HEALTHY BY NATURE

What can nature teach us about health and wellbeing?

Erasmus+

AGE RANGE

12–16

DURATION

Preparation:
30 min.

Activity:
160 minutes / 3½ lessons

SUBJECT(S)

- Science – *Biology, Chemistry*

KEYWORDS

Evolution; self-medication of animals/ zoopharmacognosy; bio-inspired medicine; phytochemicals/ active substances

SUMMARY

We can learn a lot from the natural world about how to look after ourselves by exploring how nature stays healthy. In this lesson, students learn about some of the amazing ways the natural world stays healthy, and consider what nature can teach us about health and wellbeing. This is done through exploration of the different strategies' nature uses, carrying out their own research, and applying biomimicry to rethink how nature can keep us healthy.

BIOMIMICRY PRINCIPLES

3 – Nature fits form to function
6 – Nature banks on diversity
7 – Nature demands local expertise

LEARNING OBJECTIVES

- Students understand that organisms, through the process of evolution, have developed strategies to survive.
- Students understand that specific strategies used in nature are mimicked by scientists to develop effective healthcare.
- Students understand how animals self-medicate, and how humans can learn from them in caring for their health.
- Students know the difference between degenerative to regenerative design, and can make choices based on this knowledge.

LEARNING OUTCOMES

- Students explain that healthy ecosystems are a prerequisite of human health, and biodiversity is a prerequisite for bio-inspired health cures.
- Students find analogies between plants/animals and human behavior in caring for their health.
- Students investigate the valuable traits of plants and animals for staying healthy, and how humans could benefit from transfering successful strategies to human healthcare.

BIOLEARN COMPETENCES

- Students are able to abstract principles of sustainability from the way the natural world functions.
- Students are able to identify functional design in nature, develop greater awareness and appreciation for design excellence in nature, and appreciate how nature works as a system which is elegant and deeply interconnected.
- Students are able to identify important needs and opportunities that can be addressed through design innovation for products, processes and systems.
- Students are able to use analogical creativity to innovate, using biological models to inspire solutions to design challenges.
- Students are able to work in groups.
- Students are more motivated in learning STEAM and experience that knowledge of STEAM can be widely used.
- Students become more familiar with professions and research topics that relate to nature-inspired sustainability and technological innovation, which can inform their choices in post-secondary education and careers.

SUMMARY OF THE ACTIVITIES

	Activity Name	Description	Method	Duration	Location
1	Inspirations from nature for our health	Students discover bio-inspired innovations and biomimicry thinking	• Teacher presentation	20	Indoor
2	Can we learn from nature how to stay healthy?	True/false questions to explore how nature stays healthy	• Quiz	25	Indoor/ outdoor
3	Smart animals	Students explore animal strategies to keep themselves well using a matching exercise	• Group work	45	Indoor/ outdoor
4	Natural first-aid-kit for holiday – Part I.	Students research ideas from nature to design remedies for humans	• Discussion • Student presentation	45	Indoor
5	Natural first-aid-kit for holiday – Part II. (extension)	Students apply knowledge to design/produce nature-based tinctures or ointments	• Hands-on activity	45	Indoor

BACKGROUND FOR TEACHERS

A bio-inspired approach to health means learning from nature by mimicking:

1. The behaviour of animals, for example to have enough sleep, rest, physical exercise.
2. Specific behavior of animals, for example birds place aromatic plants in their nests to avoid pests, or primates consume whole leaves of bitter plants when they do not feel well.
3. Relationships in ecosystems, for example deterring pests without pesticides by planting using species with allelopathic relationships.
4. Shapes or designs from nature, for example less painful medical needles inspired by porcupines, or antimicrobial surfaces inspired by shark skin, or colour created by microscopic structures on butterfly wings influencing how light is reflected instead using chemicals.
5. Processes from nature, for example mussels or other marine creatures produce sticky substances which adhere under water have inspired scientists to improve adhesives for internal use in medicine, or making products that can be absorbed back into nature with no harmful wastes.

Mimicking nature using some of the ways described above ensures humans can live in harmony with nature without degrading nature's ability to provide the services we need to survive. This approach can be described as moving from a degenerative to regenerative society, and is based on biomimicry.

"Biomedical researchers have repeatedly found methods of managing various pathogens, for instance, by paying closer attention to organisms which seem likely to be challenged by those pathogens in the regular course of their lives, and over the course of their species' evolution. Thus, biomedical researchers have discovered new ways of coping with venomous snake bites by looking at chemical compounds produced by peacocks (a ground-dwelling bird which includes venomous snakes in its diet), new herbal remedies for treating human parasites by studying how chimpanzees medicate themselves when sick, and new methods of warding off biting flies by better understanding why zebras have their stripes."

(Focus on Health, Sam Stier)

ACTIVITY DETAILS

1| INSPIRATIONS FROM NATURE FOR OUR HEALTH

» DISCOVER

LOCATION
Indoor

TOOLS AND MATERIALS

- projector, PC
- Healthy by Nature.ppt
- teacher's page: T1.1

RESOURCES

Learning from Nature and designing as Nature

Introduction to the topic of biomimicry and health. The presentation provides examples of self-medication by animals as well as bio-inspired innovations in health care. The broader context is that to enable survival of the human species, our society needs to change the paradigm from degenerative to regenerative.

See explanations to the slides in T1.1.

2| CAN WE LEARN FROM NATURE HOW TO STAY HEALTHY?

» QUESTION

LOCATION
Indoor / Outdoor

TOOLS AND MATERIALS

- student worksheet: W2.1
- teacher's page: T2.1

PREPARATIONS

Indoor activity.
Prepare W2.1 per pairs.

In this activity, students take part in a quiz to explore that there is a lot to learn from the ways other organisms are adapted and suited to their environment, helping us to understand how we can stay healthy.

Distribute worksheet W2.1 and asks students to work in pairs for 10 minutes. At the end of the worksheet there is a question for students: "Do you know any other examples of how people can learn from nature to stay healthy?"

Answers: see in T2.1.

LOCATION
Indoor / Outdoor

3| SMART ANIMALS

» DISCOVER

TOOLS AND MATERIALS

- student worksheets: W3.1 and W3.2
- teacher's page: T3.1
- video (optional): Biomimicry: Inspired by Nature Video – Brigham and Women's Hospital

PREPARATIONS

Indoor activity with students working in small groups of 3–4 students.

Prepare copies of W3.1 and W3.2 (optional) for each group.

RESOURCES

Website: Zoopharmacognosy: how self-healing animals could save humans

Reading: Janine Benyus: *Biomimicry: Innovation Inspired by Nature*, chapter 'How will we heal ourselves?'

This activity moves from a general understanding that nature can help us stay fit and healthy, to specific examples of animals which self-medicate. This is done using a card matching activity describing specific examples of how animals self-medicate. You can use W3.1 as cards or just let students match the numbers and letters. The pictures of W3.2 might help.

A video can be used at the end of the activity to reinforce how biomimicry is being used in modern medicine.

Follow the matching activity with a discussion. For each example, ask students to describe how the self-healing strategies in each of the examples could be used in human medicine. Does nature offer useful suggestions for alternatives?

You need to be well prepared for this discussion and have appropriate guidance questions to help students think of possible bio-inspirations in human medicine.

Questions for students:

- Which of the examples can be said to be 'behavioral' and which are 'structural' adaptations?
- What would happen if these adaptations had not happened? Would the organisms survive?
- Can you think of ways in which humans have made healthy adaptations similar to these?
- In which way do you find nature a genius?

This short video explaining how biomimicry is supporting medical research can be used at the end of the activity: www.youtube.com/watch?v=nyvOjrl6dNM. Alternatively, use the prepared presentation.

Solutions see: T3.1.

ACTIVITY DETAILS

LOCATION
Indoor

TOOLS AND MATERIALS

Student worksheet W4.1

PREPARATIONS

Indoor activity requiring access to the internet.

Prepare W4.1 per groups.

RESOURCES

- Animals that self-medicate www.pnas.org/content/111/49/17339
- Ask Nature www.asknature.org

4| NATURAL FIRST-AID-KIT FOR HOLIDAY – PART I.

» DISCOVER
» QUESTION

In this activity, students work in groups to research health issues than can arise when on holiday. They consider how nature deals with similar issues and ask if they can find solutions in nature. They present their findings to the rest of the class.

Use W4.1, handle it to each group – or you can just tell them the questions and tasks.

Some hints to the exercises:

1. Health problems on holidays:
   - Summer: bites, fever, cuts, abrasions, scratches, upset stomach, sunburn, sore throat, swelling.
   - Winter: hypothermia, frostbite, fever, cough, sore throat, bruises, broken arm or leg.

2. How would nature heal?

Health issue	Ask nature
cuts, bumps and bruises	How does nature stop bleeding? How does nature handle bumps and bruises?
hypothermia	How does nature stay warm?
sore throat	How does nature manage bacteria?

5| NATURAL FIRST-AID-KIT FOR HOLIDAY – PART II. (EXTENSION)

» DISCOVER
» CREATE

LOCATION
Indoor

TOOLS AND MATERIALS

Teacher's page: T5.1

PREPARATIONS

Read each recipe on T5.1 and prepare ingredients as required.

In this practical activity students produce three different kinds of natural medicines/ointments/dietary supplements suitable for a holiday first aid kit. Each of the four recipes is described on T5.1.

Start by asking students to examine the ingredients and think about how they can obtain active substances from them; pharmacologists use the methods of extraction and distillation.

Two options are provided depending on the ability of the students and availability of a suitable laboratory.

LITERATURE, ADDITIONAL INFORMATION

Engineering Inspired by Nature by LWN, chapter 11 – Discovering Nature's Talents – Focus on Health.

T1.1 INSPIRATIONS FROM NATURE FOR OUR HEALTH

Teacher presentation

1. **Title: Inspirations from nature for health**

2. **Can nature teach us how to stay healthy? What can we learn from turtles?**

We can look at what the turtle symbolizes, moving along slowly and cautiously. Do humans do that? So, the first inspiration could be to slow down a little bit.

Looking at a turtle 'through a scientist's lenses', what strikes you about her appearance? Turtle's shell is designed as a protective cover, consisting of several layers.

Taking inspiration from a mechanism that mimics turtles scales, researchers inspired manufacturers to develop the new skis https://tinyurl.com/y4skkmag. These skis are easy to maneuver but stiffen up in the middle of turns to improve the skis' grip on the snow.

More inspirations at https://tinyurl.com/yyr8trcg. Maybe the next time you drop your iPhone XV, a sustainable biomimetic turtle case will prevent a repair trip to the Apple store.

3. **The history of the Earth in 12 hours**

"Life has a 3.8 billion year head start in research and development." (Janine Beynus)

Man is a relatively young species that can learn from millions of survivors that turned the Earth into a sustainable ecosystem. It's time to change the paradigm how our society perceives nature, from learning about Nature to learning FROM the natural world.

"Plants, animals and microbes are amazing, they have spent billions of years engineering and testing ways to thrive on the planet. 3,8 billion years to be precise. That's a lot of research and development. After all this research and development, what did not work does not exist anymore. And what surrounds us has learned to survive. Solutions to challenges small or big are all around us."

(Source: https://www.youtube.com/watch?v=UHb_XNgIHFY)

Janine Benyus is a biologist and innovator who popularized the term biomimicry in her 1997 book *Biomimicry: Innovation Inspired by Nature*. Biomimicry is the practice of imitating life (bio means life, and mimicry means imitate). Janine is the co-founder Biomimicry 3.8 and Biomimicry Institute. More info about her at https://biomimicry.org/janine-benyus/.

4. What do they have in common?

All these animals inspire better health care. They are unique at doing things (how they move, how they stick to the surface, how they penetrate, how they kill cancer cells, etc.), and we will look at them in a greater detail. But they are just a small selections of the whole natural world, and bio-inspirations how we could stay healthy, and find better medical equipment and new cures.

5. Primates, elephants, bears, birds and insects inspire new medicines

Quote by Janine Benyus from her book *Biomimicry 3.8: Innovation Inspired by Nature*, chapter 5: 'How will we heal ourselves?'

6. Phytochemicals – protective shield for our health

Recent research suggests that sheep and goats self-medicate against parasitic infections.

Many plant tissues contain plant secondary compounds (PSC), which have long been recognized as defensive chemicals that deter herbivory via their toxic effects. If humans consume herbs, vegetables, fruits, spices, nuts, and seeds, they can boost their immune system, and defend themselves against various health conditions (especially antiparasitic, antibacterial, antifungal properties).
https://www.cambridge.org/core/journals/proceedings-of-the-nutrition-society/article/phytochemicals-in-animal-health-diet-selection-and-tradeoffs-between-costs-and-benefits/578EA7D11E35EBCD1B2D-302F78A96D19

7. What do they inspire? Less painful needles

The barbs on porcupine quill tips let them penetrate flesh with less force and hold on with more force than a barbless needle. Doctors have mimicked porcupine quills to produce medical needs which provide less painful injections. https://www.huffpost.com/entry/porcupine-quills-needles_n_2277732

Mosquito bite inspires less painful injection as well.

Current needles are relatively smooth cylinders that present large amounts of surface area to nerves, causing pain to the human subject.

A mosquito's initial bite is actually quite painless. The highly serrated proboscis touches the nerves of the skin at fewer points than a smooth surface like a needle. Much less contact area translates into much less pain.
https://asknature.org/idea/mosquito-inspired-microneedle/

8. How does nature stick things together?

This is a question biomimetic engineers would ask.

- Sandcastle worms teach us how to make underwater glue. To protect themeslves they build tubes (sand castles) with help of special proteins that are used as bio-adhesive.
- This is an inspiration for medical professionals creating a new glue to repair broken bones.

9. More medical adhesives inspired by nature

MUSSELS

Mussels possess the unique ability to attach to wet surfaces such as rocks, fish and boats. They are able to withstand strong wind and even waves. The medical profession has turned to mussel-inspired adhesives made of soy to aid in surgery. Read more from Asian Scientist Magazine: 'Mussel-Inspired Glue Closes Wounds In 60 Seconds' https://www.asianscientist.com/2015/08/in-the-lab/postech-light-activated-mussel-glue/

OCTOPUS

Octopus' sticking properties have inspired researchers to develop a composite material that adheres to skin and provides an improved conductive path, which opens the door for use with electrocardiogram (ECG) and personal health monitors.

10. Gecko – unique sight

Geckos have a higher density of cones in their retina, which means they can detect more specific light wavelengths. And that makes their eyes 350 times more sensitive than humans. Geckos also have the rare ability to see colors at night. These discoveries have engineers interested in developing more effective cameras and possibly even multi-focal contact lenses to not only combat vision loss, but enhance our vision abilities.

11. Shark skin

Shark skin has a unique surface which has the ability to repel bacteria. The antimicrobioal properties of the scales which cover sharks is being mimicked and applied to hospital surfaces to help fight bacteria growth.

12. Woodpecker

The skull of woodpecker is made of special spongy bone structure to protect them against massive shocks from beating. This spongy bone has inspired the design of a lightweight bicycle helmets and other shock absorbers.

13. The bioluminescence of jellyfish

The bioluminescence of jellyfish tentacles has inspired technology that can detect cancer, microbes and viruses. Using a green fluorescent protein called GFP that's found in jellyfish, proteins associated with cancer and other diseases can be tagged and tracked in small animals.

14. Elephant trunk – model of flexibility

The flexibility and wide-range of movements of an elephant trunk inspired a new robotic arm that can be used to help the handicapped.

15. Elephants also inspire new cures

Elephants die from cancer far less often than people do. Why? Researchers found that a tumor-suppressing protein in elephants induces apoptosis – massive self-destruction of cancer cells.

Scientists are now developing and testing a synthesized version of elephant protein to bring that protection to other creatures.

16. Re-connecting with nature?

We have come to believe that we are separate from nature but we have never been. Our survival on Earth critically depends on healthy ecosystem functions and the life-support systems of the biosphere. https://medium.com/age-of-awareness/regenerating-health-meaning-and-true-wealth-systemic-biomimicry-bd-7916d0cd4b

All fields of human activity can be performed in harmony with nature. They do not have to have adverse impact on ecosystems. On the contrary, small-scale, sensitive farming or tourism can increase diversity, and beauty of the landscape.

17. Nature has found the solutions – on the level of the organism, behaviour and ecosystem

The first level refers to a specific organism (plant or animal): mimicking the form or shape, components, materials, e.g. elephant trunk, porcupine quills or shark skin.

The second level refers to mimicking behavior or the natural processes, e.g. tumor-supressing protein produced by elephants or adhesives inspired by under-water glue made by mussels.

The third level is the mimicking of whole ecosystems, e.g. sustaining healthy ecosystems to allow survival for future generations or building a nature-inspired city.

18. Threats to ecosystems = threats to human health

To implement biomimicry at all three levels, people have to learn to design products, processes, and all parts of society (shelter, food, transportation, etc.) as nature does: to create conditions conducive to life.

Human health depends on healthy ecosystems. We need to design as nature and that means changing the human impact on Earth from being predominantly degenerative to being regenerative, patterns of economy from linear to circular, and development from unsustainable to sustainable. As nature does.

19. Biomimicry is… the conscious emulation of life's genius

Quote by Janine Benyus

T2.1 CAN WE LEARN FROM NATURE HOW TO STAY HEALTHY?

Solutions

1. **In nature, animals do not suffer from obesity.** → **T**

In principle, this is true, but there will also be exceptions, such as the recent case of an owl found in England who was unable to fly because it was a third overweight. Similar cases, however, occur in nature very rarely.

2. **No animal is immune to cobra poison.** → **F**

The peacock is. In India peacocks are valued because they are great hunters of young cobras and other poisonous snakes. Because the peacock is resistant to cobra venom, it has become a symbol of divinity and immortality in the Orient. It has become resilient through evolution by living with the cobra in the same territory and incorporating cobras into its diet.

3. **Animals take care of their teeth.** → **T/F**

Usually not, because most wild animals are naturally protected from tooth decay thanks to the food they consume (only raw food and only pure water to drink). There are exceptions, for example howler monkeys clean their teeth with plant stems. Animals dependent on strong teeth have strategies to maintain them, for example, sharks shed their teeth up to 40 times in their lives; alligators display a similar pattern.

4. **Many animals self-medicate.** → **T**

There are many examples including dogs and birds, but examples of self-healing have also been described for bees, lizards, elephants and chimpanzees. These animals eat things that allow them to feel better or prevent disease, or kill parasites such as worms, bacteria and viruses, or just to aid digestion.

5. **Animals do not exercise to stay healthy.** → **T**

Animals in the wild are unlikely to exercise by choice, but very little research has been done in this area. We know that animals change the state of their body in response to environmental conditions and produce sufficient energy for growth and movement, for attack and defense, and also for reproduction. Young animals often appear to be playing and exercising, but this apparent play is also a crucial part of learning the skills to become an adult.

6. **Animals sometimes go on a diet (eat less or different food).** → **T**

Yes, for example a dog will sometimes eat grass to improve digestion. When chimpanzees have parasites they eat only the leaves of a special plant swallowing them whole, not because of nutrition or taste, but as a medicine.

7. **Birds do not protect themselves from rain.** → **T**

Yes, waterfowl in general. They are protected by a layer of smooth feathers which keeps the water out and also helps the duck float. Moreover, ducks make a kind of oil which they spread on their feathers with their beaks.

8. Zebras are the most common victim of tsetse flies. → **F**

On the contrary, zebras have evolved stripes to help them confuse insects. Zebra stripes evoke spatial disorientation in the simple eyes of the flies causing them to fly away to look for another victim.

9. No mammal survives without water for more than a week. → **F**

This is not true; the camel can stay for 10 days without water. This is due to the special structure of red blood cells allowing them to swell and keep water in them for a long time.

10. Plants cannot defend themselves against their predators. → **F**

Plants, unlike animals, cannot escape but use other defensive mechanisms: stings, thorns and repulsive or poisonous substances. Examples include the rose, thistle, nettle, garlic, or cherubia (the whole plant is poisonous) or common castor (poisonous seeds).

T3.1 SMART ANIMALS

Solution

Cards should be matched in the following way: A6, B5, C3, D7, E9, F10, G2, H4, I1, J8

A.	Blue tit	6.	When building a nest I use fragrant herbs such as lavender, mint and wild carrots to prevent mites and other parasites; when my chicks hatch into the nest they will have a healthier environment.
B.	Ant Formica family	5.	I bring with my tens of thousands of fellow citizens to the nest pieces of coniferous resin. The resin contains volatile substances with antibacterial and antifungal effects helping to prevent harmful bacteria (*Pseudomonas fluorescens*) and fungi (*Metarhizium anisopliae*).
C.	African elephant	3.	When I feel that the time of birth has come, I will eat leaves from the *Boraginaceae* plant to induce it.
D.	Chimpanzee	7.	For digestive problems and lack of appetite, I swallow the whole leaves of *Aspilia mosambiciensis* or *Vernonia amygdalina* even though they taste disgusting. They help me to get rid of intestinal contents including possible parasites such as nematodes and tapeworms. I also notice what the physically fittest members of our troop eat and try to eat what they do.
E.	Howler monkey	9.	I use cashew stems (*Anacardium occidentale*) to clean my teeth which containing phenolic compounds of anacardic acid and cardol, acting against the bacteria responsible for dental caries.
F.	North American bear	10.	To get rid of insects I make paste from the roots of *Ligustum porteri* (also known as a bear root) mixed with my saliva and rub it in my fur coat. Then no annoying insect attacks me.
G.	Jaybird	2.	I spread ants over my feathers with my beak. This releases formic acid which repels lice, fleas and mites.
H.	Sea bass	4.	During evolution I created a slimy 'armor' around me containing useful bacteria that protect me from dangerous pathogenic bacteria (e.g. *Staphylococcus gold*) or yeast (*Candina albicans*) found in the sea.
I.	Zanzibar red colobus	1.	In my diet on Zanzibar there are toxic leaves of almonds and mangoes containing poisonous phenols. Therefore, I must also eat charcoal from forest fires as a dietary supplement which binds with the phenols so they can be quickly removed from the body.
J.	Rat	8.	I often encounter various poisoned foods. If I have eaten some poisoned food, I eat clay (the clay absorbs toxic substances). That's also why people call me 'smart as...'.

T5.1 NATURAL FIRST AID KIT FOR HOLIDAY – PART II.

FOUR SIMPLE RECIPES DO NOT REQUIRE A LABORATORY:

GINGER ELIXIR

— against viruses —

Ingredients: *ginger, honey, cayenne pepper, a quarter of lime, hot water*

Procedure: One of the best antiviral drugs is ginger. To make an elixir, mix 10 ml of fresh ginger juice with 1 tablespoon of honey, add little cayenne pepper, lime juice and 180 ml of hot water. Drink this mixture as hot tea three to six times a day.

GARLIC HONEY ELIXIR

— against coughs and colds —

Ingredients: *garlic, lemons, honey*

Procedure: Mix 6 lemons (without peel and seeds), 30 peeled and crushed cloves of garlic and 100 ml of honey into a thick paste. Pour into a glass and store in the refrigerator. Take 1–2 teaspoons a day on an empty stomach for three weeks to boost the immune system.

TICK REPELLENT

— against ticks and other bugs —

Ingredients: *water, apple cider vinegar, essential oils (rose geranium, citronella)*

Procedure: Make yourself unattractive to ticks by using homemade repellent. In a spray bottle, mix 2 cups water, 4 tablespoons of vinegar, and add a few drops of essential oils (both of these smells ticks hate). Use the spray on your skin and clothing.

BATH TEA

— with a calming effect —

Ingredients: *rosemary, peppermint, wild thyme, chamomile, lavender*

Procedure: Fill a tulle bag with a mixture of equal parts of herbs and leave to infuse well in the bath.

SOME QUESTIONS FOR STUDENTS:

Q1: Why and how are herbs or foods combined in recipes? Indicate in the recipes which substance is used as a solvent.
In each of the recipes butter, honey and water are used as solvents.

Q2: What role does fat play in a recipe? Why do we add oil to salads?
Beneficial substances are soluble partly in fats and partly in water. Since fat-soluble substances are absorbed into the body only in fat, water dressing alone is not enough. Without oil, some substances remain undigested and come out of the body unused. Examples are alpha-carotene, beta-carotene (vitamin A provitamin), lycopene.

TWO RECIPES WHICH REQUIRE A LABORATORY:

Students will practice how active substances can be extracted from plant material. Using two different extraction methods they can prepare for example:

- Clove oil (steam distillation)
- Marigold ointment, lip balm (extraction into oil, fat).

CLOVE OIL – STEAM DISTILLATION

Steam distillation – a remedy for toothache

Procedure: Prepare the steam distillation apparatus. Spread 2 teaspoons of cloves in a pestle and mortar, then mix with 10 ml of water and pour into a wide test tube. Collect the clove essential oil, and mix with olive or sunflower oil.

MARIGOLD OINTMENT – FAT EXTRACTION

Marigold ointment is a remedy for dry, irritated skin, cracked heels, eczema, varicose veins, or dry elbows and hands

Procedure: In a glass vessel, melt shea butter (shea butter is a natural preservative) and put marigold flowers in it, mix, let these two ingredients combine for about 5 minutes and remove from the heat, cover and set aside. The next day, heat the ointment and the marigold again in a water bath to melt the cream, leave it again for 5 minutes, mix well and set aside. Repeat this three times, during this time the healing ingredients of the marigold absorb into the cream, finally melt and drain through a gauze or clean cloth into clean containers. After cooling, close and store in a cool place.

W2.1 CAN WE LEARN FROM NATURE ABOUT HOW TO STAY HEALTHY?

What is true and what is false?

Bio-inspirations have the potential to improve all areas of our lives, including our health. Can we learn from plants and animals about how to stay healthy?

	TRUE	FALSE
1) In nature animals do not suffer from obesity.	○	○
2) No animal is immune to cobra poison.	○	○
3) Animals take care of their teeth.	○	○
4) Many animals self-medicate.	○	○
5) Animals do not exercise to stay healthy.	○	○
6) Animals sometimes go on a diet (eat less or different food).	○	○
7) Birds do not protect themselves from rain.	○	○
8) Zebras are the most common victim of tsetse flies.	○	○
9) No mammal survives without water for more than a week.	○	○
10) Plants cannot defend themselves against predators.	○	○

Do you know any other example from nature about how people can be inspired by nature to stay healthy?

. . . . . .

W3.1 SMART ANIMALS

Names and desriptions

A.	Blue tit	1.	In my diet on Zanzibar there are toxic leaves of almonds and mangoes containing poisonous phenols. Therefore, I must also eat charcoal from forest fires as a dietary supplement which binds with the phenols so they can be quickly removed from the body.
B.	Ant Formica family	2.	I spread ants over my feathers with my beak. This releases formic acid which repels lice, fleas and mites.
C.	African elephant	3.	When I feel that the time of birth has come, I will eat leaves from the *Boraginaceae* plant to induce it.
D.	Chimpanzee	4.	During evolution I created a slimy 'armor' around me containing useful bacteria that protect me from dangerous pathogenic bacteria (e.g. *Staphylococcus aureus*) or yeast (*Candina albicans*) found in the sea.
E.	Howler monkey	5.	I bring with my tens of thousands of fellow citizens to the nest pieces of coniferous resin. The resin contains volatile substances with antibacterial and antifungal effects helping to prevent harmful bacteria (*Pseudomonas fluorescens*) and fungi (*Metarhizium anisopliae*).
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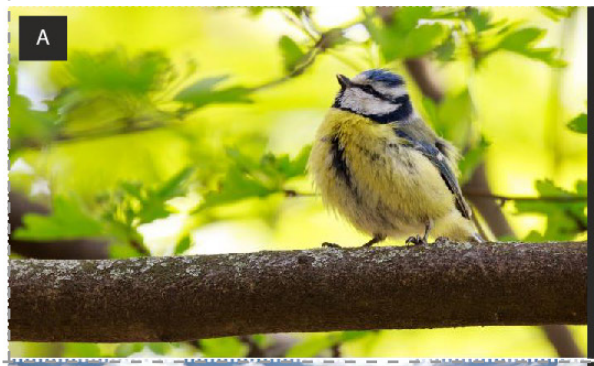
H.	Sea bass	8.	I often encounter various poisoned foods. If I have eaten some poisoned food, I eat clay (the clay absorbs toxic substances). That's also why people call me 'smart as...'.
I.	Zanzibar red colobus	9.	I use cashew stems (*Anacardium occidentale*) to clean my teeth which contain phenolic compounds of anacardic acid and cardol, acting against the bacteria responsible for dental cavities.
J.	Rat	10.	To get rid of insects I make paste from the roots of *Ligustum porteri* (also known as a bear root) mixed with my saliva and rub it in my fur coat. Then, no annoying insects attack me.

W3.2 SMART ANIMALS

Cards

A



Blue tit. Photo by dfkt on Unsplash

B

Ant Formica family. Photo by David Higgins on Unsplash

C

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D

Chimpanzee. Photo by Andrey Tikhonovskiy on Unsplash

E

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F

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G

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H

Sea bass.
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I

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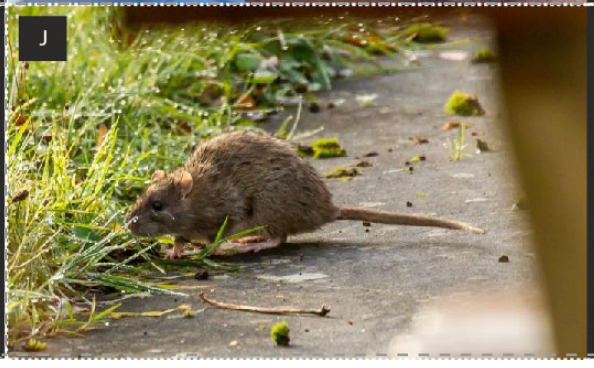
J



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W4.1 NATURAL FIRST AID KIT FOR HOLIDAY

Q1: **What kind of health problems do you expect on holiday?**
Find at least five health problems that can occur on summer or winter holiday.

SUMMER:

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WINTER:

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Q2: **What kinds of medicines / treatments might you need?**
For each of the health problems identified, list the medicines or treatments you would usually use.

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Q3: **How would nature heal?**
Keep in mind you stay in nature, with a very limited capacity to buy anything. Now, choose a few of the health problems on your list, and make questions using the pattern *How does nature...?*

HEALTH ISSUE		ASK NATURE
cuts	→	*How does nature stop bleeding?*
.....	→	.....
.....	→	.....
.....	→	.....

Q4: **Choose three health issues, and make your own research; how does nature solve the problems?** Discuss them in groups.

You can search online, key words: anti-bacterial plants (lavender, sage, thyme), antiseptics for skin (calendula), pain killers (willow's bark), sealing and disinfection of wounds (sap from fir tree), digestion aid (clay).

Q5: Concentrate on one health issue, and prepare your presentations

Each presentation should cover:

1. The health issues you chose.
2. How this health issue is dealt with in the natural world. Try to research at least 2–3 examples of how nature manages this health issue (this can also include how the human body copes with these issues).
3. Recommendations to better address these health issues based on your research about how nature manages them.

Choose a visual technique (a poster, presentation or something else), and present your findings about how nature treats your chosen health issue, and how nature can teach us to treat our health issues.