Respiration and metabolism of warm animals with Cobra SMARTsense

Biology | Animal Physiology / Zoology | General animal physiology

Difficulty level	Group size	Preparation time	Execution time
medium	2	20 minutes	30 minutes

This content can also be found online at:

http://localhost:1337/c/5f6815cce5cabf0003972883

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General Information

Application

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Experiment set-up

The human being is a mammal and therefore equidistant (homoiothermic/ antiquated: warm-blooded). This means that his body temperature always fluctuates around a certain value, about 37° C, independent of the outside temperature.

Alternating warm (poikilotherm) animals, such as reptiles, amphibians and most insects, have a body temperature that depends on external conditions. Therefore, at the beginning of the day you can see lizards lying on stones in the sun. This physiology saves energy because the temperature does not have to be kept at a level by metabolism.

This experiment investigates the metabolic rate of animals at varying temperatures.

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Other teacher information (1/2)

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Prior knowledge

The metabolic activity of animals at varying temperatures depends on the outside temperature.

Scientific principle

This experiment is based on the assumption that the metabolic activity of animals with alternating temperatures decreases with the outside temperature. It follows that respiration also decreases at lower temperatures.

Other information (2/2)

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Learning objective

In this experiment, the students will investigate animals at varying temperatures.

Tasks

In this experiment, the pupils and students will measure the metabolic activity as a function of the outside temperature by measuring the CO_2-...and observe the emissions.

It is advisable for the pupils and students to bring various animals with them.

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Safety instructions

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The general instructions for safe experimentation in science lessons apply to this experiment.

Theory

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Chemical processes run faster with increasing temperature. This can be seen when comparing how sugar dissolves in iced tea as opposed to hot tea. This principle can be applied to the metabolism, as nothing more than more complex chemical processes take place.

In humans the normal temperature is between 36.3 and 37.4°C. This temperature is maintained at this level by muscle movement and sweating, among other things. However, there are also animals whose body temperature depends on the outside temperature. These include fish, amphibians, reptiles and most insects. This way of life has the advantage that less energy is needed for thermoregulation. However, there is also the disadvantage that movements become slower in cold weather. Temperatures that are too low can also be dangerous because body fluids freeze and crystallise, tearing the cells apart.

The relationship between outside temperature and metabolic activity can be measured by monitoring respiration, as less metabolism means less oxygen is consumed and less carbon dioxide is exhaled.

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Equipment

Position	Material	Item No.	Quantity
1	Cobra SMARTsense - Oxygen, 0 ... 20 mg/l (Bluetooth + USB)	12933-01	1
2	Erlenmeyer flask, stopper bed, 250 mlSB 29	MAU-EK17082306	1
3	Rubber stopper,d=32/26mm, 1 hole	39258-18	1
4	measureAPP - the free measurement software for all devices and operating systems	14581-61	1

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Structure and implementation

Set-up (1/2)

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For measurement with the **Cobra SMARTsense sensors** the **PHYWE measureAPP** is required. The app can be downloaded free of charge from the relevant app store (see below for QR codes). Before starting the app, please check that on your device (smartphone, tablet, desktop PC) **Bluetooth** is **activated**.

iOS

Android

Windows

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Set-up (2/2)

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Crickets in a glass

First place the animal(s) in an Erlenmeyer flask. This is sealed airtight with a stopper through which the measuring device fits.

Clues:

- Here five specimens were used, and the number should remain the same for both test parts
- Mediterranean crickets were used here, but other animals with a warm climate, such as frogs, lizards or fish, are also conceivable

Procedure (1/2)

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Experiment set-up

After the sensor has been switched on and connected to the smartphone, the measurement can begin. It is recommended to set the measurement setting to "continuous" and to let the experiment last for about 20-30 minutes. Longer is also possible, but care must be taken to ensure that the animals do not suffocate.

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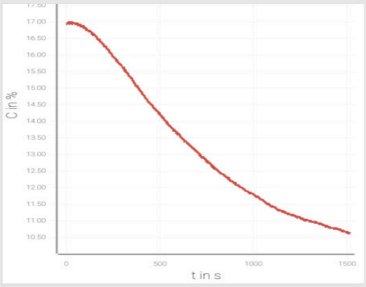
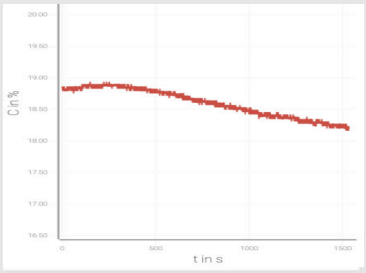
Procedure (2/2)





After the first part of the experiment is completed, the plug should be loosened to return the O_2 level to normal. Then place the test set-up in a cooler place for the same time as for test part 1. A refrigerator is recommended.

When all measurements have been completed, the results should look something like the pictures on the right. The upper picture shows the oxygen consumption under normal conditions, the lower one was measured in the refrigerator. In the lower results, the displayed amplitude was reduced so that the difference can be seen.

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Evaluation

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Report (1/3)

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What is the technical term for alternating heat?

- exotherm
- poikilotherm
- istotherm
- homoiotherm

Report (2/3)

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How can organisms influence their body temperature?

- ☐ Muscle activity
- ☐ Sunbathing
- ☐ Sweating
- ☐ Ice cream Eating

Check

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Report (3/3)

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What are the advantages of an alternating warmth lifestyle?

- [ ] Less chance of freezing to death, as it cannot become cold enough for these animals to die
- [ ] Reduced energy consumption
- [ ] More flexible habitats
- [ ] Less chance of freezing to death because they are prepared for their temperature to be low

Check

Slide	Score / Total
Slide 14: Terminology	0/1
Slide 15: Temperature regulation	0/3
Slide 16: Advantages: warm to change	0/2

Total points 0 / 6

Show solutions Repeat

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