

# ***Masterclass Biomimicry Challenge II***

## ***Student Guide***

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Are you up for the challenge? Ready to take on a new challenge? To use the knowledge you have acquired in this biomimicry challenge?

*The word biomimicry is a combination of the Greek words bios, meaning 'life', and 'mimesis' which means imitating. So, biomimicry means 'imitating life' or you could also say; following successful strategies from nature.*

These materials are developed by biomimicryNL ([www.biomimicrynl.org](http://www.biomimicrynl.org)) in collaboration with the Peelland College in Deurne (NL). This Challenge is meant for the first level VWO (special top class of secondary school).

The total package consists of two separate parts. Part II is a sequel to part I. Part II assumes that you know a number of basic concepts and the assignments are freer. You will be more challenged!

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## Introduction to Challenge II

### *This challenge*

In biology you learn about nature; how animals live and what type of trees there are. In biomimicry we learn from nature, and we view it as a model and a mentor. As a *model* because plants and animals have developed numerous genius solutions that can inspire us. As a *mentor*, because in biomimicry we always ask the question: "how would nature solve that?". Biomimicry is about how we can translate knowledge from nature into sustainable solutions for our human challenges. It requires a different approach. With this challenge you get acquainted with biomimicry, what you can do with it and how you can use it. As far as we are concerned, biomimicry is the future and it will help us to solve a large number of social issues and challenges and make the world more sustainable.

### *What do we hope to achieve*

This challenge aims to give you a lot of insights and hopefully makes you enthusiastic about biomimicry. We have drawn up a number of learning objectives. Your 'grade' is determined on the basis of achieving these learning objectives.

### *Learning goals*

After doing this challenge:

- You understand what biomimicry is and you can apply the methodology.
- You can, on the basis of a 'challenge', investigate a specific problem, derive solutions and work with this method.
- You are able to make a design based on biological design principles.
- You and your group will have experience with creating and presenting your design with the aid of a video.

This masterclass consists of two challenges in total. Both challenges are structured in six modules of two hours each. You need approximately one hour of self-study per module to get your design ready

### Challenge II

<b>Module 7</b>	Lesson 13 and 14	Introduction to biomimicry
<b>Module 8</b>	Lesson 15 and 16	Formulating a question
<b>Module 9</b>	Lesson 17 and 18	Do research
<b>Module 10</b>	Lesson 19 and 20	The best solution from nature
<b>Module 11</b>	Lesson 21 and 22	Create a design
<b>Module 12</b>	Lesson 23 and 24	Preparing for the presentation (design)

*What information can you use and where can you find it*

During the lessons the theory is explained by the teacher. We also made an introduction video for you. A special website helps you find the answers you are looking for. You are also free to use other sources like the library or via the internet. In short, we have selected a number of things for you, but there is enough space to make new discoveries as a real scientist!

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### *Use of Icons*

In this teaching material we use three different types of icons. Below is the meaning:



This icon indicates where you can find information, or what is good to view now. If you follow this, it will help you to understand the concepts better.



This icon means there is a question or a thought. Stop here and think about this. The question helps you to get a better understanding of the substance.



Now you are going to do something! An assignment or an action for yourself or with your group.



See this icon? You have a homework assignment.



### 1. De challenge

This challenge is the sequel to challenge I. You make groups of 3-4 persons. Every group chooses a research question (or creates one) and will do research to create a design for 'the problem'. Eventually the results will be filmed and the videos will be judged. You could make a video of a prototype, but you could make an animation on the computer as well. It doesn't matter, as long as your video shows what you found as an answer and as a solution for the challenge.

#### *How can your group 'win'?*

In nature we know little competition. Collaboration delivers a lot more! You are not going to fight each other, but choose which group has made the best video as a team. We will make decisions in the same way that bees do. Bees live with around 15,000-50,000 bees in a hive. If one has found a large field full of flowers (= food), how does she convince the other to go with her and that it is the best place?

#### *Making decisions like bees do*

Bees conduct an active debate. If one has found food, for example the just-named field full of flowers, she goes back to the hive and performs a dance for the other bees. The dance indicates the direction and the place of the food. But she is by no means the only one who has found a good place and other 'exploratory' bees also perform dances, so what is the best place to go?

Neutral bees match the dancing that they want to follow. Bees perform the dance only a few times, and that means that there are always new bees who have to dance to keep the place popular. If no one is interested in a particular place, the dancing stops and joins a dancing with her performing the most enthusiastic dance.

But when do the bees make a decision? If eventually all 'exploratory' bees have chosen the same place. When they all perform the same dance, a consensus has been reached. Then something interesting happens, because they have to leave for that place. The bees that belong to the location play a facilitating role here. They give a squealing signal through which the bees get ready. When that happens, they leave.



#### *Example of bee dance:*

<https://www.youtube.com/watch?v=-7ijl-g4jHg>

*What does this mean for the bees who had suggested a different place?*

#### *Bee-o-mimicry?*

*What can we learn from this if we want to make decisions ourselves?*

1. Put together a group that consists of individuals with a shared interest and mutual respect - the bees can only survive together.
2. Minimize the influence of the leaders on the thinking of the group - in a bee nest is a queen, but she does not lead the group.
3. Find different solutions to a problem - the bees examine different nesting and feeding

places.

4. Conduct a debate - the best place is chosen by the debate.
5. Agree on rules for a quick and good decision.

### *Choosing like bees*

In every class, the videos are shown simultaneously on different computers. Everyone gets the time to view all the videos and decide which he / she thinks is best. When the time runs out, you go to the computer with the movie that you liked best. The movie with the most 'followers' wins! The winning video then continues to the school finals and here too we will choose a winner in the same way. In this way we learn to apply the principle of bees for making decisions. This is exactly what biomimicry is! Without you realizing it, we have used biomimicry.



Form now a group of 3-4 students.

Tell your teacher who is in your group and if you want, you can come up with a name for your group.

## **2. Bio-what?**

We have mentioned it a number of times, but what is Biomimicry? Biomimicry comes from the words 'bios' that means life and 'mimicry' that we can translate as the science of imitating. We will mimic ideas from nature for human challenges.

Let's start at the beginning

Man has always been used to finding necessities in nature. The fruit on the trees, the eggs of the chickens, pearls for jewellery, leather for clothes, oil for fuel etc. At an early stage people knew that nature also carries a lot of wisdom. For example, the first people used many herbs and plants from nature to cure diseases. In fact, man is part of nature. We have, however, forgotten this way of thinking through the industrial revolution, the arrival of cities and the ever further remote living of nature. For centuries the economy continued to grow, man became richer and he increasingly lived with the idea that he was not part of nature, but better and greater power. He could use everything from nature, as much as he wanted



*If you want to know what the weather will be like, do you look at the clouds or the app on your mobile phone? And if you have to find your way in the dark, do you use the stars, or rather google maps? Do you still use nature?*

With the use of computers and machines, the realization grew that people might have taken away too much from nature. All kinds of animals and plants are threatened with extinction and the climate is warming up due to an increase in CO<sub>2</sub> in the air.

We humans are still 'but' around 200,000 years on this planet. That sounds like a long time, but if you consider that life on earth already exists for 3.8 billion years, man is only a baby in relation to other plants and animals that have existed for much longer. Perhaps we should not think that we already know everything, but focus on nature with questions.

Many plants and animals know much better, because of their longer experience, how to adapt in order to survive. Can we learn something from nature, see nature as a teacher and give ourselves the modest role of an inquisitive pupil?



*If you look at how people now live on earth, are we the 'smartest species'? Or can we still learn something from nature? And what then is the difference between learning about nature and learning from nature?*

*A solution with biomimicry*

We at BiomimicryNL want people to be inspired by nature and once again go into nature to get answers to our social questions. You can safely say that every question can be answered in nature, you only have to find it!

Biomimicry applies natural solutions to 'human' questions. You will translate the example from nature into your own challenge / problem. We have just done that with the bees when we have translated their principle into our challenge. Another example is the train in Japan whose nose is an imitation of a beak of a kingfisher. And of course we also want to use natural (and therefore non-polluting) materials when applying the solution.



*Name five materials that we do not want to use, and five that we should use?*



*Do you already know another example where biomimicry is used to find a solution? Or maybe you have already used it yourself?*

When using Biomimicry we use the so-called 'life's principles' as they are called in biomimicry terms. These principles help you during the design to find solutions such as nature does. The more you incorporate these principles into your solution, the better your result will be!

Why? Because nature makes use of all these principles. Do you know how to use these in the solution, so you know for sure that you mimic nature as well as possible!

The 6 'life's principles' are (see module 2 lesson 3 for the scheme):

- Use life-friendly chemistry
- Be well-attuned to your local environment
- Integrate development with growth
- Adapt to changing circumstances
- Deal efficiently with raw materials
- Evolve to survive

During the next module the 'life's principles' will be discussed in detail.



*Introductory film biomimicry*

'Grommen met Grol' movie 'Shark' (<https://www.youtube.com/watch?v=x198qKdJ1yU>)

'Focus op beta' site on [www.biomimicryNL.org](http://www.biomimicryNL.org)

Lesson 14 module 7

### **3. Get started!**

We discussed the challenge, the learning objectives, the reason why we presented this challenge to you and we discussed the theory behind biomimicry. Time to get started!

To understand biomimicry well, we have two assignments for you that you can put into practice this week. In any case, take your findings to the next lesson.



#### **1. Make a biomimicry-memory game together.**

*Every person in your group searches for five examples of biomimicry innovations on the internet. Together you have 15-20 different examples. Now make two tickets*

*for each example; on one card you make an image of the plant or animal that brought the inspiration and on the other card what the innovation was. For example, the kingfisher and the Japanese train. The back of the cards must of course be exactly the same (the teacher will take care of that).*

*Tip: Try to find as many different examples as possible with the class (keep track of who does what), then you get the largest possible memory game*



*Have you yourself used one of the examples where biomimicry has been used to find a solution?*



### *2. Research in your own environment*

Sometimes you have something precious, for example your mobile. You do not want it to be stolen or broken. Animals and plants also protect themselves against 'stealing' and 'breaking down'. Go into the schoolyard in the break or when you're at home enter the garden / park and have a good look around. Do you see solutions that nature has for protecting valuable things (self, seeds and fruits)?

If you would translate these solutions into the protection of your mobile, what would this look like? Make a few simple sketches of this and take them to the next lesson!

***Good Luck!***



### 1. Check-in and discuss findings

The previous lesson you got an introduction to biomimicry. Then you did two assignments that help you understand biomimicry. Discuss the findings and the sketches you made in the classroom.



Watch the movie of Grommen met Grol 'School wissen' (<https://www.youtube.com/watch?v=I4TOcSGKmsM>)

### 2. A good research question is half the work

In this challenge you go in groups using biomimicry to find a solution for a 'human' challenge. There are three research questions that you can get started with. Decide before the next lesson which research question you will investigate.

#### *Research question 1: Energy management*

Problem: Energy use of (school) buildings is a tricky business. We want the same indoor temperature in both summer and winter (18-19 °C) and you do not want to use too much energy to heat or cool the building. Sometimes there are many pupils in the building, the other time no one. The aim is to be as energy efficient as possible, but there must also be sufficient fresh air in the rooms.

Challenge: What can we learn from nature for a good energy management of (school) buildings?

#### *Research question 2: Getting people 'along'*

Problem: Sustainable and environmentally conscious action is better for all of us, both for our health and for our planet. That sometimes conflicts with our wishes. Many people buy and use materials that cause damage to the earth. How do you 'convince' or 'seduce' your people to sustainability? For example, how can you 'seduce' students into throwing trash in the street but in a trash can? Or can you get others to buy environmentally friendly products?

Challenge: What can we learn from nature when it comes to getting others (individuals and / or a whole group) into sustainable behaviour (producing less waste, buying products, etc.)?

#### *Research question 3: Open assignment*

Problem: The third research assignment is an open assignment that you can fill in yourself.

Challenge: In terms of approach, you can choose from 'from biology to design' or 'from design demand to biology' or: you choose a plant or animal and research what you can learn from it or choose a challenge (such as question 1) and formulate that to a design challenge.

Tip: when choosing your research question, ask yourself whether you really want to know the answer. Very briefly: you would rather carry out research that you are really interested in. And: chances that you will do your best even better!

Difficult to think up a problem yourself? Think about it:

- Due to climate change it can sometimes rain more heavily than we are used to. This

sometimes causes flooding in cities. What can we learn from nature about preventing flooding?

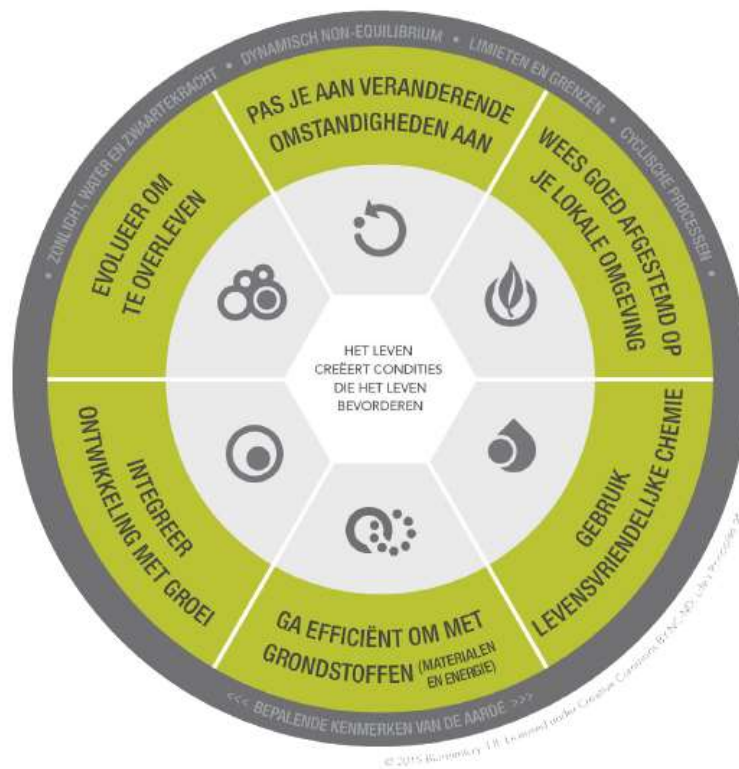
- The traffic flows around a school can sometimes lead to dangerous situations; cyclists, cars, pedestrians all arrive at school at the same time. What can we learn from nature about regulating traffic flows?

- Companies spend a lot of time on staying ahead of the competitor. It all costs a lot of money and energy. There is not that much competition in nature, but there is a lot more cooperation. What can companies learn from cooperation in nature?

Lesson 16 module 8

### 3. Life's Principles

During the last lesson they were briefly discussed; the life's principles. You had already read that the more of these life's principles come back in your design, the better and especially more sustainable your design is! Nature always uses these principles. Just go and see, in nature there are no coal plants to generate heat and without the sun there is no plant that grows! Let's take a closer look at these principles.



Below we explain the life's principles on the basis of an example. With each principle there is an example from nature and its application. After the example you will find an assignment. Do all six assignments together with the group as much as you can. Not present in the lesson? Complete the assignments at home.

## 1. Use life-friendly chemistry

### *A degradable and edible*



Animals and plants use natural foods. This also applies to the spider. The spider turns homemade threads into a super strong web. If she no longer needs the web or wants to move it, she eats the wires again.

More and more products are degradable. For example, there are bioplastic packaging that can waste at the GFT, glue based on soybeans, underpants and plates of bamboo and even edible coffee cups.

### *Assignment 1*



life-friendly chemistry means that used substances do not affect organisms (plants and animals). Make a list of at least ten substances with the group that you are sure are NOT life-friendly and also note why. Can you then find life-friendly alternatives / solutions?

## 2. Be well attuned to your local environment



### *Use what is there*

A dandelion, like other plants, uses the minerals in the environment available in the soil. And she uses the wind to spread the seed fluff.

There are stairs and dance floors using the presence of people. The movement of the dancing and passing people is converted into energy; an energy-generating dance floor has been developed by Studio Roosegaarde.

### *Assignment 2*



Using what is there is a good example of being locally attuned. Look for another example from the nature of local attunement.

## 3. Integrate development with growth

### *Simultaneous development*



In mammals, an embryo develops in the womb of the mother animal. The embryo becomes larger and develops organs and body parts. In an embryo, (changing) organs develop and when they are created they grow out (what is, becomes greater).

Cities or neighbourhoods where facilities (such as shops and public transport) grow with the size of the city experience fewer problems than new neighbourhoods that are faced with missing facilities in the beginning.

### *Assignment 3*



Integrating growth and development is one of the life's principles. Sounds logical, doesn't it? But do we allow people to do so in the growth of companies or cities? Search with your group for an example where growth and development are not integrated.

## 4. Adapt to changing circumstances

### *The same idea in a different way*



The arctic fox and the pole hare have a brown coat in the summer that they exchange in the winter for a white coat. In both seasons, for example, they have a good protective color.

In the past, stores were buildings where you had to go to buy products. With the rise of the internet, many retail chains have adapted and offer online products.

#### Assignment 4



Adapting to changing circumstances is what animals really can do well. To the changes of the seasons for example, or to sudden weather changes such as prolonged drought. Together with your group, look for another two nice examples of this 'change'.

#### 5. **Deal efficiently with raw materials**

*Take back what is valuable*



The leaves of deciduous trees change color in autumn. This is because the tree retracts the valuable leaf green pellets from the leaves before dropping the leaves. The leaf green is used again the following spring.

Taking back and recycling products such as washing machines, cars, but also glass and plastic are good examples of efficient use of raw materials.



#### Assignment 5

Why do trees only take the leaf green back from the leaves and other dyes do not? And what could we learn from this?

#### 6. **Evolve to survive**



*To make clever use of errors*

*African elephants have wrinkled skin due to a flaw in the DNA. This error turned out to be an advantage because it allowed them to cool better. All African elephants have this characteristic through natural selection.*

*Glue producer 3M wanted to produce an extremely strong glue but what lacked there was a glue that was not as strong as intended, but could stick several times without leaving traces. 3M saw the potential of this error and used this glue for its world-famous post-its.*



#### Assignment 6

Why can an elephant actually cool off better with wrinkly skin? To develop this life's principle 'to survive' is to make clever use of 'mistakes'. Consider another example together as a group.

Preparation for the next lesson:

As indicated earlier, a good research question is half the work. You have now also become acquainted with the life's principles. For the next lesson, we ask you to choose / study a research question and to complete the assignments of the life's principles (if this has not yet succeeded in the lesson).

**Good luck!**

### 1. Check-in and discuss findings

The previous lesson you have deepened in the life's principles and we have discussed the research questions. Have you managed to come up with a research question for your challenge? Tell the rest of the class your research question. Can you also tell us why you have chosen this? Discuss this in the classroom.



Watch the video of 'Grommen met Gro!' 'Stoel'  
<https://www.youtube.com/watch?v=j1XJSKwPKn0>

### 2. Apply the biomimicry method

In the end you create a design for this challenge, namely a biomimicry design. Before you can make this, and you prepare the presentation, it is important to do good research. Meanwhile, we have learned a lot about biomimicry, but the time has come to actually apply it!

The most important thing to start with biomimicry is to ask yourself: "What do I want my design to **do**?" So if we take a building as an example, you wonder what the **function** of the building should be instead of what it should look like. A function can for example be: providing a pleasant and healthy environment for pupils. Or: provide a constant temperature. And then ask the question; "How would nature fulfil this function?"

The **context** of the building is also very decisive! What does the environment look like? What kind of nature can be found, what kind of buildings are there, what kind of people are there, how many, are they there day and night, how big is it, etc.



#### *Function and context*

Can you apply this with your group to your research question? Try to make a list of 'functions' and try to think of some examples of the 'context'. Sometimes it can help to make a quick sketch. Share some examples with the rest of the class, maybe you bring each other ideas (note: by working together you get further than competing!).



*Tip: take a look at Challenge I on p. 20 for more explanation about function and context.*

Now that you have outlined a picture of the context and function for yourself, you have come a long way. It is now time to start researching solutions that nature has found for your design problem. In this module you do not yet have to find the best answer for your challenge. The point is to map out as many options as possible. At this moment all ideas are welcome. If you find possible solutions, write them all, in the next module you will learn to choose the best solution.



Now check for yourself: is my research question clear, do I understand well what the context and function look like? If I have to search now, what search terms would I use?



Practice first with your group using the website: [www.asknature.com](http://www.asknature.com). Try to formulate a question together with which you want to find an answer with this website. This may be for your research question, but this may also be another question. Formulate your question in English: How does nature ... (filter, protect, cool, attract, etc.)

Lesson 18 module 9

### 3. *Doing research*

It's time to get started! Divide the tasks with your group and make clear agreements. Again: the idea is that you have found as many ideas from nature as possible that help solve your design problem.

We will help you on your way with a number of examples that we have collected for you. Of course you can use it, but look for more possible solutions, especially on the internet and in the library! And do you have biologists or ecologists in your family and at school? Ask them especially!

Tip: divide your design question into several sub-questions.



Look at [www.asknature.com](http://www.asknature.com) and use your English search terms.

On [www.biomimicrynl.org](http://www.biomimicrynl.org) 'Focus op bèta' you will find several examples for each research question.

*Preparing for the next lesson:*

Go out and research with your group! Think of as many solutions as possible for your research question, be creative. Consult various sources such as: [www.biomimicrynl.org](http://www.biomimicrynl.org), [www.asknature.com](http://www.asknature.com), internet, the library etc.

***Good luck!***



## Module 10      The best solution from nature

Lesson 19 module 10

### ***1. Check-in and discuss findings***

The previous lesson we started with doing the research. If all goes well, you have now written down a large number of possible solutions for your challenge / research. How did the research go? What did you encounter? How did you solve this? Was it difficult to find the solutions and have you been able to come up with solutions yourself? What did you learn from this? We discuss how this happened in the classroom.



Watch the movie of 'Grommen met Grol' 'Verf' to see how the feathers of the argus peacock have inspired a beautiful innovation (<https://www.youtube.com/watch?v=aRttpI92egY>)

### **2. The best solution from nature**



You are now going to choose the best solutions together. The questions below will help you do that.

- Make a list of all possible solutions.
- Together draw a large table and fill in all found solutions.
- Together choose two or three solutions that you think are best suited to your challenge.
- You have 15 minutes for this assignment

To refresh your memory we have given the example from Challenge I in idea 1

Idea no	Challenge	Function	Context	Biologized question	Inspirational Organism
1	<i>A sports shoe that does not slip on ice</i>	<i>Hold a grip on slippery surfaces</i>	<i>Cold, smooth, wet surface, for a person standing on 2 legs</i>	<i>How would nature keep grip on a slippery surface? Or: How does nature prevent slipping?</i>	<i>Polar bear</i>
2					
3					
4					
5					

6

Idea no	Working mechanism (how does the function of the organism work?)	Is the operating mechanism applicable in other situations?	Is the working mechanism easy or difficult to imitate?	Can it contribute to a sustainable solution?	Top 3
1	<i>Polar bears have legs with a rough underside that provide anti-slip and sharp curved claws on their front legs that work like hooks to climb out of the ice.</i>	<i>Yes, we think so.</i>	<i>The rough bottom is easy to mimic, the hooks maybe a bit more difficult.</i>	<i>Yes, depending on the material.</i>	
2					
3					
4					
5					
6					

### 3. Apply to your challenge



You are now going to translate your solution into the design challenge. It is important that you take these steps carefully and in succession. And then make a building plan for each solution. You have 15 minutes to do this again.



### ***Solution 1***

What is the working principle from nature?	How can you imitate this in your context?	What materials do you need if you would make it?

### ***Solution 2***

What is the working principle from nature?	How can you imitate this in your context?	What materials do you need if you would make it?

### ***Solution 3***

What is the working principle from nature?	How can you imitate this in your context?	What materials do you need if you would make it?

You have now examined three solutions and made a construction plan. Assess the three building plans together. Do you want to use all three solutions or is one of the solutions the best?



Make a construction plan with the design, or the designs, that you want to use. Then you need materials. Also make a material list of the materials you need for making your prototype in the next module.

The design (drawing)

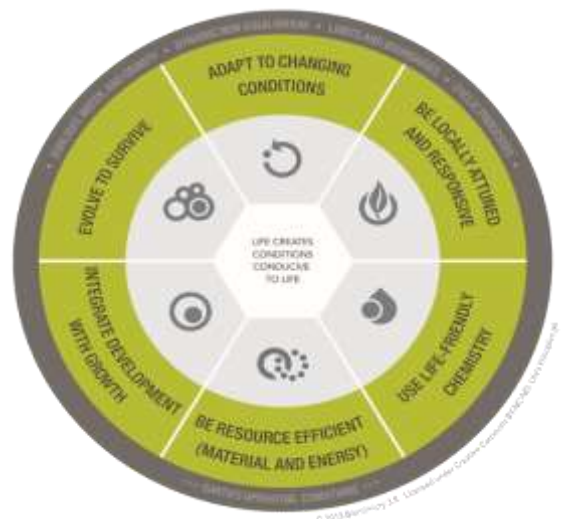
What materials do you need if you actually make it?

Blank area for drawing and material list.

Lesson 20 module 10

#### 4. *Life's principles, there we go !*

In module 2 we practiced with the Life's Principles. The more nature principles you can apply to your design, the better it will be. How many Life's Principles have already been incorporated in your design? Take a very critical look. Would you be able to process a few more? You will certainly improve your design!



#### *Life's Principles in practice*

Go (with your group) over all these questions:

- Are you using materials efficiently?
- Where do your materials come from?
- Do you really use the minimum to this?
- Are the materials nature-friendly or could you choose more nature-friendly materials?
- Have you taken the seasons into account?
- Have you taken into account some variation in use over the year?
- Is your design completely fixed or can it take other forms?
- Can your design fulfil multiple functions?
- Can your design be easily recycled?



*Preparing for the next lesson:*

For the next lesson you have to prepare a list of requirements (criteria) that the design must meet and try to find as much information as possible about the solution you have chosen. The criteria should be based on the Life's Principles. The better you understand how this works, the easier it becomes to translate it to a good design.

Requirements (which Life's P Principles MUST be applied to the design)	To wish (of which Life's P you would also like the principle to be met by the design)	How does your solution meet the Requirements and Wishes?	Anything else to improve the solution?

***Good luck!***

## Module 11 Create a design

Lesson 21 module 11

### 1. Check-in and discuss findings

The previous lesson we have chosen the best solution from nature. Was this difficult? And why did you choose this solution? Could you translate it correctly into your challenge / research and what did you learn from that? Discuss this in the classroom



Watch the video of 'Grommen met Grol' 'Koraal'. What Life's Principles do you hear coming back in this example? (<https://www.youtube.com/watch?v=ZyAjRmbmTpA>)

### 2. Create a design

You have deepened in finding solutions from nature, and you also have made a list of requirements that your design should meet. This lesson you are going to make a design. During the research you have thought a lot about the function and context, now we are going to think about how the design (or prototype) will look like. We will summarize the previous modules. Check your findings.

1. You have a research question and important (search) terms.
2. You have described the function.
3. You know in which context you have to place the whole.
4. You have found a solution from nature and investigated further.
5. You have examined which of the Life's Principles you can apply to your design (you've been thinking about for example materials, resource, or a variable shape or solid form, etc.).



Find a place with your group, and consider how you are going to make the design. Use your building plan for this. Note: the next lesson you will actually build and in the last module you will make a movie to present your design. Perhaps it is also wise to think together about how your prototype will return in the video.

*Preparing for the next lesson:*

Make sure you complete the design the next lesson. This is very important because you are going to build the next lesson. So make sure you know which materials you need for next lesson and take them with you. After this lesson there is no time left to finish the design!

Lesson 22 module 11

### 3. Build the design

In this lesson you will build / shape / prototype your prototype. Use your construction drawing (s) and creativity and think carefully about how you can get a good picture of your prototype and what text you need for that.

**Good luck!**

### **1. Check-in and discuss findings**

The previous lesson we have made a design based on the best solution from nature. What kind of design did you make? Does it still look like the technique you have learned from nature? And does it meet the Life's Principles? Discuss what you have learned in class.

### **2. Presenting your design**

The final step in this challenge for your group, namely making a video of your research and of course the result. The icing on the cake! You can know how to make this **video** yourself. It can be an animation on the computer, it can be a movie of your prototype, as long as it becomes clear to the people who do not know your project (and will have to assess it later) what the research question you started with (what do you want you solve), which technique has proven to be the best solution from nature and what the result is after you have made the translation. Be creative when making the film, and consider how your findings are best shown. Think back to the bees, the more enthusiastic and better you tell us about the findings, the more chance you get many followers!

What should the video meet:

- Up to 3 minutes.
- A good picture of the research and the results.
- A translation of the solution from nature to your challenge.

Lesson 24 module 12

### **3. The presentation round**

Finally it is then time. The moment you have been working towards all these weeks! You can present the videos to each other. Who knows how to collect the most followers (bees) with his film, can go to the school finale!

Some more tips that you can pay attention to when evaluating the videos:

1. Is the research question clear?
2. Is the solution from nature clear?
3. Does it work well? In other words: does it solve something, does it answer the question?
4. Is the whole well presented?

**Good luck!**