

PROGRAMA DE PÓS-GRADUAÇÃO EM ZOOLOGIA

EDITAL n. 04/2024

SELEÇÃO DE CANDIDATAS(OS) ÀS VAGAS DO PROGRAMA DE PÓS-GRADUAÇÃO EM ZOOLOGIA PARA O CURSO DE MESTRADO ACADÊMICO PARA O PRIMEIRO PERÍODO LETIVO DE 2025

PROVA DE INTERPRETAÇÃO DE TEXTO EM LÍNGUA ESTRANGEIRA

A prova escrita abaixo deve ser respondida individualmente pelas(os) candidatas(o)s em folha pautada anexa, à caneta esferográfica. Apenas o número de inscrição deve ser informado tanto no caderno de questões quanto na folha de respostas, de forma que nenhum outro tipo de identificação deve ser colocado. A prova tem tempo previsto máximo de duas (2) horas para resolução. Não podem ser consultados nenhum tipo de material nem outras pessoas. Tanto o caderno de questões quanto a folha de respostas devem ser entregues. As(os) candidatas(os) podem usar uma folha de rascunho. As respostas devem ser em língua portuguesa. É permitido o uso de dicionário impresso. A pontuação é apresentada para cada questão.

Boa prova.

Número de inscrição: _____

Avalie o texto 1 e responda (em português) às questões 1 a 3.

TEXTO 1

Variation in mating preferences coupled with selective predation may allow for the maintenance of alternative mating strategies. Males of the South American live-bearing fish *Poecilia parae* fall in one of five discrete morphs: red, yellow, blue, stripe-coloured tail (*parae*) and female mimic (*immaculata*). Field surveys indicate that the red and yellow morphs are the rarest and that their rarity is consistent across years. We explored the role of variable female mating preference and selective predation by visual predators in explaining the rarity of red and yellow males, and more generally, the maintenance of this extreme colour polymorphism. We presented wild-caught *P. parae* females and *Aequidens tetramerus*, the most common cichlid predator, with the five male colour morphs in separate trials to determine mating and prey preferences, respectively. We found that a large proportion of females shared a strong preference for the rare carotenoid-based red and yellow males, but a distinct group also preferred the blue and *parae* morphs. The cichlid predator strongly preferred red and yellow males as prey. Together, these results suggest that the interaction between premating sexual selection favouring and predation acting against the red and yellow morphs may explain their rarity in the wild. The trade-off between sexual and natural selection, accompanied by variation in female mating preferences, may therefore facilitate the maintenance of the striking colour polymorphism in *P. parae*.

Interaction between female mating preferences and predation may explain the maintenance of rare males in the pentamorphic fish *Poecilia parae*. J. L. Hurtado-gonzales, D. T. Baldassarre, J. A. C. Uy. Journal of Evolutionary Biology, Volume 23, Issue 6, 1 June 2010, Pages 1293–1301, <https://doi.org/10.1111/j.1420-9101.2010.01995.x>

1. Com base no resumo do artigo acima responda como o efeito da seleção natural atua na variação de cores dos machos e sua abundância no ambiente, elencando quais morfótipos são preferências para a predação.
2. Com base no resumo do artigo acima responda como o efeito da seleção sexual atuam na variação de cores dos machos e sua abundância no ambiente, elencando quais morfótipos são preferenciais para fêmeas.
3. Quais morfótipos são mais raros na natureza e para qual sexo?

Avalie o texto 2 e responda (em português) às questões 4 e 5.

TEXTO 2

Ecology is a key driver of morphological evolution during adaptive radiations, but alternative factors like phylogeny and allometry can have a strong influence on morphology. Lepidosauria, the most diverse clade of tetrapods, including lizards and snakes, have evolved a remarkable variety of forms and adapted to disparate ecological niches, representing an ideal case study to understand drivers of morphological evolution. Here, we quantify morphological variation in the lower jaw using three-dimensional geometric morphometrics on a broad sample of 153 lepidosaur species. Our results suggest that phylogeny has significantly influenced mandibular shape evolution, and snakes have diverged from a lizard-like jaw morphology during their evolution. Allometry and ecological factors like diet, foraging mode and substrate also appear to drive the diversification of mandibular forms. Ecological groups differ in patterns of disparity, convergence and rates of evolution, indicating that divergent evolutionary mechanisms are responsible for the acquisition of different diets and habitats. Our analyses support that lepidosaurs ancestrally use their jaws to capture prey, contrary to the traditional view favouring lingual prehension as ancestral. Specialized or ecologically diverse lineages show high rates of jaw shape evolution, suggesting that morphological innovation in the mandible has contributed to the spectacular ecomorphological diversification of lepidosaurs.

Ballell A, Dutel H, Fabbri M, Martin-Silverstone E, Kersley A, Hammond CL, Herrel A, Rayfield EJ. 2024 Ecological drivers of jaw morphological evolution in lepidosaurs. Proc. R. Soc. B 291: 20242052. <https://doi.org/10.1098/rspb.2024.2052>

4. Explique o motivo da escolha de membros do clado Lepidosauria como modelo de estudo.
5. Quais aspectos além da proximidade filogenética são elencados como impulsionadores da diversificação de forma das mandíbulas de Lepidosauria pelos autores do estudo?

Avalie o texto 3 e responda (em português) as questões 6, 7 e 8.

TEXTO 3

Blood types—A positive, O negative, AB positive, and others—aren't just letters you need to remember when giving or receiving blood. The groups, which are based on the immune proteins in a person's red blood cells, are coded in our genes, and each evolved to carry strengths and weaknesses against particular pathogens. A new study reveals the blood types of early modern humans who lived throughout Europe and Asia between 46,000 and 16,500 years ago, as well as those of our close cousins, the Neanderthals. The results shed light on their comings, goings, and commingling, and could help researchers better understand blood type interactions today.

“Blood types have been a really strong target of positive selection throughout our history,” says Joshua Akey, a population geneticist at Princeton University who wasn't involved with the work, and they reflect the diseases ancient people encountered. Likely as a result of such ancient exposures, people with type O blood are more likely to have severe cholera infections, but are more resistant to severe malaria. And although humans have 47 different blood groups, which can play a vital role in our immune defenses, researchers are not yet sure how all of them originated.

But little is known about the origin of these blood groups or exactly how they've changed over human evolution. To learn more, Stéphane Mazières, a genetic anthropologist at Aix-Marseille University, turned to previously sequenced genomes from 22 *Homo sapiens* individuals who lived from 46,000 to 16,500 years ago, 14 Neanderthals who lived roughly between 120,000 and 40,000 years ago, and a single individual from about 98,000 years ago thought to be descended from both Neanderthals and another close cousin, the Denisovans. The ancient DNA from these people came from sites scattered throughout Eurasia, from modern-day Germany to Siberia and China.

In these genes, the team zeroed in on markers for 10 blood groups that are medically relevant today because they can cause fatal complications during blood transfusions if they aren't compatible with the recipient's type. They found that blood groups in Neanderthals remained mostly unchanged during their last 80,000 years of existence, even though this group mingled with other hominins before going extinct roughly 40,000 years ago. This makes sense, Mazières says, because Neanderthals overall had very little genetic diversity across their relatively small population, and having limited variety in their blood groups reflects that.

Homo sapiens's blood types told a different story. As our species migrated out of Africa between 70,000 and 45,000 years ago and expanded into Eurasia, new genetic variants determining blood groups emerged and entrenched themselves in these roving populations.

“It's fascinating that every single ancient human they looked at had these unique variants,” says Fernando Villanea, a population geneticist at the University of Colorado Boulder who was not involved in the new study. It was “very unexpected” that they would have evolved in such a short time, he says.

Archaeological evidence suggests that along their journey out of Africa, *H. sapiens* groups paused and remained in the Persian Plateau, a region between the Zagros mountains in Iran, for about 15,000 years. The researchers think that would have been enough time for humans to develop the genetic variation underlying these new blood types only found outside of Africa—a sort of “genetic incubator” period—before these humans then continued to spread into Eurasia. There, interactions with diseases

distinct in different regions would have selected for different blood type variants in different populations. A similar effect happened when humans paused their migration in Beringia and diversified before populating the Americas.

The team also traced a rare blood group, known as the RHD DIII type 4 variant, that originated in Neanderthals and made its way to modern-day individuals via interbreeding while *en route* to Southeast Asia, more than 65,000 years ago. This acquired blood group may have “helped modern humans better survive and reproduce as we migrated into these new environments,” Akey says. The finding also has implications for modern-day transfusions and pregnancy monitoring, Mazières notes, as this variant is involved in a sometimes-life-threatening disease in newborns that develops if their blood type doesn’t match their mother’s.

Some variants the team uncovered have disappeared altogether. One of the oldest genomes decoded from modern humans, from the 45,000-year-old remains of an individual from Siberia known as Ust’-Ishim, contained three blood group variants that are not found in humans today. “The genetic legacy of Ust’-Ishim has been lost since,” Mazières says. “He and his people represent a dead-end lineage” of *H. sapiens*.

The blood groups that did survive in our species may have provided our ancient ancestors with advantages in fighting off diseases, but researchers haven’t yet connected them all to specific maladies. These variations might have been part of people’s “ancient arsenal” as they migrated far and wide, Mazières says, “but against which pathogen? So far, we don’t know.”

Mazières and his team are now probing another blood-related question in the ancient genomes: whether they contain specific mutations that cause inherited diseases in red blood cells, such as beta thalassemia and sickle cell disease. We know these diseases go far back in human history, he says. “The question is, how far?”

EDITORIAL. 2025. Ancient humans evolved new blood types after leaving Africa: Genetic study also reveals blood groups modern humans acquired from Neanderthals. *Science*, 23 Jan. 2025.

6. De acordo com o texto, quais as vantagens e desvantagens de se possuir sangue do tipo O?
7. Quais as principais características dos grupos sanguíneos apresentados nas amostras de neandertais analisadas no estudo e quais seriam as possíveis causas dessas características?
8. Quais problemas a variante sanguínea RHD DIII tipo 4 pode causar na população humana atual?