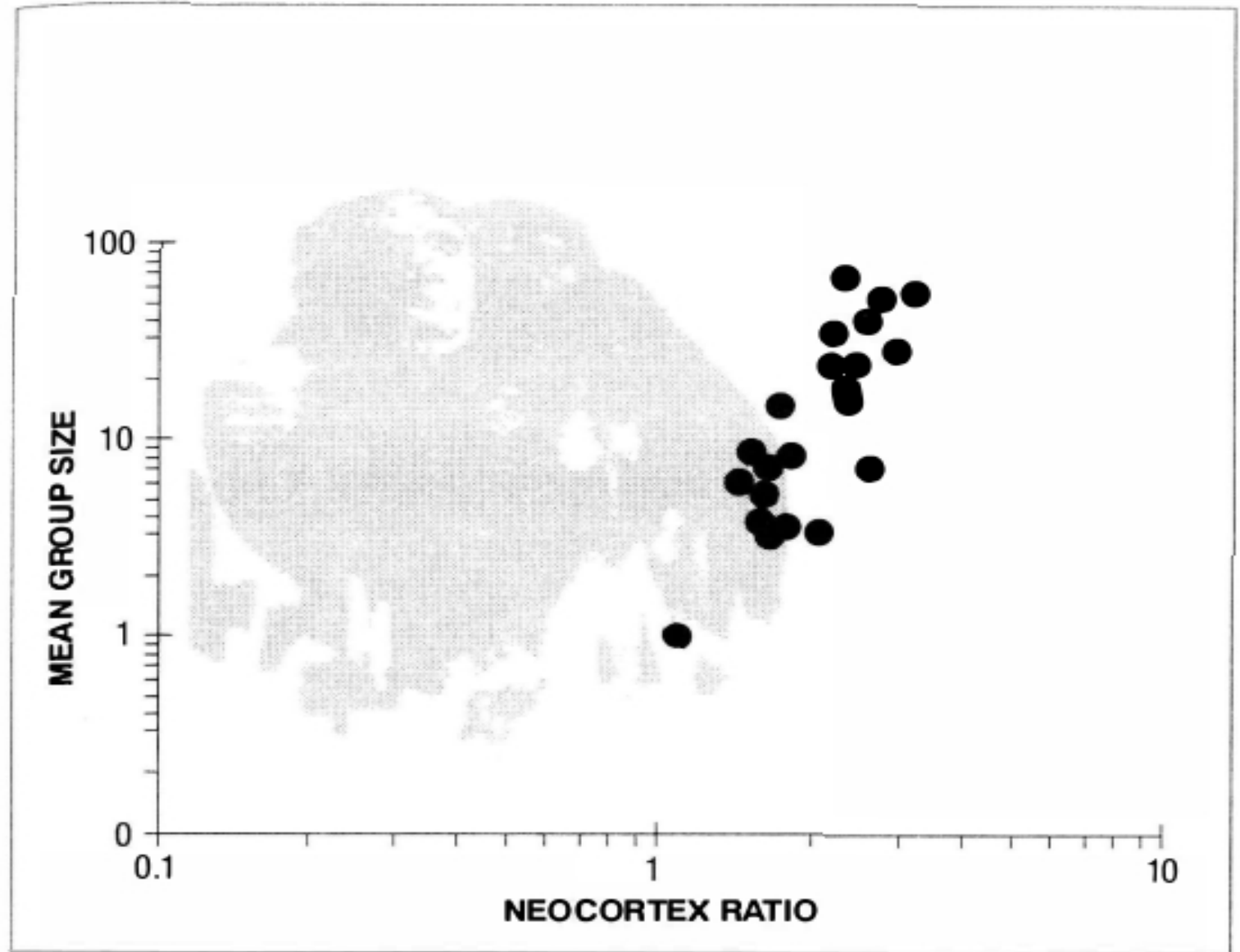
- Aumento do tamanho dos indivíduos;
- (e/ou) aumento do tamanho do grupo.

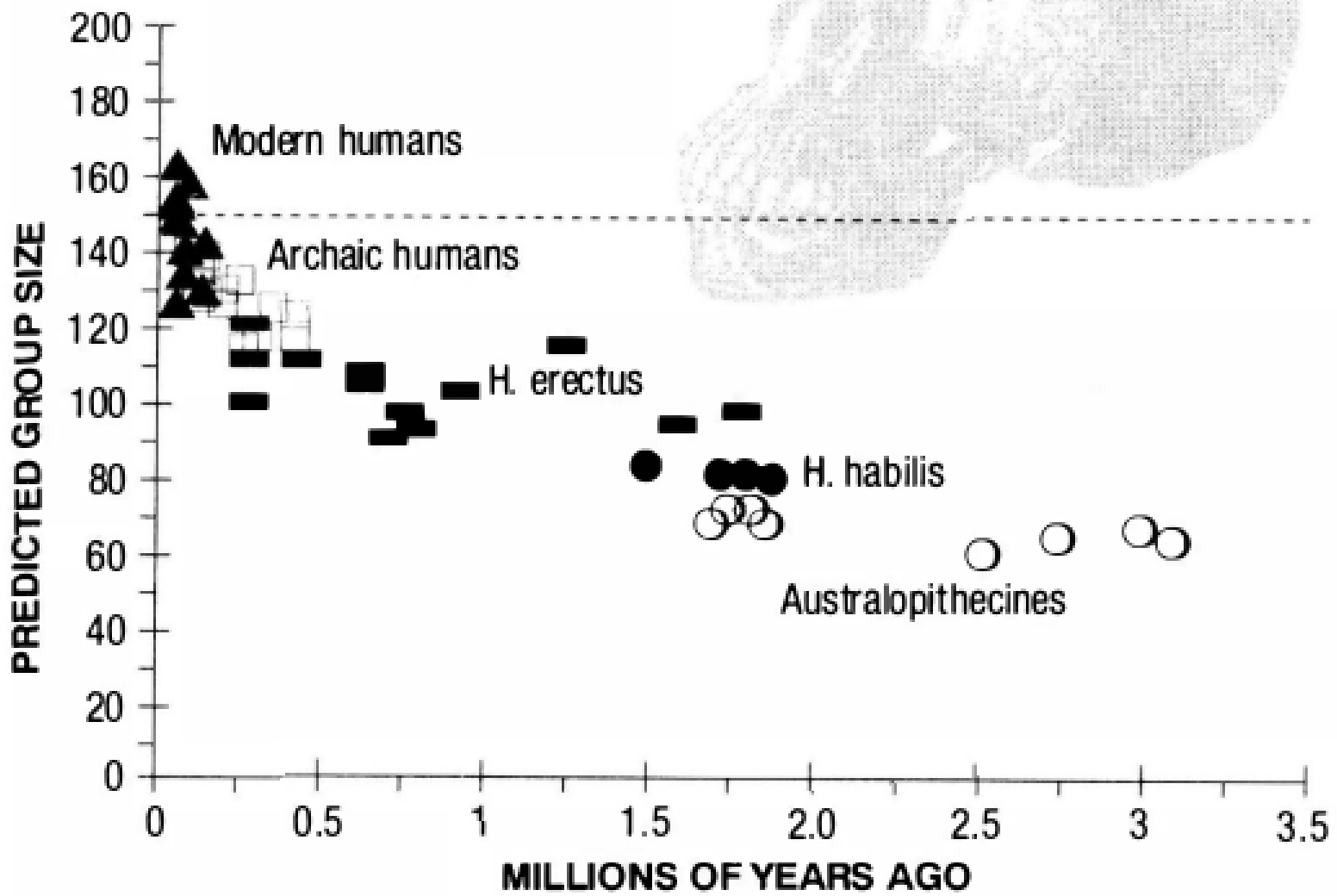
Vida em Grupo



Cérebro Social

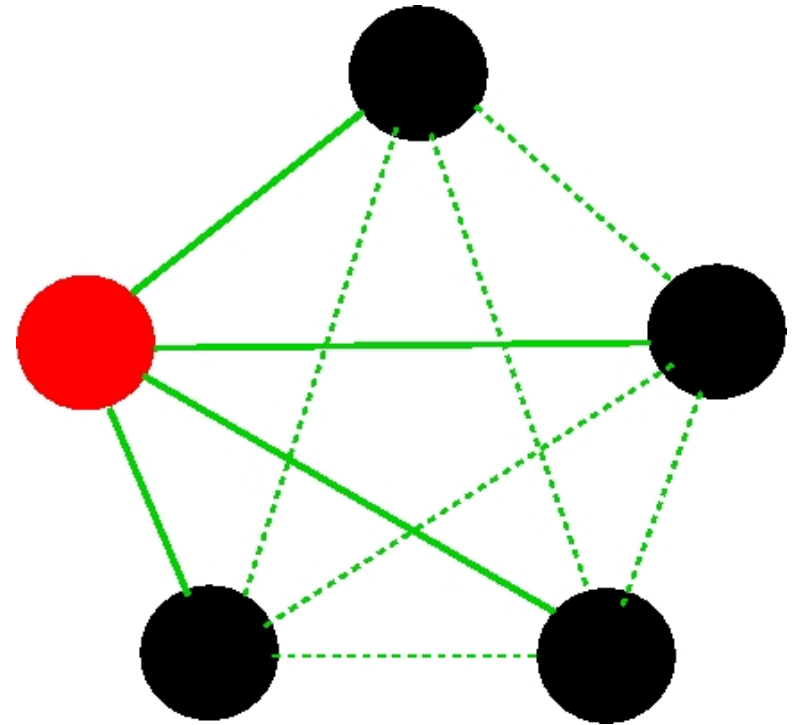
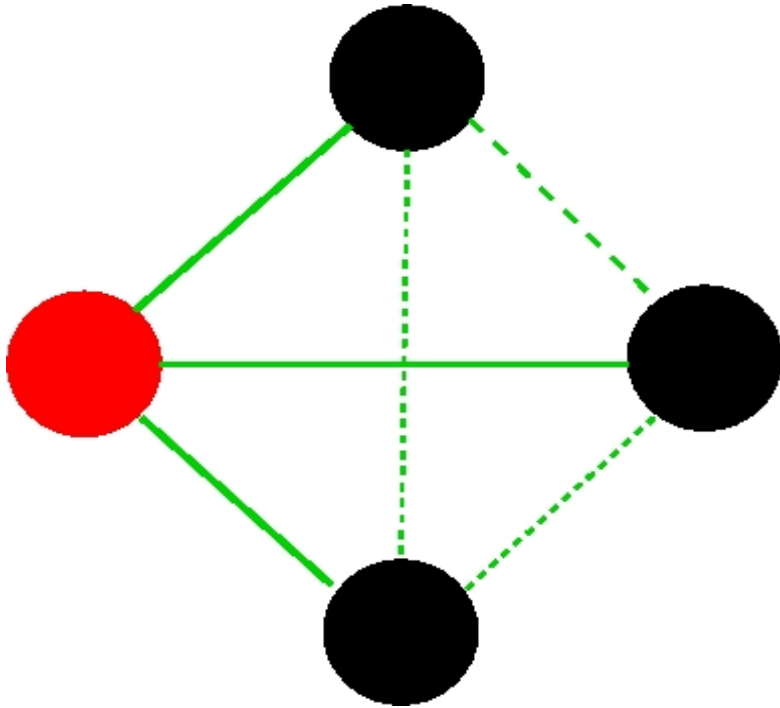




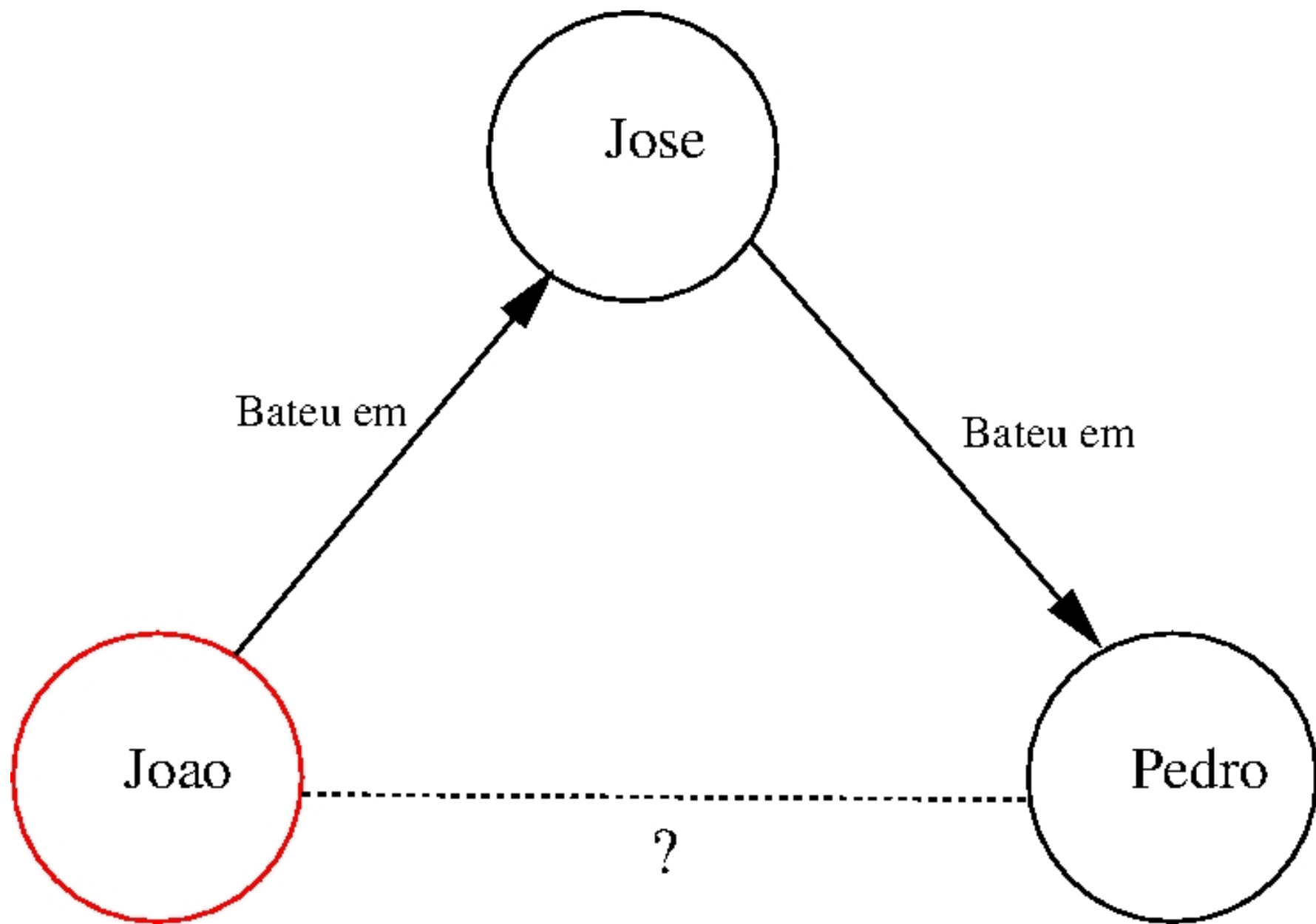


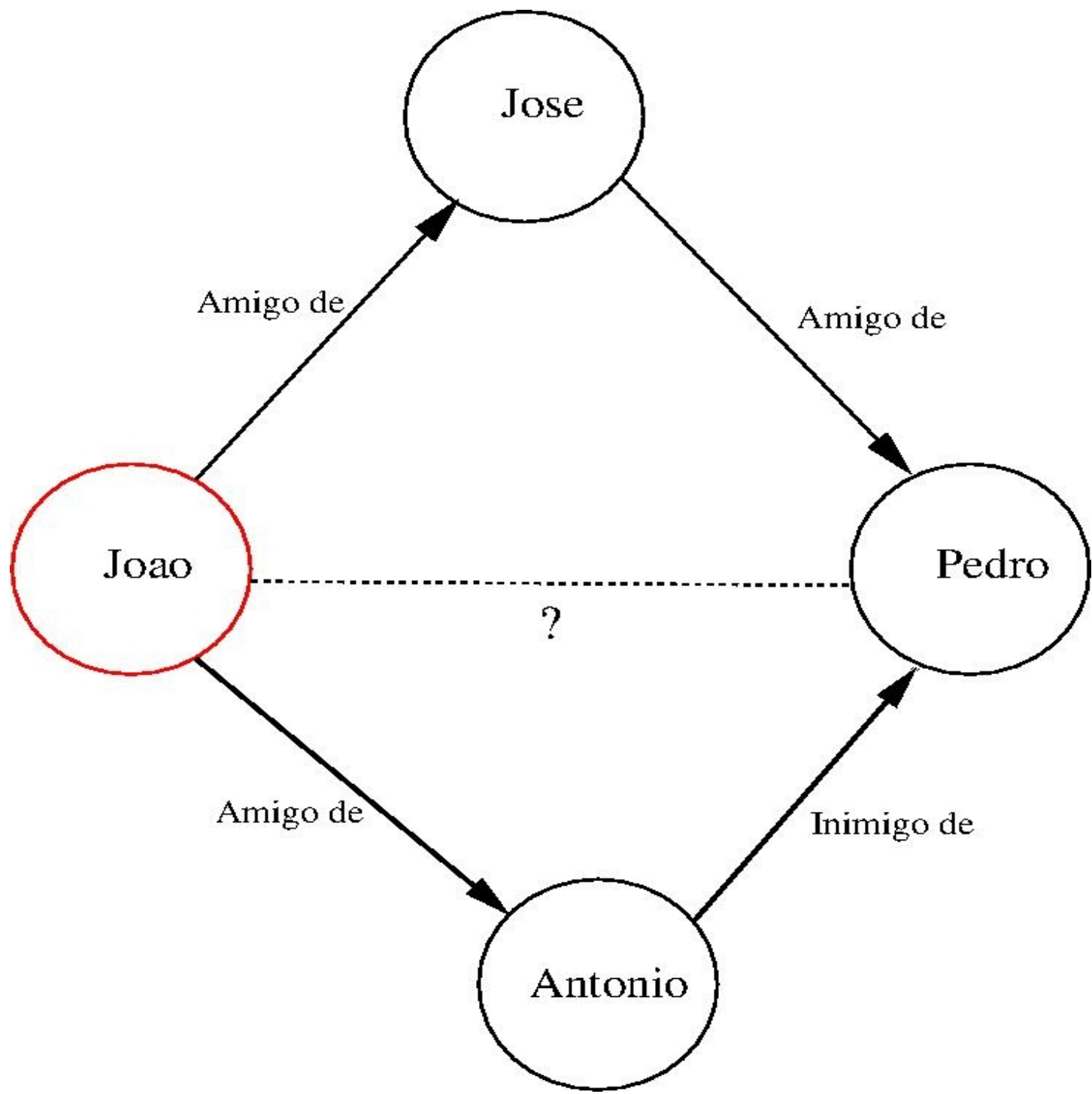




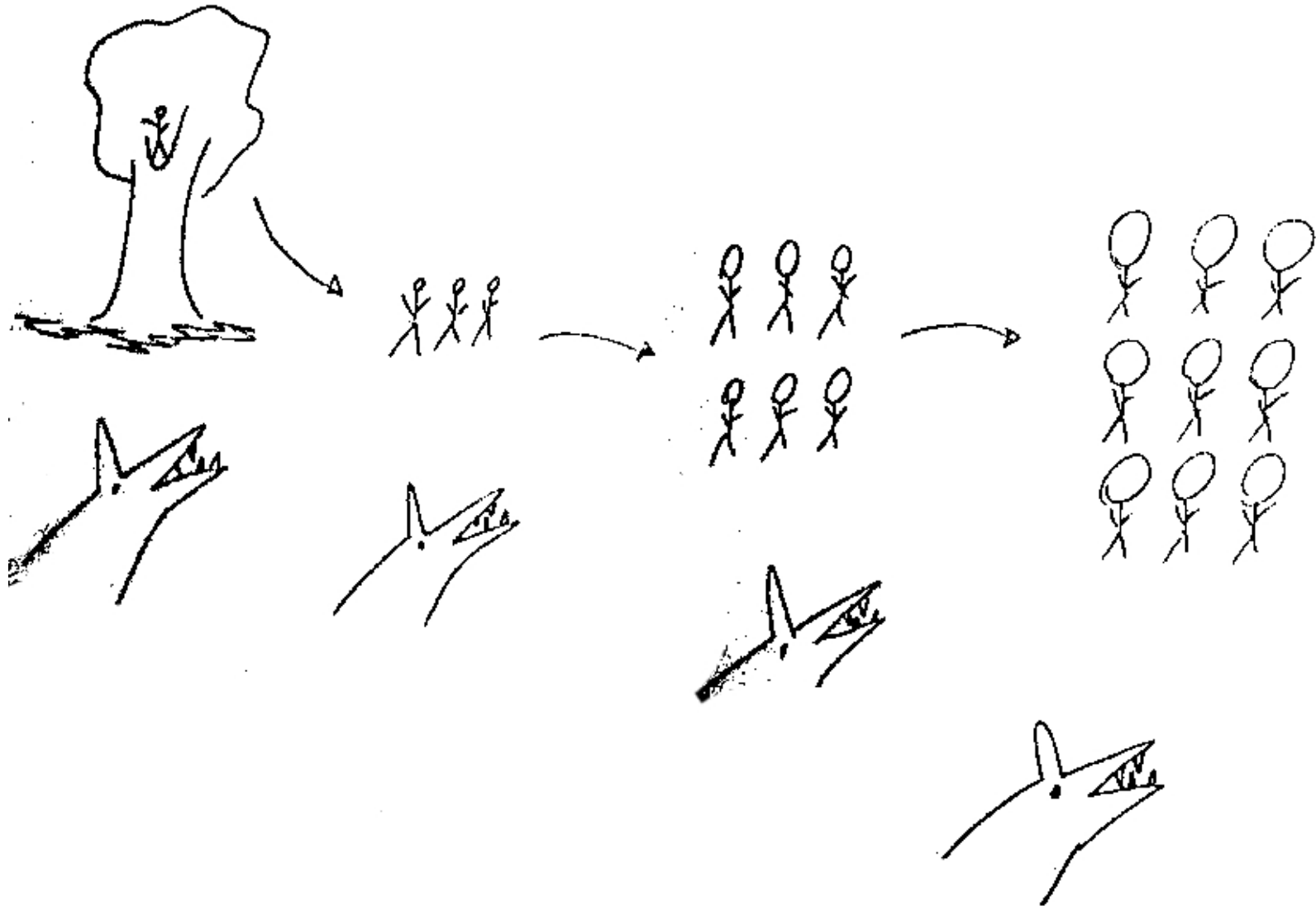


- # Links de 1. ordem: $N-1$
- # links de 2. ordem: $\frac{1}{2} N(N-3) + 1$
- # total de links: $\frac{1}{2} N(N-1)$





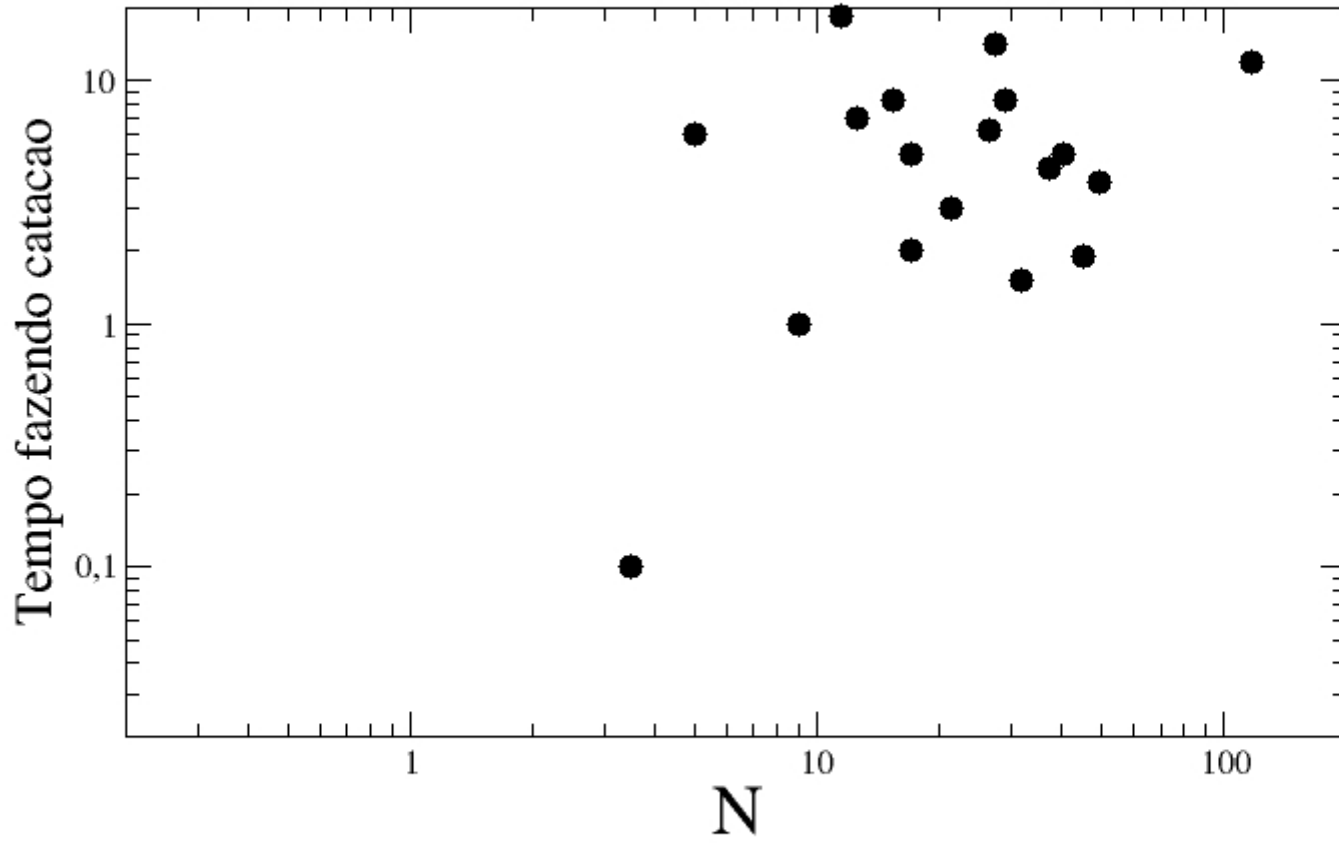
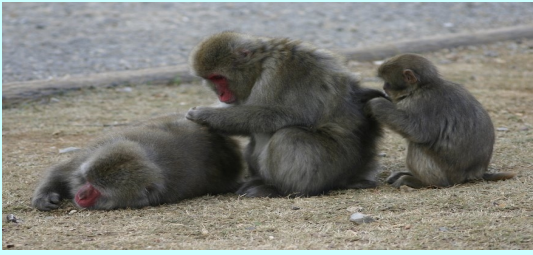
Evolução do Cérebro em Primatas Sociais - Esquema Geral



Links:

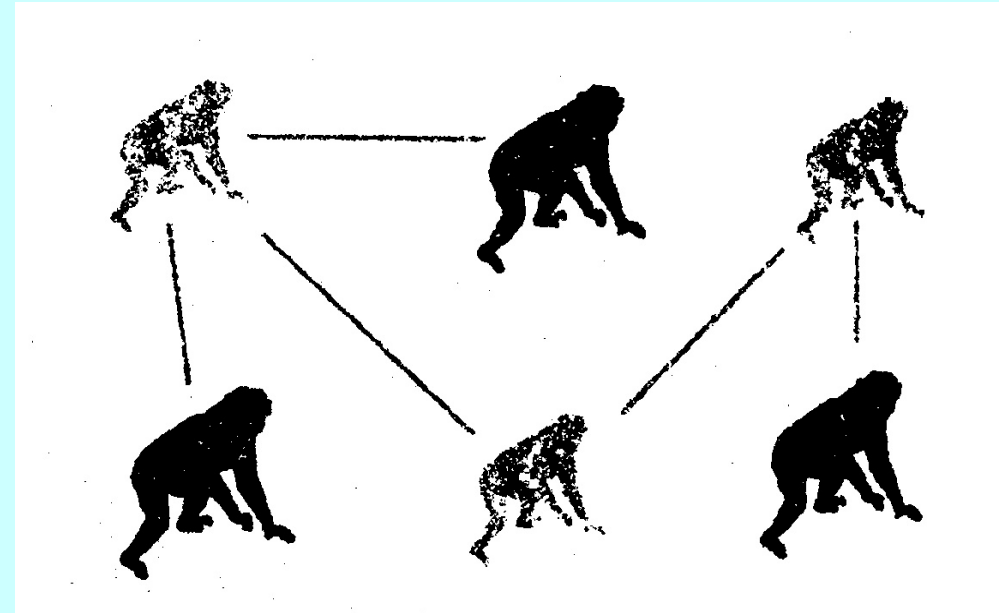
Quantidade ou Qualidade?





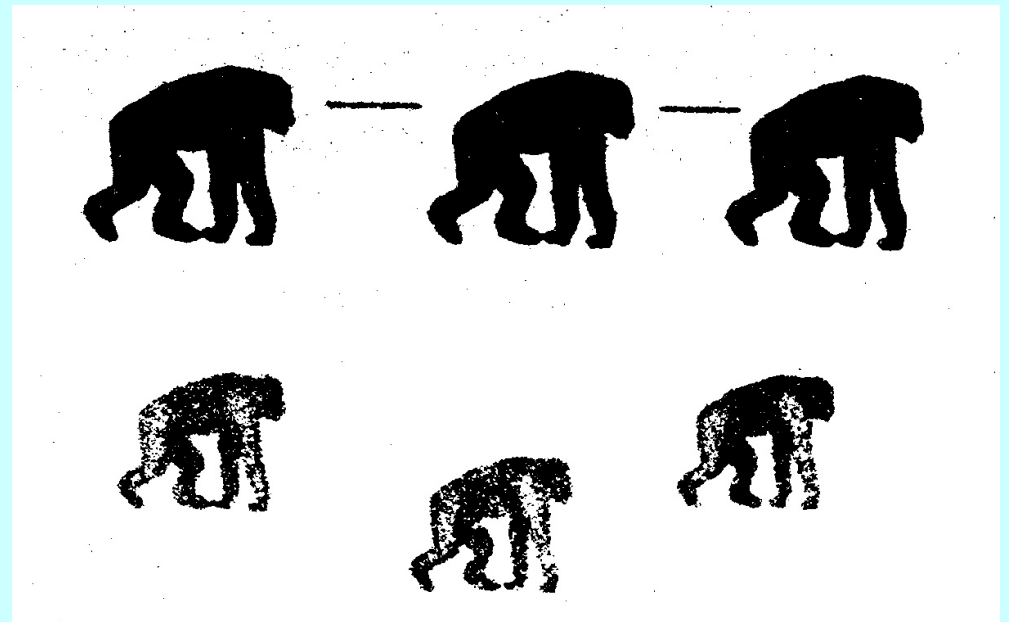
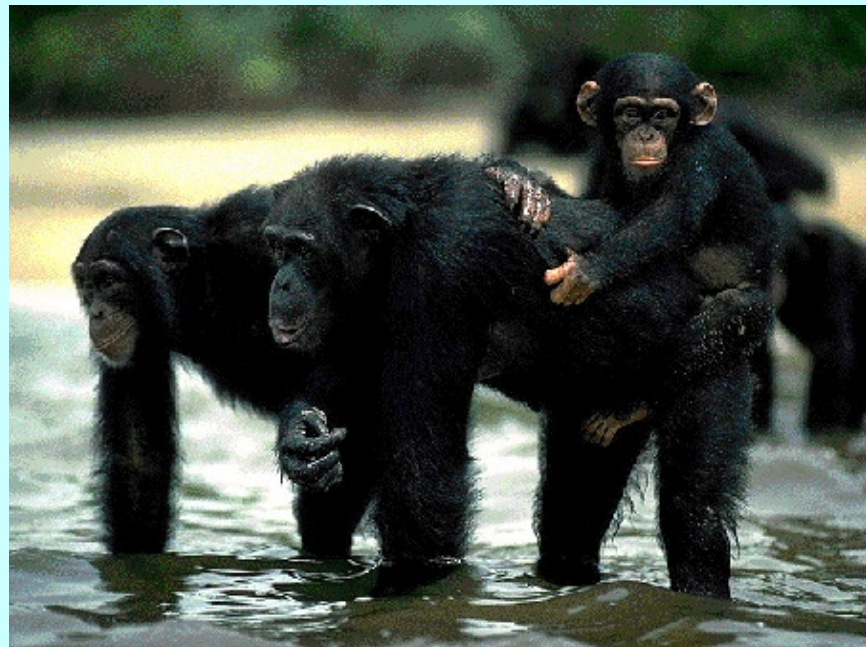
Organização Social dos Primatas

Bonobos



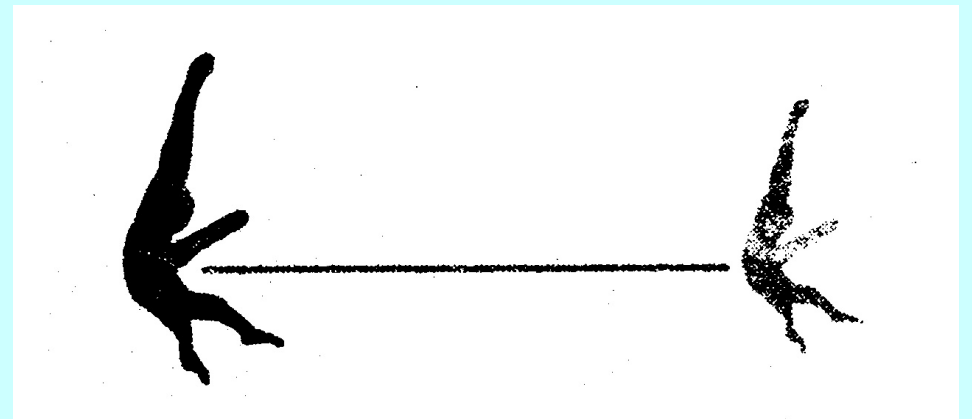
Organização Social dos Primatas

Chimpanzé



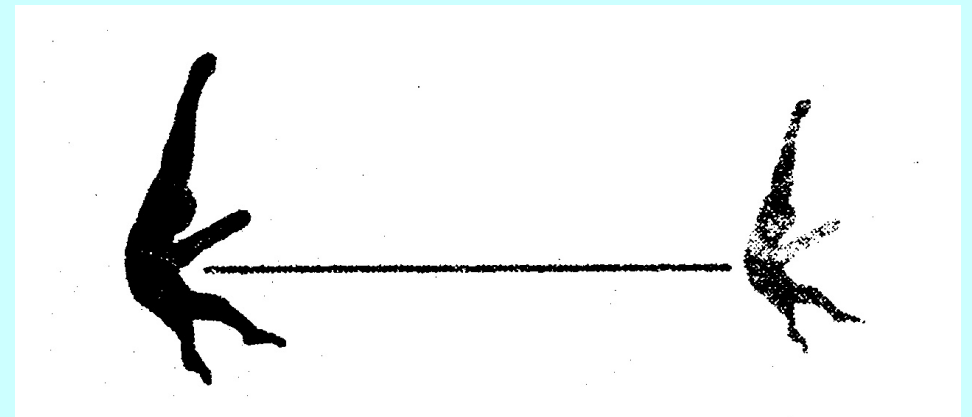
Organização Social dos Primatas

Gibão



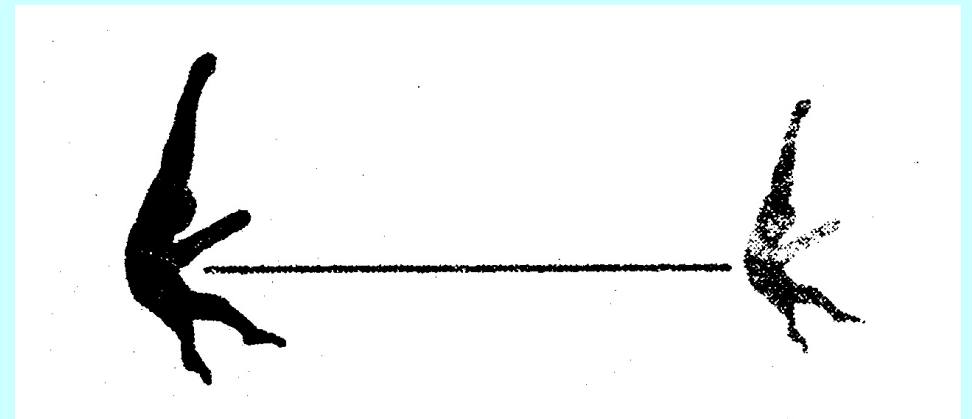
Organização Social dos Primatas

Gibão



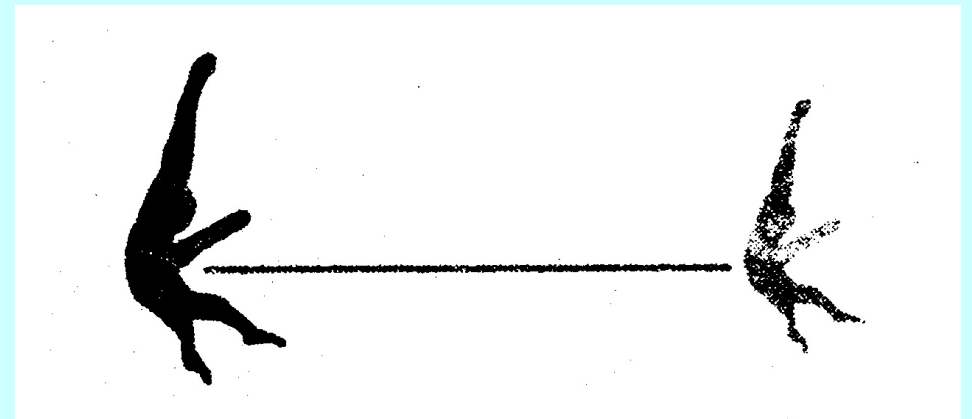
Organização Social dos Primatas

Gibão



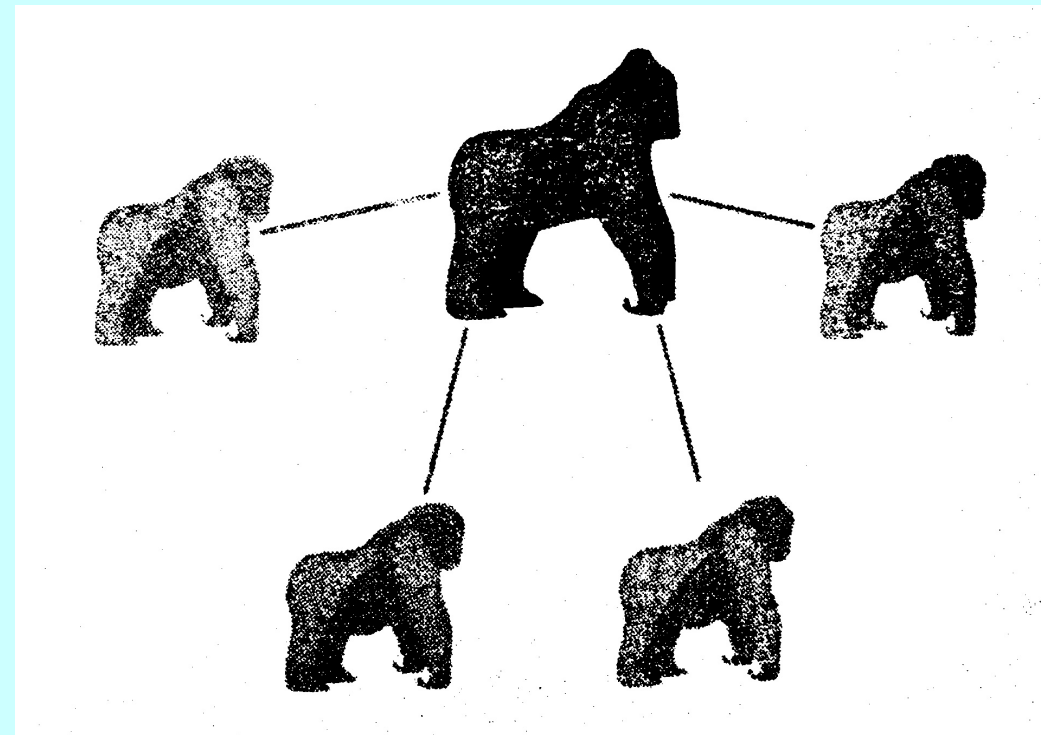
Organização Social dos Primatas

Gibão



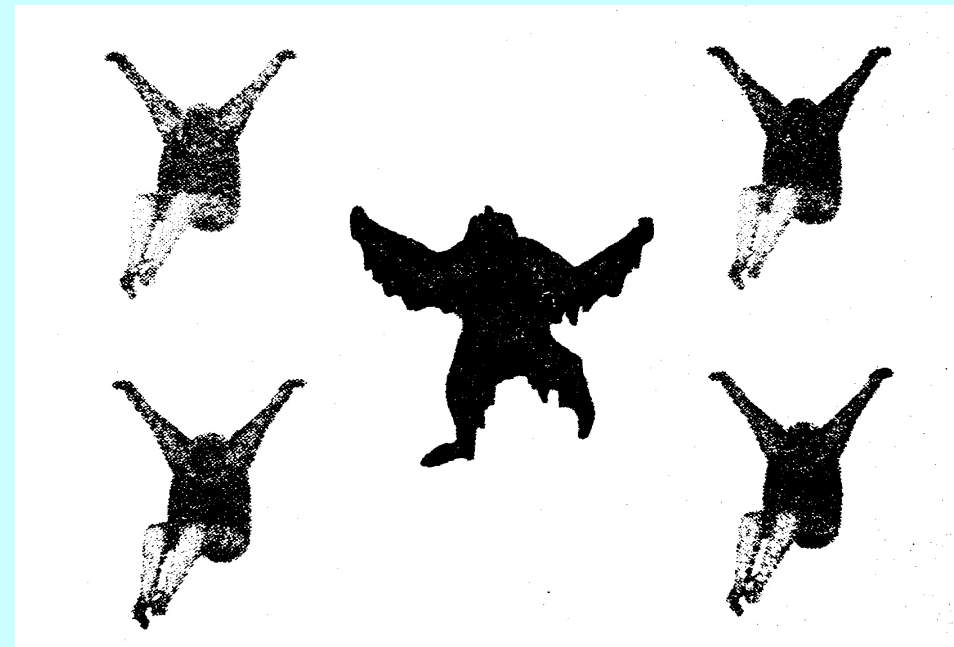
Organização Social dos Primatas

Gorila



Organização Social dos Primatas

Orangotango



Organização Social dos Primatas

Humano

