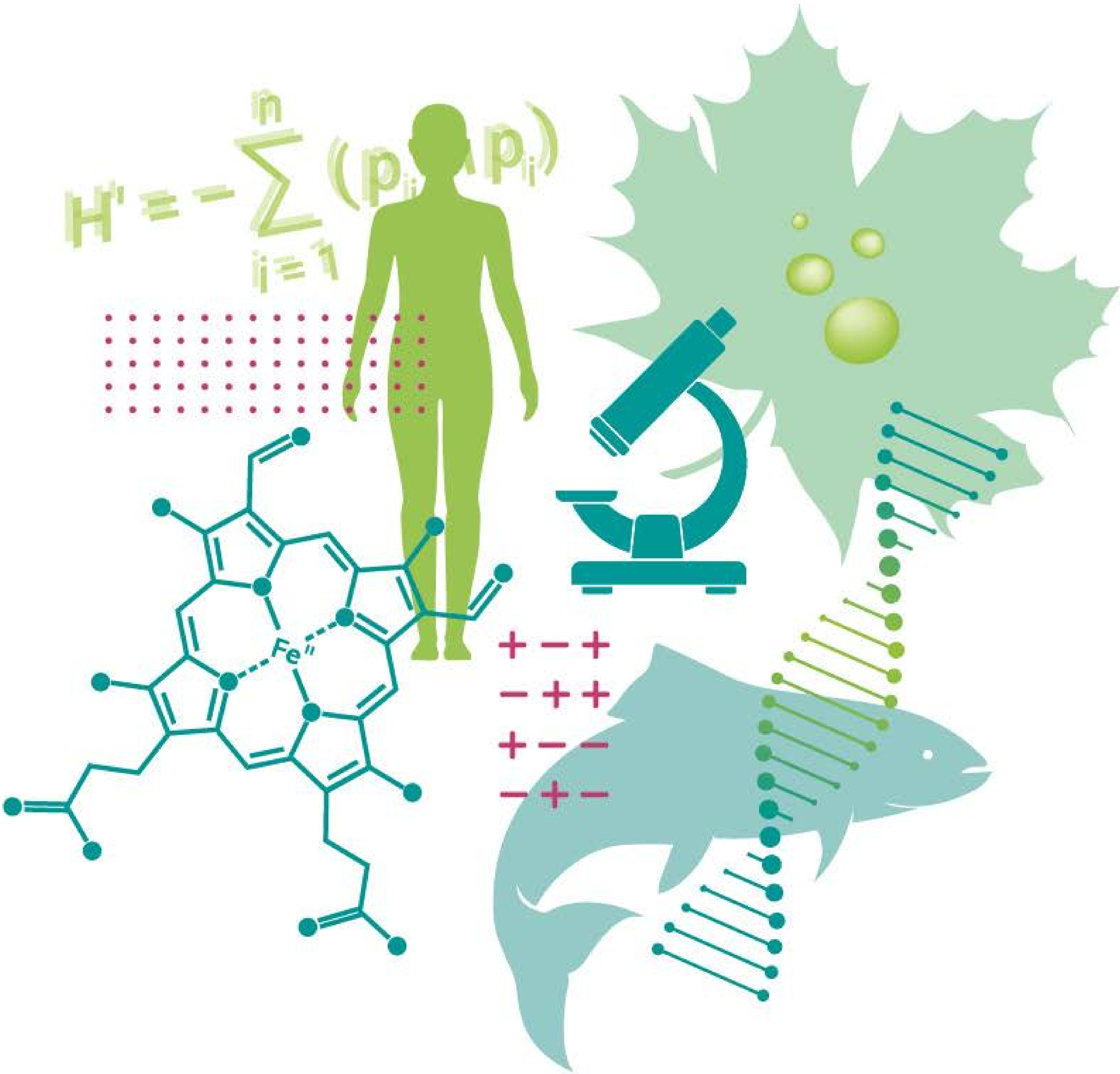
Sebastian Opitz & Burkhard Schroeter (Eds.)

IBO ASSESSMENTS

Theoretical and Practical Tasks from 2013 to 2015



Bern, Switzerland 2013 | Bali, Indonesia 2014 | Aarhus, Denmark 2015

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Office of the International Biology Olympiad e.V.

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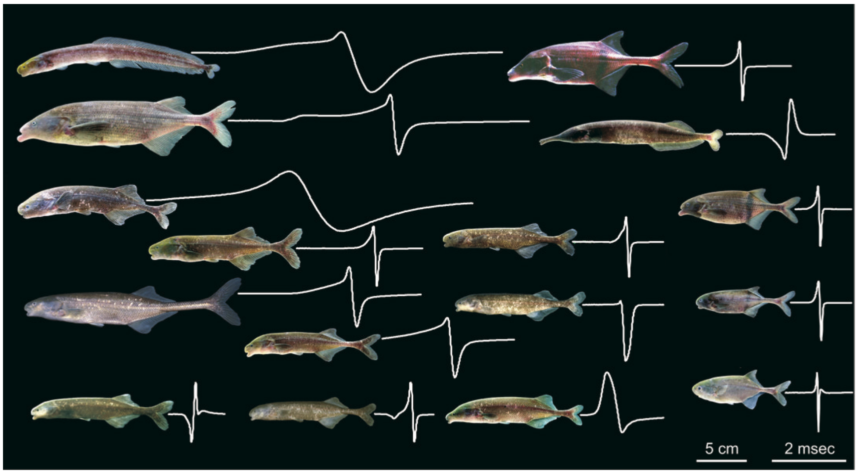
Task 45

Fish species of the family *Mormyridae* are known for their ability to locate objects and communicate by weak electric fields called electric organ discharges (EOD). They are also able to sense EODs of other *Mormyridae*. The figure shows body shape, relative body size and EOD-waveform used for communication (white lines) for 16 *Mormyridae* species living in a central African rainforest drainage system.



Indicate if each of the following statements is true or false.

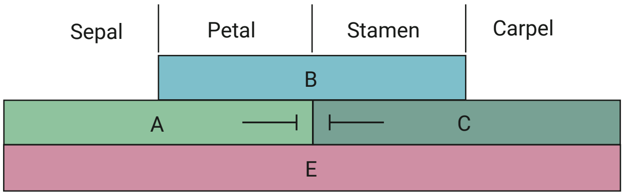
A. *Mormyridae* show characteristics typical for fish specialized on preying on other fish of similar size.
B. *Mormyridae* show characteristics typical for a group of fish warning their predators of an electric shock via shared visual warning signs (Müllerian mimicry).
C. *Mormyridae* show characteristics typical for fish living in highly turbid water or are mainly nocturnal.
D. *Mormyridae* show characteristics typical for fish that attract mates with non-visual cues.

A. False / B. False / C. True / D. True

CORE IDEAS | Structure & function | Information & communication | Variability & adaptedness | History & relatedness
SCIENTIFIC PRACTICES | Analyzing & interpreting data

Task 24

According to the *ABCE*-model of flower development, activity of genes from different classes *A, B, C or E* determines the identity of floral parts. Expression of class *A* genes is needed to determine future sepals and petals, class *B* genes to determine future petals and stamen and class *C* genes to determine future stamen and carpels. *A* and *C* genes inhibit each other's expression. Differentiation of each floral part additionally requires activity of class *E* genes. The figure illustrates the *ABCE*-model and shows flower samples of *Arabidopsis* (*1* and 2), the alpine grass *Poa alpina* (*3*) and two flowers of the snapdragon *Antirrhinum majus* (*4;* the arrow indicating the bilateral wildtype, while the radial symmetric to the right is a mutant).



1 2 3 4

Indicate if each of the following statements is true or false.

A. The phenotype of *Arabidopsis* (*1*) is best explained by a loss of function of class *B* genes.
B. The phenotype of *Arabidopsis* (*2*) is best explained by a loss of function of class *A* and *C* genes.
C. The phenotype of the Grass (*3*) is best explained by a loss of function of class *E* genes.
D. The symmetry of the mutant flower of Snapdragon (*4*) is best explained by a loss of function of class *C* genes.

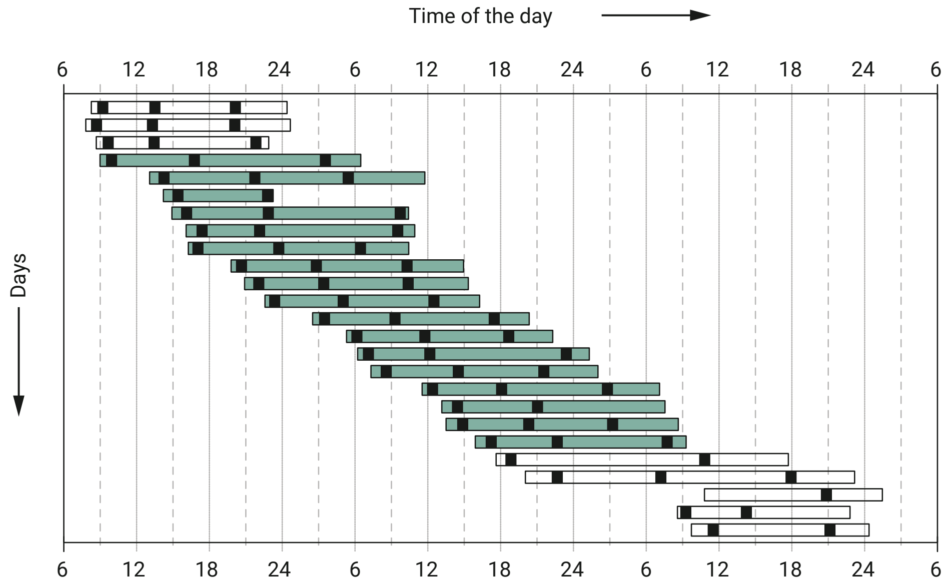
A. True / B. False / C. False / D. False

CORE IDEAS | Structure & function | Steering & regulation | Information & communication

SCIENTIFIC PRACTICES | Developing & using models | Obtaining, evaluating & communicating information

Task 40

The following figure illustrates the result of an experiment during which a person was alone in a room and allowed to freely choose the awake and sleep periods by turning a bright light on and off. The consecutive time of light for each day is shown as a rectangle with times at which the person chose to eat a meal indicated by black bars. While the person had no time cues from the outside world during the days shown in green, the room was exposed to natural light during the days shown in white.



Indicate if each of the following statements is true or false.

A. Without external cues, the person chose increasingly longer periods of light.
B. The endogenous clock of this person cycles on a 28.5 h rhythm.
C. These results are in agreement with bright light being a cue to delay the sleeping phase.
D. These results suggest that the endogenous clock of this person can readjust completely within two days.

A. False / B. False / C. True / D. False

CORE IDEAS | Steering & regulation | Information & communication

SCIENTIFIC PRACTICES | Analyzing & interpreting data

PRACTICAL EXAM 3

Evolutionary Ethology

Dear participants,
This test consists of three tasks:

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Part 1.2: Aggressive behavior of *Neolamprologus pulcher*	**152**	
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Part 1.6: Statistical analysis of bite or ram attacks	**154**	[20 points]
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Part 2.1: Puffed throat behavior of *N. pulcher*	**158**	
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Task 3: Social groups 12	**160**	**[19 points]**
Part 3.1: Quantifying task sharing in social groups of *N. pulcher*	**160**	[15 points]
Part 3.2: Interpret your observations	**161**	[4 points]

CORE IDEAS | Reproduction | Compartmentalization | Steering & regulation | Information & communication | Variability & adaptedness

SCIENTIFIC PRACTICES | Analyzing & interpreting data | Mathematics & computational thinking | Constructing explanations | Obtaining, evaluating & communicating information