The International Biology Olympiad (IBO) is one of the most prestigious competitions for secondary students in the life sciences. For more than 30 years, the best four students from all participating nations come together each summer to compete in hands-on practicals and theoretical exams. Today, this means almost 300 secondary students and 200 Jury members from almost 80 countries meet for one week in July for competitions in some of the most challenging life science tasks for this age group. Besides the academic challenge, IBO is of course also about meeting likeminded individuals and allowing intercultural exchange.

The vast majority of IBO tasks cover contents, scientific practices and domain-specific laboratory working techniques far beyond the level most regular secondary level schools can cover. Through its competition, the IBO community wants to identify, challenge and support top performers and future talents in the life sciences.

This book aims to save the unique intellectual resource IBO exams represent. It provides close to 300 closed-ended theoretical test items and twelve challenging practical exams developed for the IBOs 2013 (Bern, Switzerland), 2014 (Bali, Indonesia) and 2015 (Aarhus, Denmark). The book is intended as a resource for students preparing for national biology competitions and for IBO, as well as for team coordinators that help their students in training.

IBO tasks are developed by large groups of international life science professionals and -educators. The tasks address cutting-edge life science research and many socially relevant biological phenomena / problems. We therefore believe that this book will also provide a valuable inspiration for science educators and curriculum or assessment designers much beyond the frame of IBO.

INTERNATIONAL BIOLOGY OLYMPIAD e. V. IBO

IPN Leibniz Institute for Science and Mathematics Education

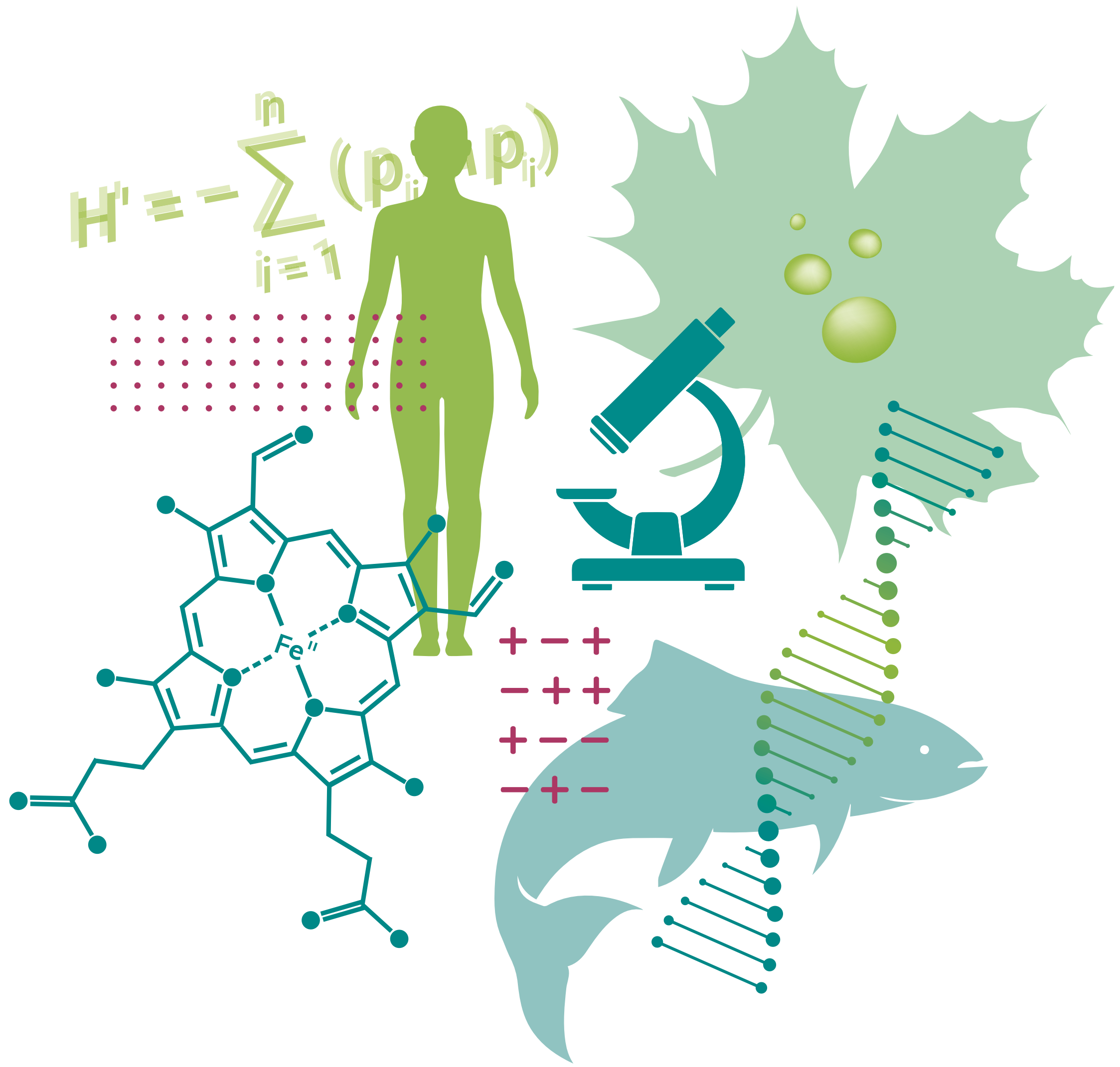
ISBN: 978-3-89088-309-0

Sebastian Opitz & Burkhard Schroeter (Eds.)
IBO ASSESSMENTS | Theoretical and Practical Tasks from 2013 to 2015
IPN

Sebastian Opitz & Burkhard Schroeter (Eds.)

IBO ASSESSMENTS

Theoretical and Practical Tasks from 2013 to 2015



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

Sebastian Opitz & Burkhard Schroeter (Eds.)

IBO ASSESSMENTS

Theoretical and Practical Tasks from 2013 to 2015

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

Office of the International Biology Olympiad e.V.

Imprint

International Biology Olympiad e.V.
Office of the International Biology Olympiad
Kiel / Germany
www.ibo-info.org

IPN – Leibniz Institute
for Science and Mathematics Education
Olshausenstraße 62
D-24118 Kiel

info@leibniz-ipn.de
www.leibniz-ipn.de

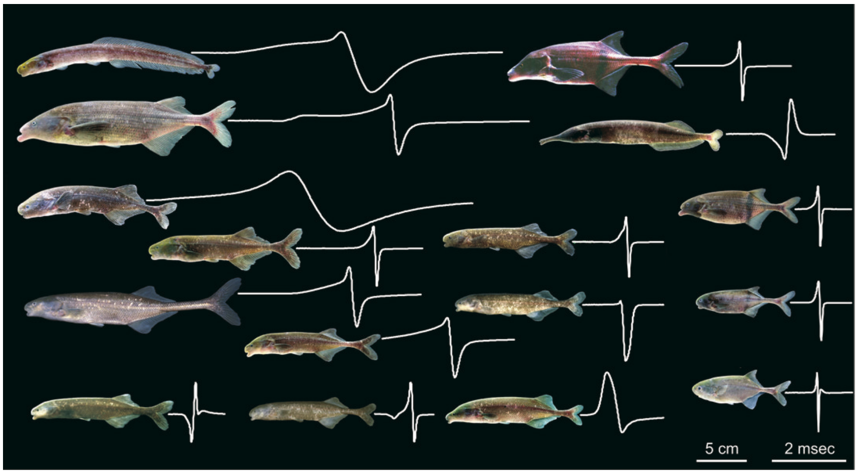
Editorial Team: Sebastian Opitz & Burkhard Schroeter
Layout, Typeset & Coverdesign: Karin Vierk & Jan Uhing, IPN
Print: Gebr. Klingenberg & Rompel GmbH, Hamburg / Germany

ISBN: 978-3-89088-309-0

CONTENTS

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.



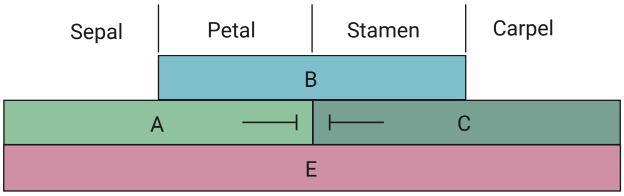
Indicate if each of the following statements is true or false.

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

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.

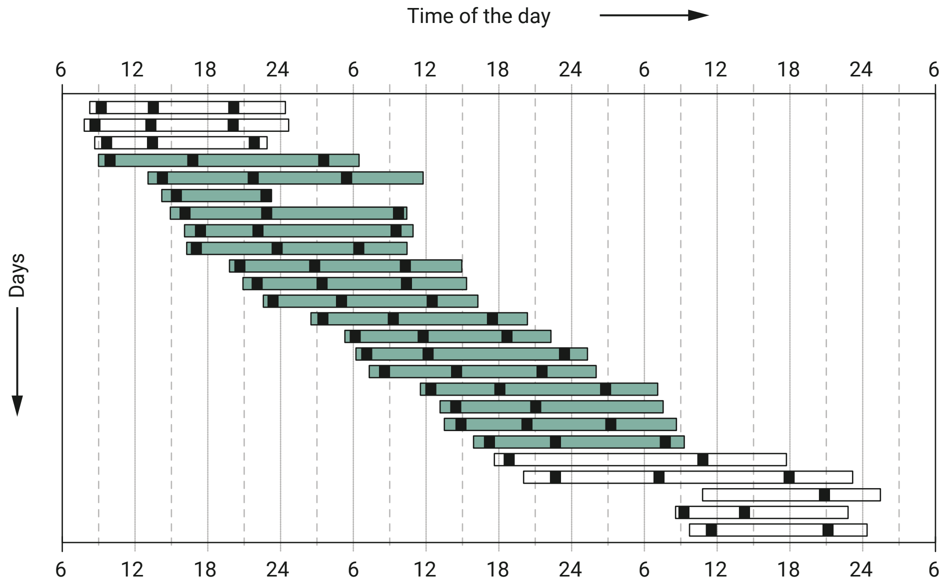
A. True / B. False / C. False / D. False

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

PRACTICAL EXAM 3

Evolutionary Ethology

Dear participants,
This test consists of three tasks:

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

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