Mystery of sea nomads' amazing ability to free dive is solved

By Nicola Davis, The Guardian on 04.25.18
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Image 1. A Bajau diver hunting fish on the reef. Photo by: Melissa Ilardo

The secret behind the ability of a group of "sea nomads" in Southeast Asia to hold their breath for extraordinary periods of time while free diving to hunt fish has finally been revealed – and it's down to evolution.

The Bajau people are able to dive tens of meters underwater with no conventional diving aids. Instead they rely on weights, handmade wooden goggles – and a single breath of air.

But while the Bajau people's talents have long been known, it was unclear whether the skill was the result of practice, as in the case of the excellent underwater vision of Thai "sea nomad" children, or the result of adaptations which have their roots in the Bajau people's DNA.

Now experts say they have the answer: over time the Bajau people have undergone natural selection, resulting in certain versions of genes becoming widespread – many of which are linked to biological changes, including having a larger spleen, that could help the Bajau to hold their breath underwater for many minutes at a time.

The team say the findings could eventually prove useful in medical settings, potentially allowing experts to identify patients that might be at greater risk of death if they experience a lack of oxygen, for example during surgery.

"There seems to be so much to learn from the Bajau and other diving populations about how the human body is able to react to oxygen deprivation, which is an important medical issue," said Dr. Melissa Ilardo, first author of the study who was at the University of Copenhagen at the time of the research.

Writing in the journal Cell, the scientists reveal how they unpicked the mystery following a clue from previous research: species of seals which can dive for longer have larger than expected spleens – an organ which, among its functions, can store oxygen-carrying red blood cells.

As a result the team used an ultrasound device to measure the spleen in 43 Bajau people and 33 people from a neighboring group of farming people, the Saluan.

"The spleen size is about 50 percent larger in these sea nomads than it is in the [Saluan], so already it was like 'Oh, my God – it is really [an] extreme physiological characteristic,'" said Professor Eske Willerslev, a co-author of the study from the University of Cambridge.

The team notes the trend held regardless of whether the Bajau individual was themselves a diver, and even when factors such as age, sex and height were taken into account.

Genetic testing revealed that certain versions of genes are more commonly found in Bajau people than would be expected, with many apparently linked to biological changes that could help individuals cope with low-oxygen conditions.

Among them is a form of a gene linked to an increased spleen size – an effect the team reveal is likely down to an increase in thyroid hormone levels. Crucially, a contraction of the spleen is one of the features of the so-called "diving reflex" – a set of responses in mammals that occur when the head is submerged. A large spleen means even more oxygen-carrying red blood cells can be pumped into the circulatory system when the organ contracts, allowing individuals to stay underwater for longer.

Another is a form of a gene linked to a different feature of the diving reflex: narrowing of the blood vessels to the extremities, aiding delivery of oxygenated blood to organs such as the brain, heart and lungs.

Further analysis by the team revealed that these genetic boons are not the result of chance, but evolutionary adaptations arising from natural selection.

Stephen Stearns, professor of ecology and evolutionary biology at Yale University who was not involved in the research, said the study adds to evidence for recent natural selection on certain genes in human populations – with previous examples including genes for lactose tolerance that cropped up with the advent of domestication of dairy animals, and genes for adaptation to high altitude in Tibetans and Native Americans in the Andes.

"What we lack at this point, and badly need, are samples large enough to allow us to infer when the selection [in the Bajau] started to happen," he said. "We know that the Bajau have been leading this lifestyle for at least a thousand years, but we do not know when they started it – perhaps much earlier."

Quiz

1 Read the central idea statements below.

1. *Research has revealed that the ability of the Bajau people to hold their breath for long periods of time while diving is the result of changes to their DNA.*
2. *The Bajau people have a secret ability to dive tens of meters underwater with no conventional diving aids.*
3. *These changes are linked to a larger spleen and other genetic features that affect the storage and use of oxygen in the body.*
4. *These changes have also been proven in Tibetans and Native Americans in the Andes mountains in South America.*

Which two options accurately reflect the central ideas of the article?

(A) 1 and 3

(B) 1 and 4

(C) 2 and 3

(D) 2 and 4

2 Read the two details from the article.

> *"The spleen size is about 50 percent larger in these sea nomads than it is in the [Saluan], so already it was like 'Oh, my God – it is really [an] extreme physiological characteristic,'" said Professor Eske Willerslev, a co-author of the study from the University of Cambridge.*
>
> *Genetic testing revealed that certain versions of genes are more commonly found in Bajau people than would be expected, with many apparently linked to biological changes that could help individuals cope with low-oxygen conditions.*

Select the option that BEST describes how these details develop a central idea of the article.

(A) Both details demonstrate the dedication of scientists to discovering the secret of the Bajau people's diving ability.

(B) Both details reflect the view that further research is necessary to understand the genetic changes of the Bajau.

(C) Both details contribute to the understanding that natural selection has given the Bajau extraordinary genetic traits.

(D) Both details highlight the perspective that scientists can use their study of the Bajau people to understand natural selection.

3 Which idea did the author develop LEAST in this article about the Bajau people's ability to free dive?

(A) the potential use the study of the Bajau people could have for doctors in medical settings

(B) the need for further information about how natural selection in the Bajau occurred

(C) the relationship between the size of the Bajau people's spleens and their ability to store oxygen

(D) the methods that scientists used to evaluate the presence of natural selection in the Bajau

4 What role does the diving reflex play in the Bajau people's ability to hold their breath for long periods?

(A) It is a set of responses that tells the body to adjust its use of oxygen by contracting the spleen and narrowing the blood vessels when the head is submerged.

(B) It is a set of responses that develops over time in a population to increase the thyroid hormone levels that control the use of oxygen throughout the body.

(C) It is a basic response that changes with age and sex among populations in order to allow those who practice diving to hold their breath for longer periods.

(D) It is a basic response that helps those who have already benefited from natural selection to hold their breath and to see better when underwater.