

CHLORELLA OXYGEN PAVILION CONCEPT AND THE SYMBIOSIS IN DESIGN

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ABSTRACT

Symbiosis is an interdependent lifestyle of two or more species. Both of the species enjoys the advantages of this co-op living. Could we use this efficient movement of the biology in a bigger scale from the perspective of design? Can we combine the innovations of the biotechnology with design?

In my master thesis I'm looking for an answer for this question.

The chance to get fresh air will become a very frequented question in the future. How can the future urbanist breathe the necessary gas? My idea is a portable pavilion, which can be mounted in different places in the cities, metropolises based on the algae-human symbiosis.

The CHLORELLA combines the advantages of the algae photosynthesis and oxygen therapy.

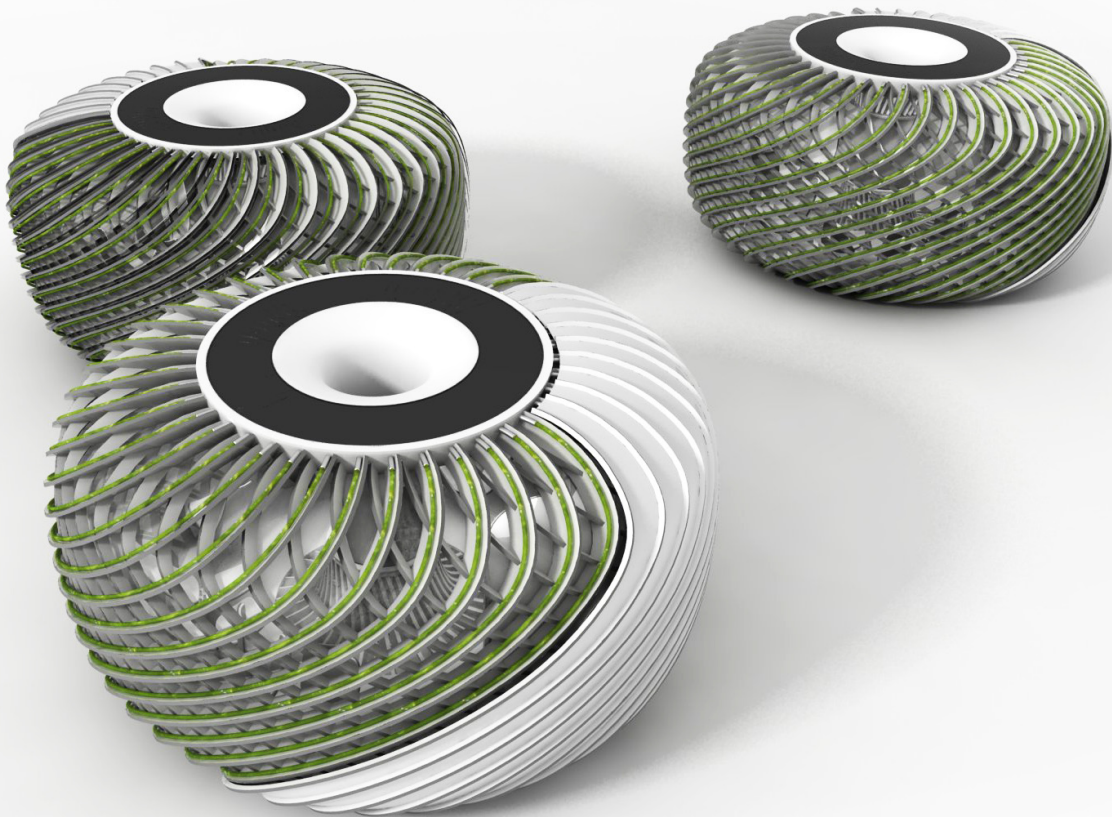




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PERMACULTURE, “PONICS” AND THE ALGAES

three determining directions at the beginning

PERMACULTURE

At the beginning of my project, I started the research with the human nature interaction and I found the theory of the urban gardening and the permaculture.

WHAT IS THE PERMACULTURE? COULD IT FIT TO THE THEME CALLED SYMBIOSIS?

The philosophy of the permaculture was established by the Australian Bill Mollison in 1970. Mollison realized, if the humans continue the processing of the world's raw materials, woods, waters, minerals...etc., they, or WE will destroy the whole ecosystem of the planet, and our world as well. The solution of the permaculture is the imitation, copy of the efficient movements, systems in the nature, and using in the modern environment.

(Zsuzsanna F. Nagy, Permakultúra - biokultúra, 1998; Bill Mollison & David Holmgren, Permaculture I., 1978)



One of the 12 design principles of the permaculture (David Holmgren - 12 principles of Permaculture) says: "Integrate rather than segregate: By putting the right things in the right place, relationships develop between those things and they work together to support each other."

These words come from the methodology of the symbiosis.

The philosophy of the permaculture offered me a wide picture about the gardening, the integration of the elements in an urban environment. The idea of the permaculture saved Cuba from the effects of the oil crisis in 1991.

(The Power of Community: How Cuba Survived Peak Oil - American documentary film, 2006)

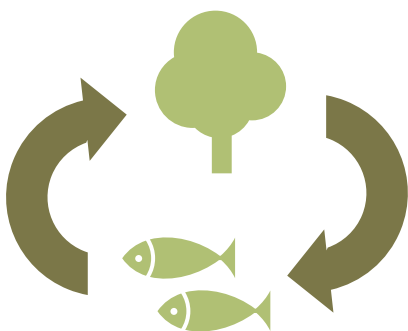
The idea brought the new idea, and I continued my work to the next inspiration.

THE "PONICS"

AQUA, HYDRO, AERO, VERMI

Aquaponics is basically the combination of Aquaculture and Hydroponics. Both Aquaculture and hydroponics have some downsides, hydroponics requires expensive nutrients to feed the plants and also requires periodic flushing of the systems which can lead to waste disposal issues.

The aquaponics is based on the water-based gardening and the fish cultivation. This is an inventive form of closed-system gardening. (J. E. Rakocy, Thomas M. Losordo and Michael P. Masser, Recirculating Aquaculture Tank Production Systems - Integrating Fish and Plant Culture, 1992)



HOW DOES THIS SYSTEM LOOK LIKE?

There are three main elements: the Growing bed, the Flood tank, and the Fish tank. (appendix I.)

The water mixed with waste from the fish tank fills the flood tank (named as toilet tank). When the tank empties, the nutrient-rich water flows into a

gravel-filled bed, feeding the plants. The roots of the plants helps to clean the water. The clean overflow water returns to the fish tank, the water and fish waste are pumped from the fish tank back to the flood tank and the cycle repeats. (Ronald D. Zweig, AQUACULTURE MAGAZINE May/June, 1986 pp 34-40)

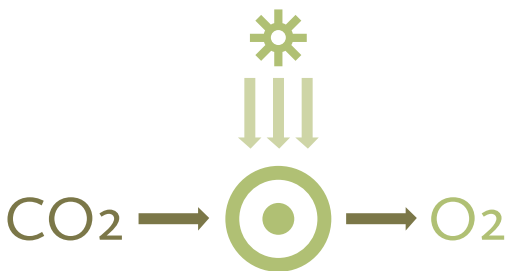
The vermiponics uses large number of worms to make the soil nutrient rich, this system can be mixed with aquaponic flushing as well.

The Aeroponic is very similar to the hydroponic or aquaponic. The roots of the plants are feed with nutrient rich water mist or aerosol continuously or discontinuously. The aeroponics reduce the rooting time, the necessary gases like O_2 and CO_2 are available to the roots, stems and leafs. The nutrient input is just $1/4$ of the hydroponics, and easier to clean the vegetables. This kind of gardening system was researched by the NASA ([www.nasa.gov / mission/earth/technologies/aeroponic_plants](http://www.nasa.gov/mission/earth/technologies/aeroponic_plants)), to try growing plants in a space environment. Very simple and efficient system wich perfectly fits in the space.

To make the water nutrient rich, I wanted to use algae colonies, which are already available on the market as a nutrient concentrat.

The “aero” from the aeroponics drove me to the next step, next inspiration. The air. I kept the topic still under the title symbiosis, but the perspective has already changed. I still wanted to work with the algae, but I focused on the new possibility, the gas production.

THE ALGAES



We can not live without air. Our body uses the oxygen from the fresh air... but where is the oxygen comes from? Most of the people says: The trees! - The answer is correct, but we have to re correct it.

Approximately 70% of the pure oxygen comes from the oceans. The cyanobacterias (blue algae) and the green algae photosyntetise them.

The tool is the photosynthesis, which is a chemical process that transform the CO_2 into useful compounds and oxygen. The essence of this process is the sunlight.

The special appliance which needs to growing algae is the photobioreactor. The photobioreactor contents a light source, which can be natural or artificial or both, to use the photonic energy input in the reactor. The reactor is an enclosed, illuminated system able for controlling the biomass production of the phototrophic species.

The adventegaes of the closed system are the followings:

- minimize the contamination
- better controlling of the biocultural conditions
- prevents the water evaporation
- increase the cell concentration

This tube system made of transparent material.

The algae needs an average temperature and a continous flow in the system. On different climate we can use different algae, which is a big advantage of this process.

The algae filled water can mixing with the air throught a microgrid, which keeps the bacterias outside the system. After the mixing the photosynthesis will be succeed for the sunshine.

The micro-algae are the microscopical sized, able for photosynthesis, living in water organisms. They have approximately more than 25 - 30 000 different subspecies.

These organisms which are able for the photosynthesis can be a sources of different valuable elements: biomass, pigments, unsaturated fat acids, vitamins, nutrients, gases (oxygen)...etc.

They have more important properties as well, that is the reason why the interests increase for the algae-technology.

The algae can transform the light energy to chemical energy in a more efficient way than the continental plants, trees. They have a bigger tolerance against the smoked gases of the factories with higher CO₂ level, and they can utilize them as well. They don't need organic chemicals to the reproduction thanks to the photosynthesis.

THE USAGE OF THE ALGAE:

(appendix II.)

Biomass: food, dietary supplement, fodder, soil conditioner

Pigments, Anti-oxidants: dietary supplements, fodder, cosmetics, experimental elements

Fat acids: dietary supplements, medical treatments

Polimers: dietary supplements, cosmetics, medicines, bioplastics

Gas production: ???

(J.U. Grobbelaar, C.J. Soeder, J. Groeneweg, E. Stengel, P. Hartig, Rates of biogenic oxygen production in mass cultures of microalgae, absorption of atmospheric oxygen and oxygen availability for wastewater treatment, n.d.;

John H. R Ryter - Limnology and Oceanography, Vol. 1, No. 2 (Apr., 1956), pp. 72-84)

INFORSE, Europe response to Review of EU biofuels directive, Public consultation exercise, 2006)



OXYGEN, LIFE AND POLLUTION

solution for problems

OXYGEN AND BARS, OXYGEN AND LIFE

There is no human life without oxygen. This gas is a necessary vital element for most of our body's cells. The functions of the organisms - like brain functions, neutralization of the poisoning components, the senses, thinking - depends on the energy from the oxygen.

The key of the maximal performance and health is the perfect oxygen supply of the cells. Why is necessary the added oxygen consumption for the urban citizens? The most relevant argument is the oxygen level reduced to 18% in the biggest cities around the world, the normal level is 21%.

THE EFFECTS OF THE OXYGEN:

- protects against the air pollution
- increase the performance
- increase the memory and the nervous system
- refreshing
- detoxify
- treats the digestion problems
- relaxing

OXYGEN AS A MEDICINE:

The oxygen supplementation is used as a medicine, because the oxygen uptake is the purpose of respiration. The high oxygen level in the patients blood decreases the resistance of diseases.

Dr. Eigi Noguchi says, the effects of the oxygen lack are for example: headache, permanent tiredness, anxiety, stress, low performance and allergy.

Hyperbaric oxygen therapy: The patients are closed in a special chamber, capsule...etc. for a determined terms where the the air pressure is higher than atmospheric pressure. The machine produce 100% oxygen.

OXYGEN PRODUCTION WITH PLANTS:

How to grow your own fresh air? - oxygen producing experiment, performed by Greenspaces (leader: Kamal Meattle)

Testing of three kind of plants for 15 years at Paharpur Business Centre and Software Technology Incubator Park in New Delhi. This building was a 20 years old, 50 000 ft2 building with over 1200 plants for 300 building occupants.

They used 3 kind of plants: Areca Palm, Mother-in-law's Tongue, Money Plant. The Areca plam converted the CO₂ to Oxygen during the day, the Mother-in-law's Tongue during the night, and the Money-plant removed the Formaldehydes.

This building became the most healthiest building in India. The Government study explored that there is a 42% probability of increasing blood oxygen by 1% if one is inside the building for 10 hours, the eye irritation

reduced by 52%, lower respiratory symptoms by 34%, headaches by 24%, upper respiratory symptoms by 20%, lung impairment by 10-12% and Asthma by 9%.

(Govt. of India, Central Pollution Control Board and Chittaranjan National Cancer Institute, Kolkata, India, September 8, 2008)

This experiment tell us how and what can change the fresh air and oxygen in the cities.

OXYGEN BARS

The oxygen consumption is very famous in oxygen bars and sports as well, it has a side effect which is the mild euphoria. These bars were established in Japan, California and Nevada. The visiting oxygen bars, and breathing pure oxygen became a very fashionable habits nowadays. After work the people goes to a "bar" and get fresh air from a device. These machines creates new sociological aspects as well, the people visit these places but not just for fun, the fresh air is necessary for our body. (appendix III.)

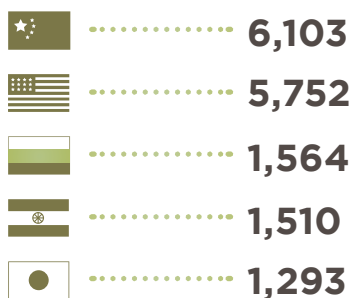
My direction is focusing on the fresh air consumption in a daily life.

ENVIRONMENTAL CHANGES - THE POLLUTION

WHY DID I CHOOSE THE OXYGEN PRODUCTION POSSIBILITIES?

CARBON DIOXIDE EMISSIONS PER YEAR

(10⁶ Tons)



I wanted to work with a relatively new field in the algae research, the air purification, oxygen producing. After the consultations with researchers, scientists and an algae research laboratory (Albitech kft.) I started to develop a new application for the future. I looked for the upcoming environmental changes, the tempo of the pollution and I realized that the most frequented problem will be the air pollution, especially in the big cities. In the statistic of the WHO is calculated the 60% of the Earth's population will live in big cities in 2030, the another fact is the oxygen level in these cities will reduce to 18%, it means that 60% of the humans population will breath polluted air, will feel the effect of the oxygen-lack. We didn't calculated with the other changes, like until 2030 55% of the Amazonian Rainforests will disappear, which causes 55-97 billion tons of unabsorbed carbon-dioxyde pollution.

Lets see an example for today: In he European Comission's survey (2005) we can see that 77% of the European cities are polluted and causes 4,5-22 000 death every year.

First of all I would like to clarify the most important informations about the CO₂ emission.

- HOW DO WE CAUSE CO₂ EMISSIONS?

The 4-5% of the carbon-dioxyde emission is from burning fossil fuels and 90% is from deforestation and ocean pollution.

- WHERE DOES OUR CO2 GOES?

45% remains in the atmosphere

30% absorbed by plants & soils

25% absorbed by oceans

- Normal rate of the CO₂ emission is less than 350 ppm. Current rate is closer to the 450 ppm. (ppm - parts per million, equivalent to 745 billion metric tons of carbon)

Average Urban CO₂ emission sharing between sectors (example is about Hungary - 2010)

35,3 % - energy industry

18,4 % - industry

6,6 % - service

1,9 % - agriculture

21,5 % - transport

14,4 % - customer using

0,7 % - trash burning



The polluting elements in the cities are the followings:

Industrial pollution, traffic pollution, pet allergens, household materials, pollens, dust & dust mites. The most polluting elements (industrial and traffic) size are under 10 micron.

WHAT CAN BE THE SOLUTION?

Of course there is a lot of ways to change the problem of the air pollution, but from the perspective of my thesis project the new application of air purification and the following design possibilities are much more important.



TECHNOLOGY DEPENDENCE

alternative perspective of psychology

ECO-ME AND TECHNOLOGY DEPENDENCE

The modern human living have so many side effects...

One of these is the Technology dependence.

The wish to having gadgets, controlling everything. The object of this dependce is the comfort needs, we would like to arrange everything with the pressing a button. The reason is the disengagement from the nature (missing needs like tastes, smells, voices). The prelude of the disengagement is the industrialisation and technology development (just 6-7 generations grown up) and this short term isn't enough for the adaptation.

The cities created a hibrid lifestyle in between the natural and "without nature" life. It is impossible to drive the humans back to the "wild-natural" lifestyle, which is environmental friendly of course. From psychological aspect, this might be not the purpose.

We can not say this is a step of the evolution. The modern urban citizen get used to the gadgets, advertisement, services. The relationship with the nature changed as well, the visit in the wild nature become an uncommon habbit per months/year. How the time will go further, the urbanists will more acclimate to the life in metropolises and they would like to control the nature more as well. As a designer personally I think we have to pay attention on these psychological visions, doesn't matter utopia or distopia.



How can change the human - nature interaction nowadays, and in the future? The archaic vision about this relation was: human means nature, humans are on the same level like the nature, they can live together as one organism (in an efficient symbiosis). It has changed a little bit in the "classical" aspect. The classical human and a nature are also on the same level, but they are both individual, their relation is a cooperation. The last human vision is the "modern". The modern humans are on a higher level than the nature, they controls the nature so in the hierarchy the people are over the planet. Dr. Chellis Glendining calls it technology dependency. The movement is like a circle wich creates new needs. Can the algae give a new "nature-impulse" for the humans? Having a controlled nature can be a new change?

My answer is: definately, new product brings new experiences, algae are a new "version" of the nature. My idea helps the people to thinking more on the importance of nature, could be a marketing weapon, because these tiny species can purify the air, which becomes a luxury needs.

(Kruse-Graumann (1996), Ökologische Psychologie, Psychologie Verl. Union, Weinheim, 167-169, 177-180

Lazarus R., Folkmann S., (1984), Stress, appraisal and coping, Springer, New York

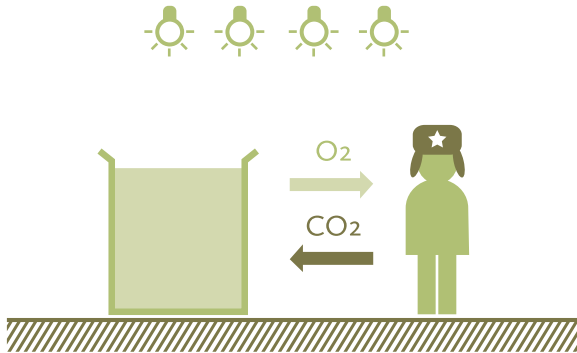
Lovelock James (1979), Gaia: A New Look at Life on Earth, Oxford University Press)



ALGAES IN SYBERIA...
the scientific essence of my concept

RUSSIAN CELSS STUDIES

Controlled Ecological Life Support System - The Russian scientists were the first researchers in this field. Konstantin Tsiolkovsky and V.I. Vernadsky were the pioneers of this experiments. The first closed ecosystem was built in 1950s and 1960s and expanded to the famous Bios-3 facility. The experiments were performed at the Institute of Biophysics in Krasnoyarsk, Siberia.



In 1965 the Russians established the first manned experiment, they used algae to recycle the exhaled CO₂ of the humans and transform to necessary oxygen. The chlorella (used algae organism) replenished the air with oxygen thanks to the method of the photosynthesis. The photosynthesis was supported by artificial lighting, one human needed eight square meters exposed chlorella to maintain the necessary oxygen and carbon-dioxide level. With the recycling of the nutrients and water, they increased the efficiency to 80-85% in the later time.

The Bios-3 experiments were used until 1984, the longest one was a three man crew experiment which took 180 days in 1972-1973.

The Bios-3 were developed into a self sustainable system, where the vegetables were feed with algae nutrients. These informations became very important in the space technology, and later the closed ecosystem research focused on the plant growing, and waste recycling. In 2005 the European Space Agency joined to the research, and the Nasa also started the experiments in space environment.

These experiments were built in a very big areas, needed huge spaces to perform, but in my project I calculated with the development of the algae research. The efficiency of the oxygen producing can be controlled with different chemical elements, and we can reduce the size of the containers into a much smaller size.

(Frank B. Salisbury, Josef I. Gitelson and Genry M. Lisovsky BioScience, Bios-3: Siberian Experiments in Bioregenerative Life Support, n.d.)



DESIGN PROCESS

implementation, results and reflection...

WHAT I WANT TO ACHIEVE?

I would like to make a concept, which is a urban shelter against the air pollution, and bases on the experiences of the users.

I would like to tell my experiences with the different quality of the airs. When I was in New-Delhi in India, where the air is very smoggy, I felt dirty myself, I always wanted to have a shower, I felt the dust and smoke in my nose and lunge as well. At the end of the day I layed in my bed and tried to get air. A little bit earlier I was in Abisko, northern part of Sweden, where the air pollution was close to the zero in the National Park. My body was light, the air was very clean, which cleaned my body as well, I always wanted to breath a deep, I didn't feel any stress or sickness. I would like to give the last feeling to the people in New-Delhi, Sanghai, Tokyo, Rio de Janeiro...etc. (appendix IV.)

The experiences are supported to the air quality. The indoor air uses the practical effects of the oxygen, the philosophical side of the algae-nature and the human relation

WHO? - I would like to create a new custom: using oxygen bars. The breathing fresh oxygen will be similar experience like the saunas where people enjoy the warm air, like the light rooms where the users feel the psychological benefit of the "sunshine".

In these pavilions the users can relax, and of course the oxygen supports the healing effect. The space is designed for separation or social life as well. The space is calculated for up to 10 people.

WHY? - We can just imagine, what will happen in the next 20 - 100 years. The emissions tends to be higher day by day. Nowadays it seems the quality of the air will reduce extremly. The fresh clean air will be just a rarity in the future, of course there is a lot of solution against this fact. Breathing some oxygen will be the same feeling like drinking a glass clean water.

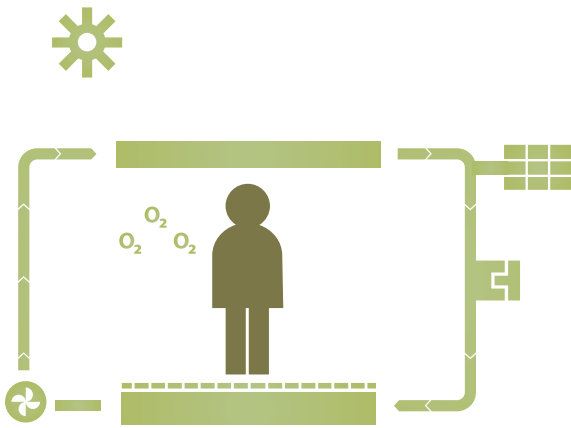
WHEN? - As a new custom I imagined this habbit right after work, or after lunchtime. Breathing fresh air is a right of every lifeform on the planet, the service can be free.

WHERE? - Public spaces, these "containers" can be placed together (3-4 pieces) or alone as well. The size is relatively big, I'm concentrating on the common areas.

BIONICS - BIOMIMICRY

Biomimicry or biomimetics (greek words: bios=life and mimetics=imitation) is a direction of the sciences which wish to combine the biology and engineering. The main purpose is the implementation of the natural creatures structure, mechanism in the artificial mechanisms, materials. The imitation of the perfect solutions of the evolution in the artificial world.

THE MAIN ELEMENTS OF THE OBJECT



When I imagined the concept in my mind, I started to visualize it as an object structure. I collected the most important details. The object needs a long-term continuous sunshine for the algae photosynthesis; it must be an outdoor product. Of course I need a photobioreactor which is a transparent tube system filled with algae (*Chlorella regularis*). The tubes are flexible plastic tubes; the producing of them is cheap, and easy to clean or replace them. The whole system contains 5 cubic meters of algae in a circulating way. The artificial lighting is supported by the solar energy; on the top of the pavilion is a solar panel located. For refilling the system it needs a tap, where the algae will be refreshed every 2 weeks. The algae needs a continuous flow; it must be slow, with a compressor the circulation is supported. It is important to separate the different quality airs. I guessed a sluice system to the doors, which perfectly isolates the purity.

After establishing the elements I made some experiments with the shapes to guess the most suitable direction. (appendix V.) I was inspired on the segment and shell structure. The most relevant tags were the followings: easy to mount, durable, light, flexible, remembrance, simple, constructive. I made 3D model experiments, light foam-mock ups, I experimented the patterns. The final result is a kind of mixture of the biomimicry and the regularities of the Golden section.

HOW COMES THE BIOMIMICRY INTO MY PROJECT?

I used the microscopical phytoplanktons, the algae as an essence of my concept. I tried to add a shape to the whole concept. I already knew which kind of elements, details should the product contain, just the shape were missing. I made a lot of experiments to give a shape to the pavilion, and after unsuccessful ideas I went back to the beginning: the microscope. I started to collect drawings and pictures made of electron microscope about the phytoplanktons. I found the book of the famous German zoologist, philosopher called Ernst Haeckel. In his book (*Die Radiolarien*) I found the perfect shape, which fits into my concept. (appendix VI.)

All of the chemical elements, natural creatures built of a geometrical way. We can notice the theory of the golden section in many kind of species (nautilus), or natural phenomenon (water spiral). The branches of the trees follow the Fibonacci's rule when they grow. The structure of the broccoli bases on the fractal regularities.

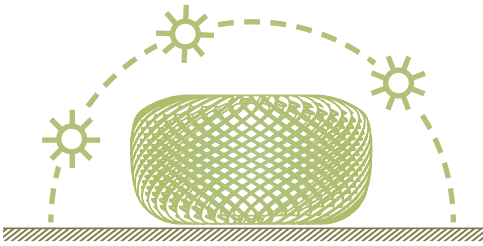
I combined all of these information and the architectural solution of the space frame structure to design the shape of the *Chlorella*. The result is a durable structure and a memorable design. (appendix VII.)

The structure reminds us to the microscopical picture about the sphere-like phytoplanktons, cyanobacterias, and the algae like the *Chlorella*.

THE ARCHITECTURE

BIOCLIMATIC CAPABILITY

The essence of the bioclimatic architecture is the care about the individual weather properties, and minimize the external energy usage, but maximalize the indoor comfort. The bioclimatic architecture is not a new kind of science. The ancient Egyptians already used the advantages of the water evaporation, air temperature relations...etc. Most of the traditional architectural solutions use the methodology of the bioclimatic architecture.



The essence of the bioclimatic design are the following:

The placement of the building and a distribution, to keep them under the sun, green belt areas, wind protection, temperature, wind speed and moisture.

We should pay attention on the people's daily routes, the chance to walk, riding a bike or public transport.

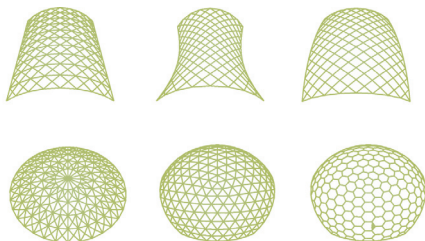
The active and passive systems can be utilized in the temperature changes.

In my concept the sunshine works as a base point. The photobioreactor is made of transparent plastic tubes. These tubes are mounted in a circulating shape, which supports the maximum using of the sunshine. The circulation is a very efficient solution, because it "follows" the way of the Sun. This solution offers the access to the sunshine for each of the tubes, but still keeps a place for the shadow, which is the relaxing zone for the algae. (appendix VIII.)

The rounded, circulating shape gives a freedom at the placement, the orientation doesn't matter.

The segment structure supports the sound isolation, the "buffer-area" for the sound waves is relatively small, the structure is able to reduce the sound-pollution.

The spherical shape is the best choice from the aspect of the indoor air circulation. Normally in squareish room the way of the airflow is on a circulating curve, but the corners can be fresh airless. I will tell about this part more detailed at the paragraph of the indoor airflow.



THE SPACE FRAME STRUCTURE

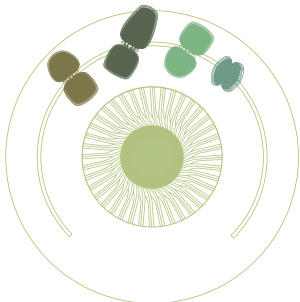
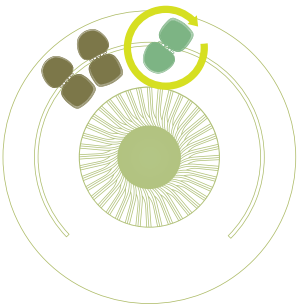
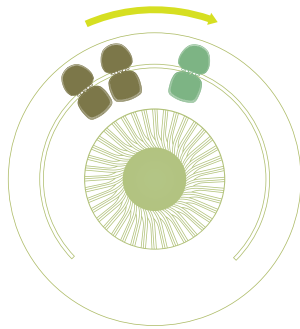
The space structure is a truss-like, lightweight rigid structure, which is constructed from interlocking elements and shapes a geometric pattern. (appendix VII.)

THE INTERIOR

(appendix IX.-X.)

The interior is designed as minimal as possible. The function is the relaxation, the semi-disconnection from the urban environment. The frames are covered with semi-transparent teflon-membrane. The membrane can perfectly isolate the different quality airs, it can decrease the sounds, voices, and the semi-transparency offers the semi-disconnection from the “world”. Why is it important to not isolate perfectly?

The reason is, during the daily life there is no time, place or wish for enjoy spa-s places available for meditation. My pavilion concept is for the “one-moment switch off”. This relatively short term doesn't enough to offer the perfect SPA experience, the total disconnection, that's why I think the full isolation isn't important. My concept creates a new habit, a new experience for the short term relaxation in the hectic daily routine.



In the middle of the interior there is an algae fountain, which is the essence of the whole pavilion. (appendix XI.)

There are 10 chairs (maximum) around it, which moves on a rail. The chairs are designed for relaxation, the direction of the seat and back are various, easy to customize them. The position of the seats are also flexible, the customer can change it on the way of the rail. (appendix XII.) They can move more close together, if they are a couple of friends, or move it far away a little bit, for the separation from the others. They can rotate it as well, they can have an own decision if they wish to enjoy the visual of the algae fountain, or looking outside.

Social issues

Of course these closed small spaces creates an individual social problems. I calculated the space relatively big compare to the number of the users. I designed the zones around the chairs are wide (110 cm) bases on the proxemics and the regularity of the personal and public zones. I wanted to give the chance to have communal activities and individual separation.

THE MOLAR MASS BASED AIR CIRCULATION

Molar mass, is a physical property of a chemical element or chemical compound, namely it's mass per amount of substance. The different gases have different mass, which can be an advantage in the air circulation.

We are talking about Oxygen and Carbon-dioxyde in this concept, the molar mass of these gases are the followings:

The normal are is: 29 g/mol

O₂: 32 g/mol < CO₂: 44 g/mol

This regularities can determine the position of the gases in a closed area. The weight of the expiratory is more heavier than the fresh purified air, the CO₂ will flow down to the extraction system. The fresh air come from the ventillation above us, it will flow slowly down, to level of the guests. The extraction is a little bit down to the peoples faces.

The spherical shape supports the efficiency of the airflow, there is no space, corner ...etc. where is no fresh air. (appendix XIII.)

AIR CONSUMPTION IN CLOSED SPACES

I used the data of the NASA research to the calculation. The average oxygen needs of a person is 0,84 kg oxygen per day, which means 0,035 kg oxygen per hour. The data can change depends on the activity, these numbers are about the normal daily habit, and air consumption. The length of time to use all oxygen in 1 cubic meter is 0,36 day if the pressure is a standard 17,5%. In the chlorella pavilion, which is 50 cubic meter inside 1 person can breathe all of the oxygens in 2 days, but the pavilion is able to have 10 guests in the same time which means, they will use the whole air during 4,8 hours. This is the calculation without fresh air supply. With the algae this term can be extended to double long term because they absorb the CO₂ and exhale the oxygen at the same time. The perfect calculation needs a longer research and experiments as well. In the possibilities I trusted in the opinions of algae researchers, specialists which was enough for me right now to build a creative concept on it.

THE ALGAE FOUNTAIN

(appendix XIV.)

The indoor air circulation bases on the different molar masses of different gases. The fountain has 48 valves (connected to the plastic tubes outside, to the photobioreactor) in the upper part, where the algae flows through, it creates an effect of the water curtain. It has two important functions, the first one is the absorption of the gases, the falling water drops can mix the gases more easily and efficient. The surface of the water is much more bigger. The other function is the decoration, there is a decor light behind the water curtain, which increases the sight. In the lower part of the fountain a sink is located. The sink is shaped in a half sphere, which helps to make the fountain more silent, because the water drops falls on the angled surface.

The ventilation contains two parts as well, the upper part is the ventilation out to the user's space. The algae purified O₂ saturated air flow out. The way of the air will go slowly down to the height of the customers. The algae smell is treated with the active carbon filters, which makes the fresh air odorless.

The consistence of the purified air:

~ 21-27% oxygen

~ 0,01-03% CO₂

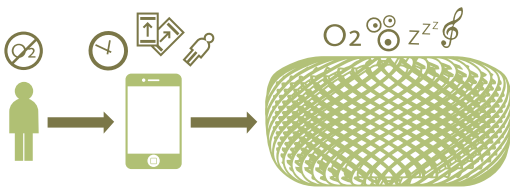
In the lower part there is a ventilator which blows the expiratory inside, and makes possible to mix with algae filled water.

When the pavilion is empty, the cleaned air will flow directly outside, to clean the city's air.

SLUICE SYSTEM

The perfect isolation of the different quality airs needs a sluice system. This part of the object was very regulated, the function was much more important than the form. I chose the rounded square type of chambers, which form used in the space technology, hyperbaric cabins...etc. The only problem with this solution is the lack of the harmony with the main design. I wanted to hide it, and I designed an outer shell-structured door, which perfectly fits into the form concept. The “shell-door” entrance is divided into two parts, and rotates around a horizontal axis. The mechanism of the door opening is placed on 2 points (up and down ring) of the pavilion. It can be manual or automata as well. (appendix XV.)

HOW TO USE IT? - BUSINESS IDEAS



Free - The algaees need to be refilled every 2 weeks, the “old algaees” should be changed for a new, fresh colonie in the photobioreactors. The older algaees are available for further processing. The collected algaees from the oxygen bars will be further processed in medical, cosmetic, biofuel companies. These companies can support the maintenance. In this case the pavilions works as a pre-processing factories.

Credit - Promotion of the algae products. We can hear, read, see: Algae is super creature! - and yes it is right there is a lot of argument why the algae consumption is necessary, useful...

In my second business idea the customers, who buy algae based products (medicines, cosmetics, biofuel..etc) will get credits, which can they pay for the using oxygenbars.

REFLECTION

I changed the classical design methodology, and I searched for innovations in the bio sciences, and after that I started to design an application. Why was it challenge for me? During my studies I always followed the classical processes: Problem - Analysis - Idea - Solution - Product. But now I had to change this movement. I started my work with reading academic articles and I collected informations from different fields of the bio sciences.

My personal aim was to design a concept, which is able to be handed in different competitions. I always participating on design concept competitions, where the companies, organisations are looking for creative ideas. I wanted to keep my idea as fresh as possible. In my opinion it doesn't needs more indepth in the details yet.

I followed my time schedule very strichtly, it was the only way to get to know a lot of informations from the different scientificl backgrounds. I learnt a lot about the information organizing, using databases and consultations with different professionals and laboratories.

I definately think the algaees will fulfill a very important role in the design in the upcoming years. In the next years I would like to develop more creative ideas bases on the possibilities of the algaees and/or other fields of the bio-sciences.

Adam Miklosi - Kisvárda - Hungary - 2012



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- ZOLTÁN SZUCS - PHD candidate - Cambridge University - Institut of Biosciences
- GYÖRGY PÓSFAL - professor - Science University of Szeged - School of Biological Sciences
- ÁKOS MARÓY - researcher, programmer, artist, bio-developer
- DR. ERZSÉBET VERESS - pulmonary - pulmonology
- ERIKA GREIPEL - researcher in algatechnology - BME - Budapest
- AGNES MARIA STEPAN - bioengineer, PHD candidate - Chalmers
- SELVA KUMAR - biologist - SRM University
- IGEN TEAM CAMBRIDGE - researcher team - bioluminescence - Cambridge University
- DR. ANDREA DÚLL - eco-psychologist - urban/eco psychology - BME/ELTE - Budapest
- ALBITECH - company - biodeveloping, algatechnology - Hungary

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APPENDICES



Mathieu Lehanneur - Local River, photo: Mathieu Lehanneur

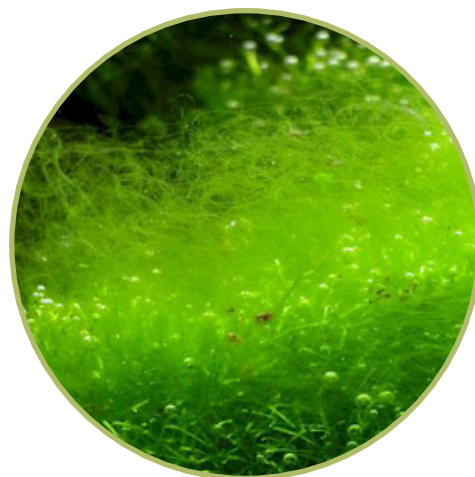




photo: www.choosenatural.com



photo: <http://www.impactlab.net>





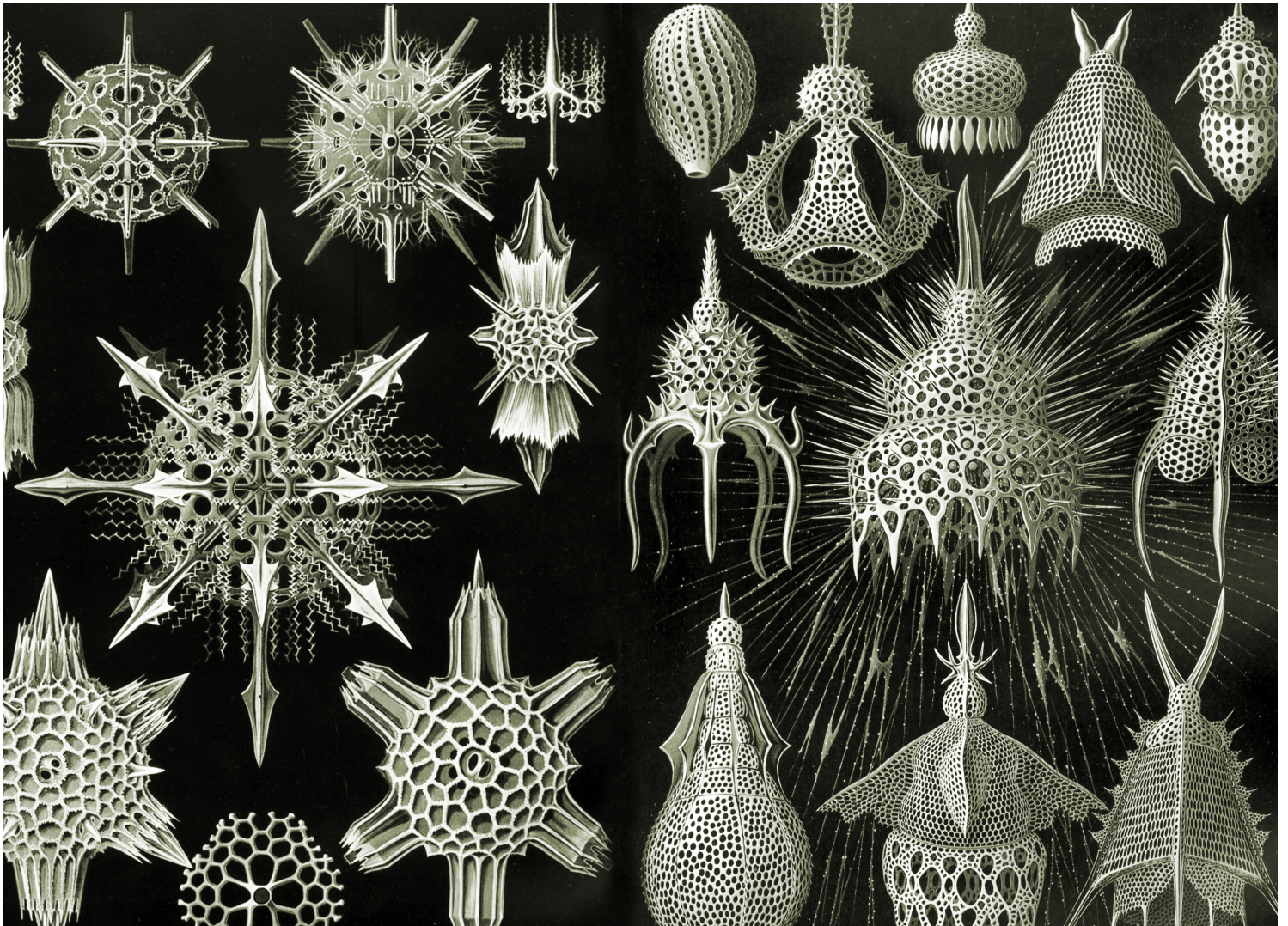
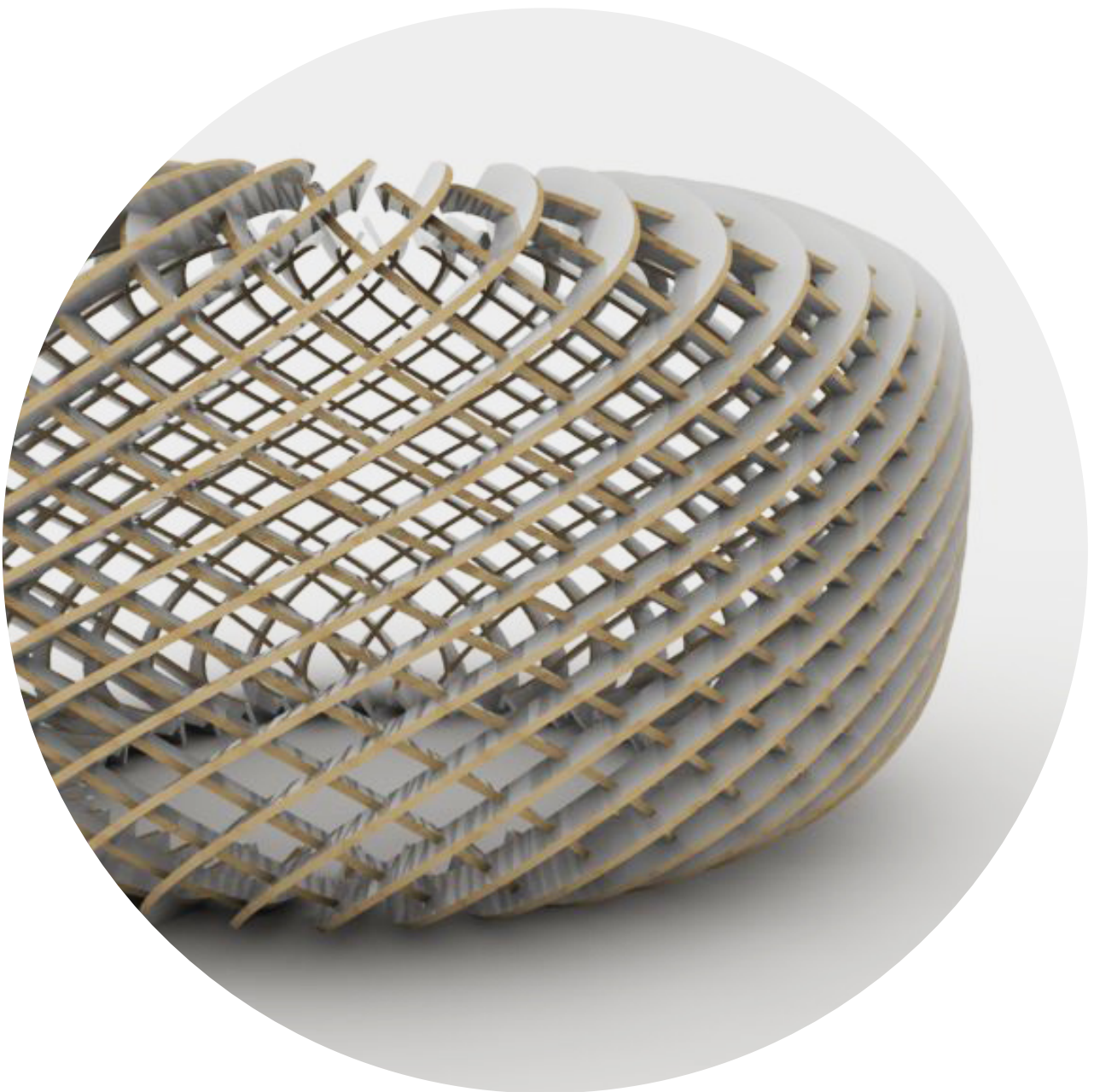
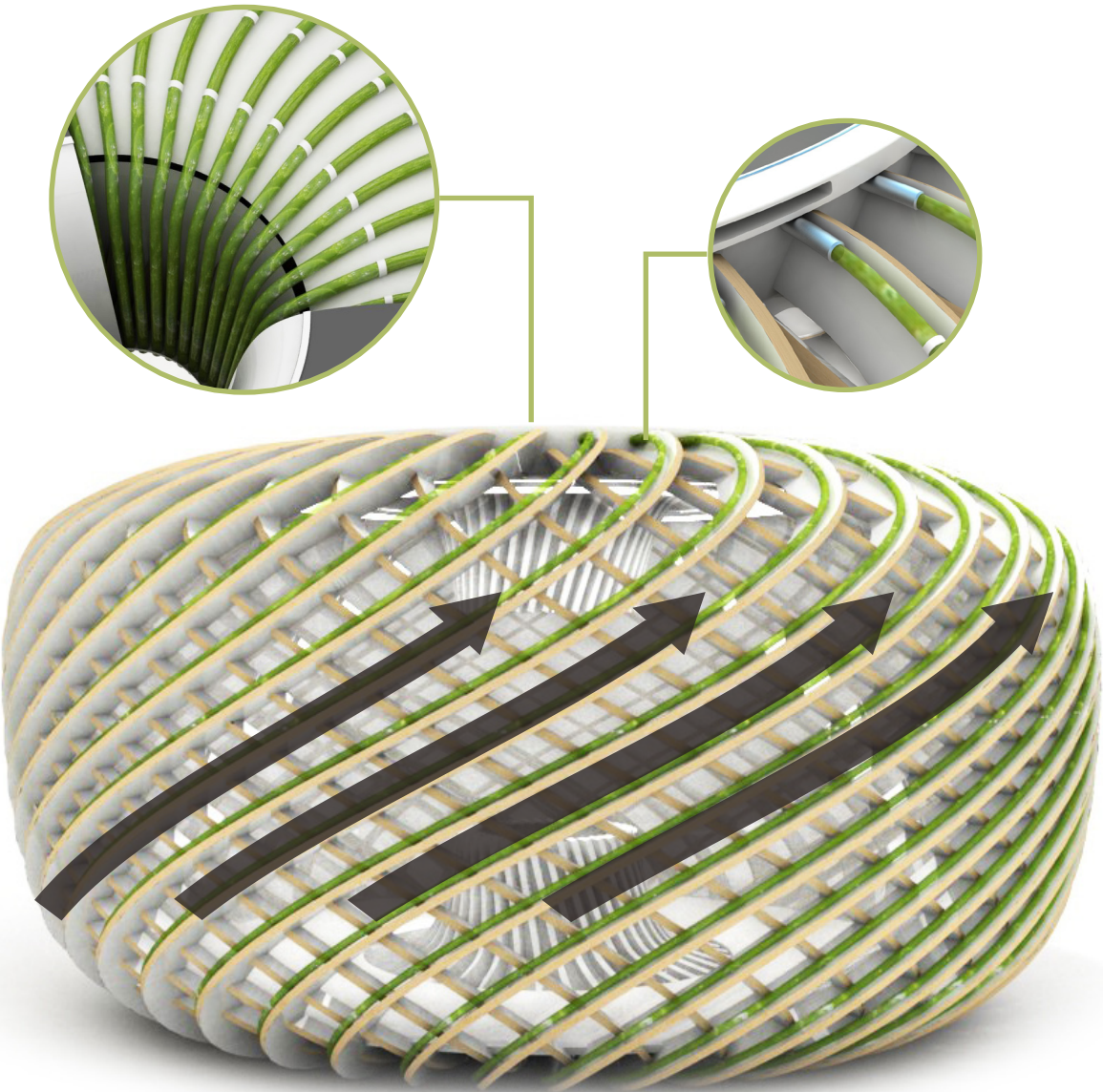
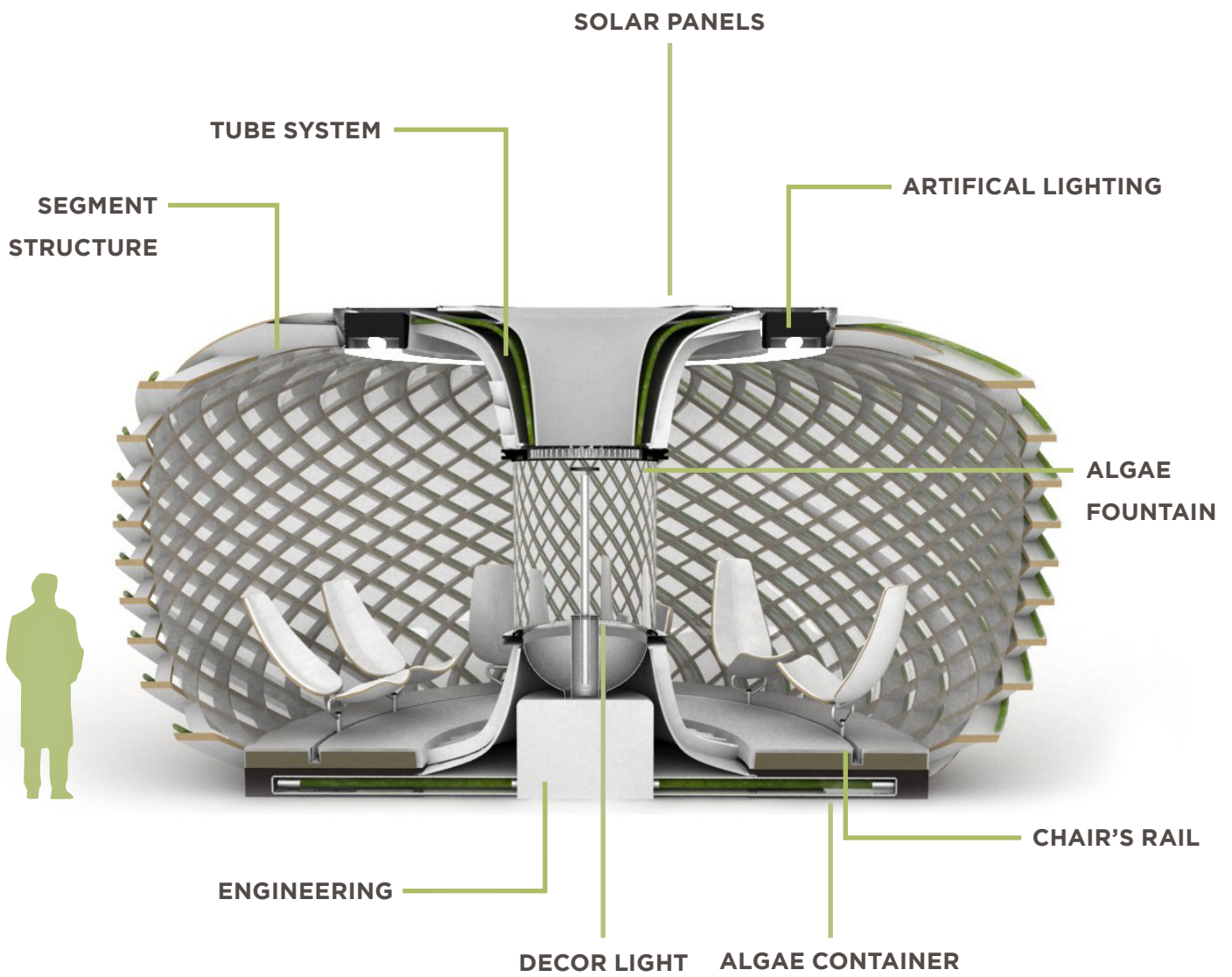
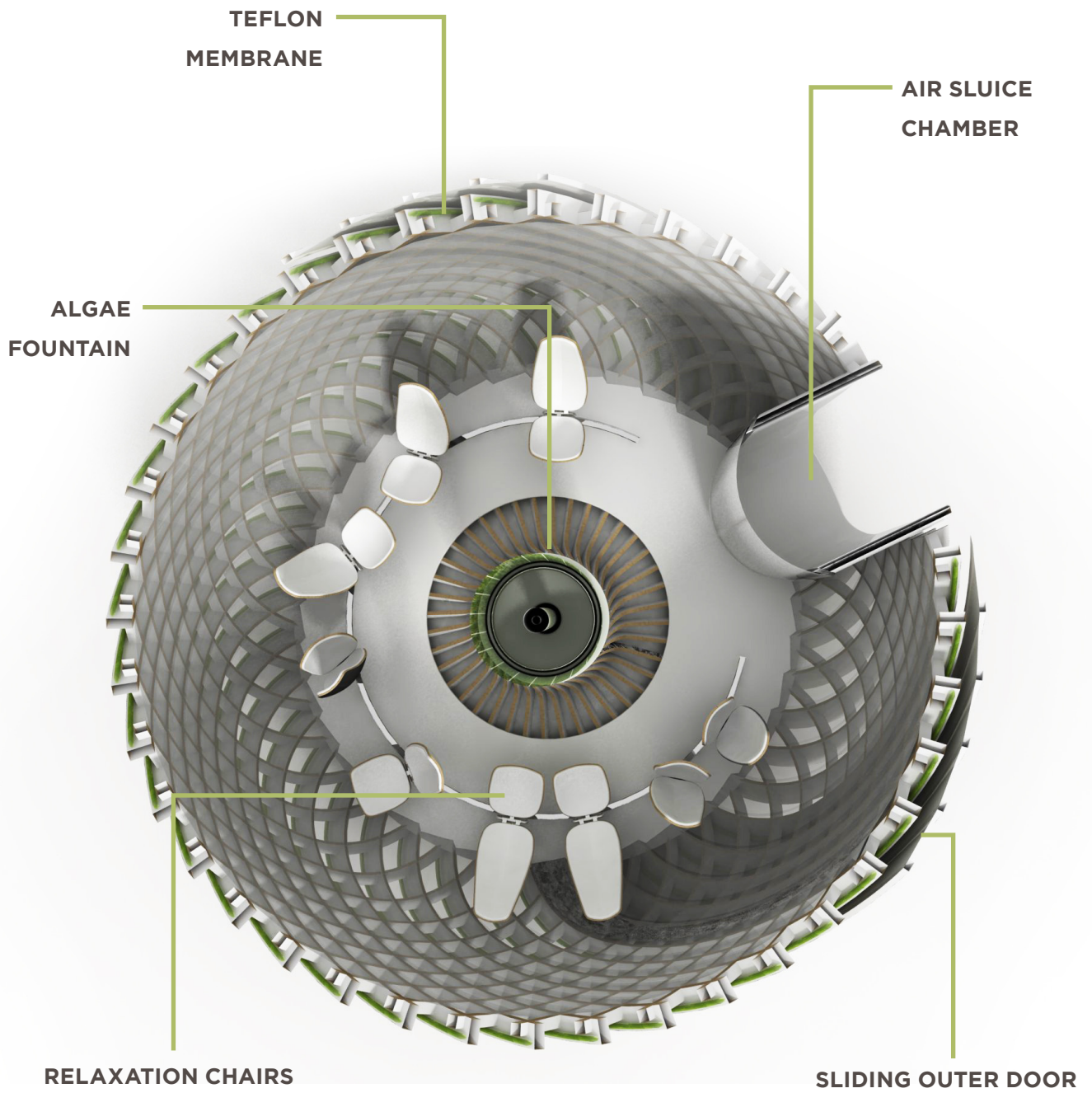


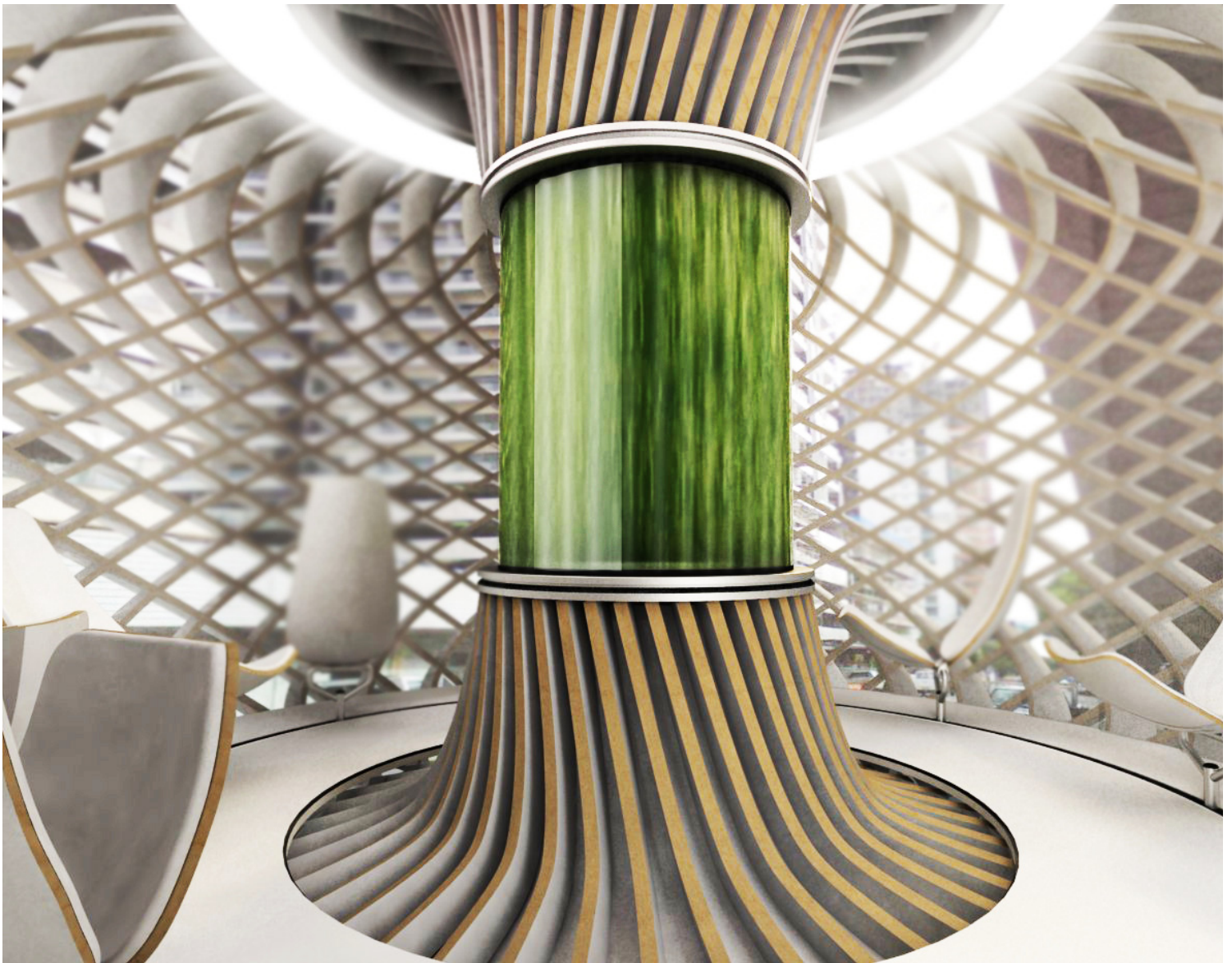
photo: Ernst Haeckel: Kunstformen der Natur, 1904



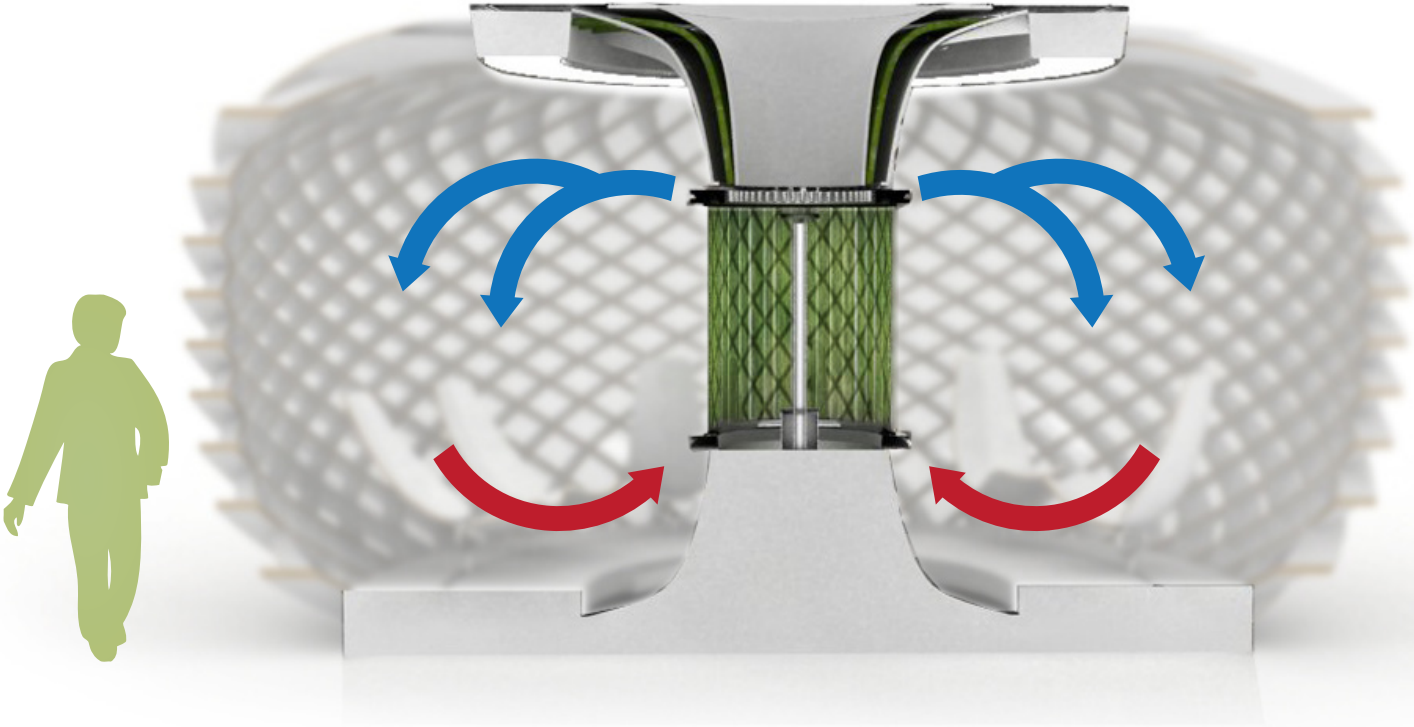


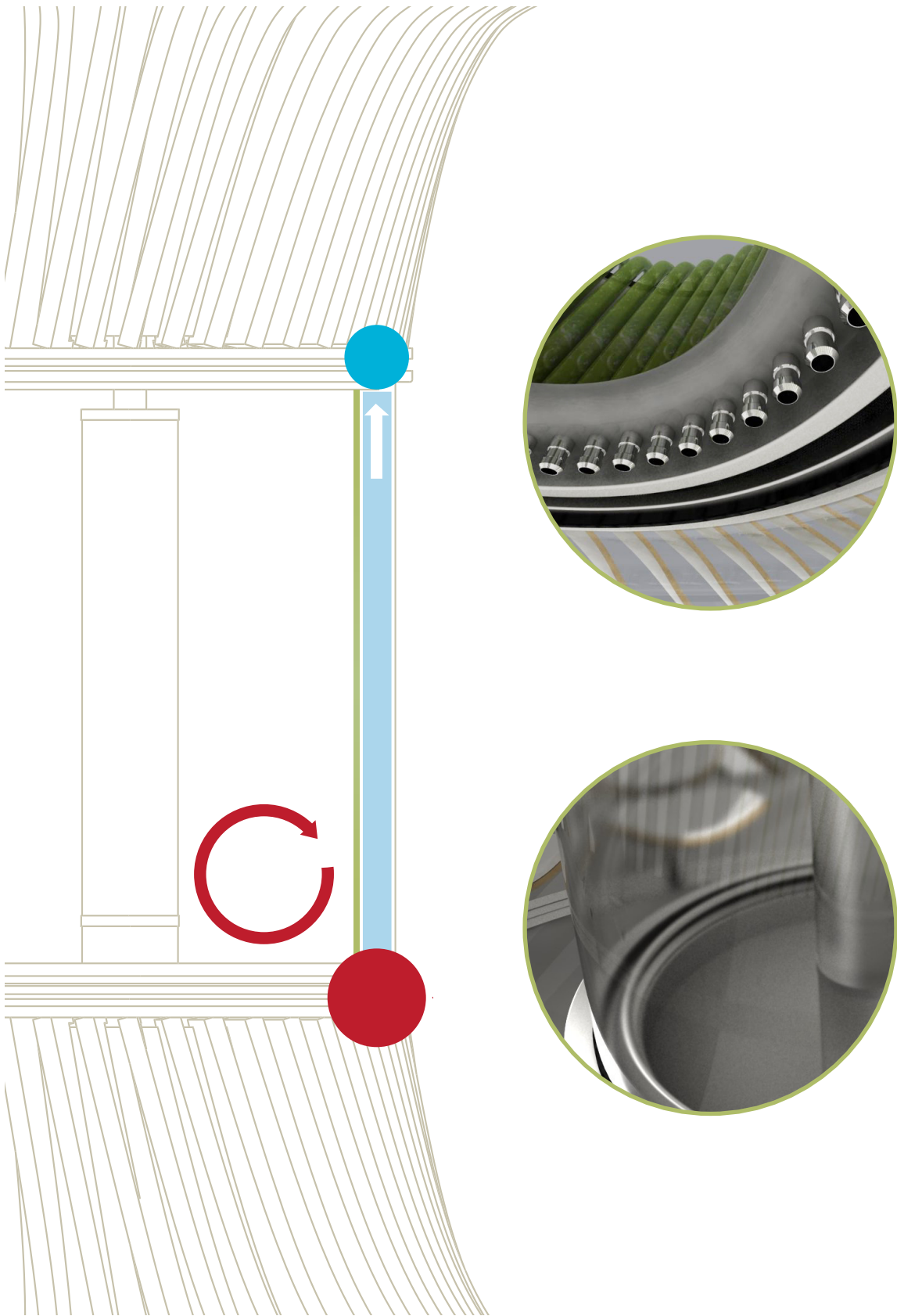


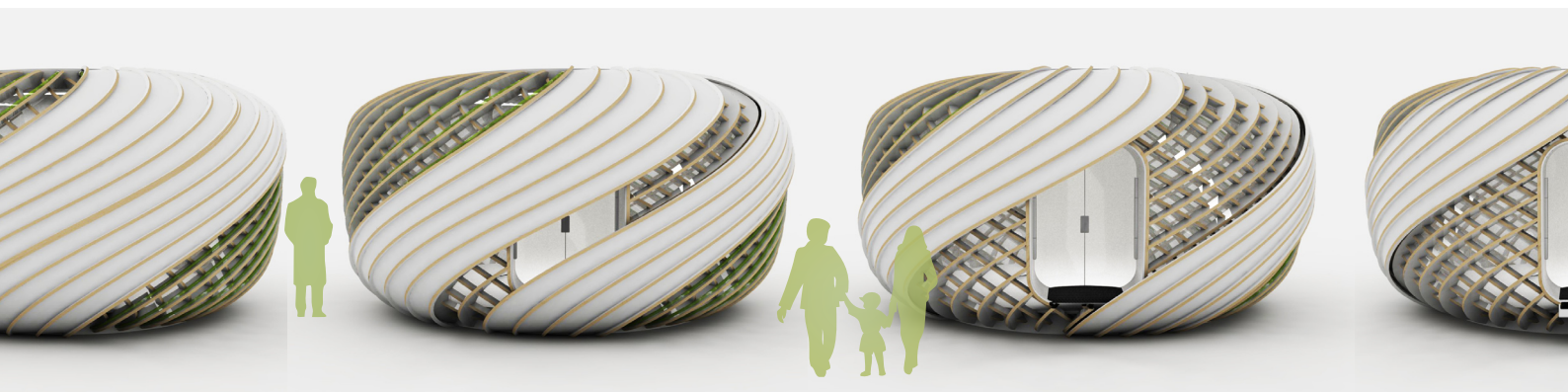
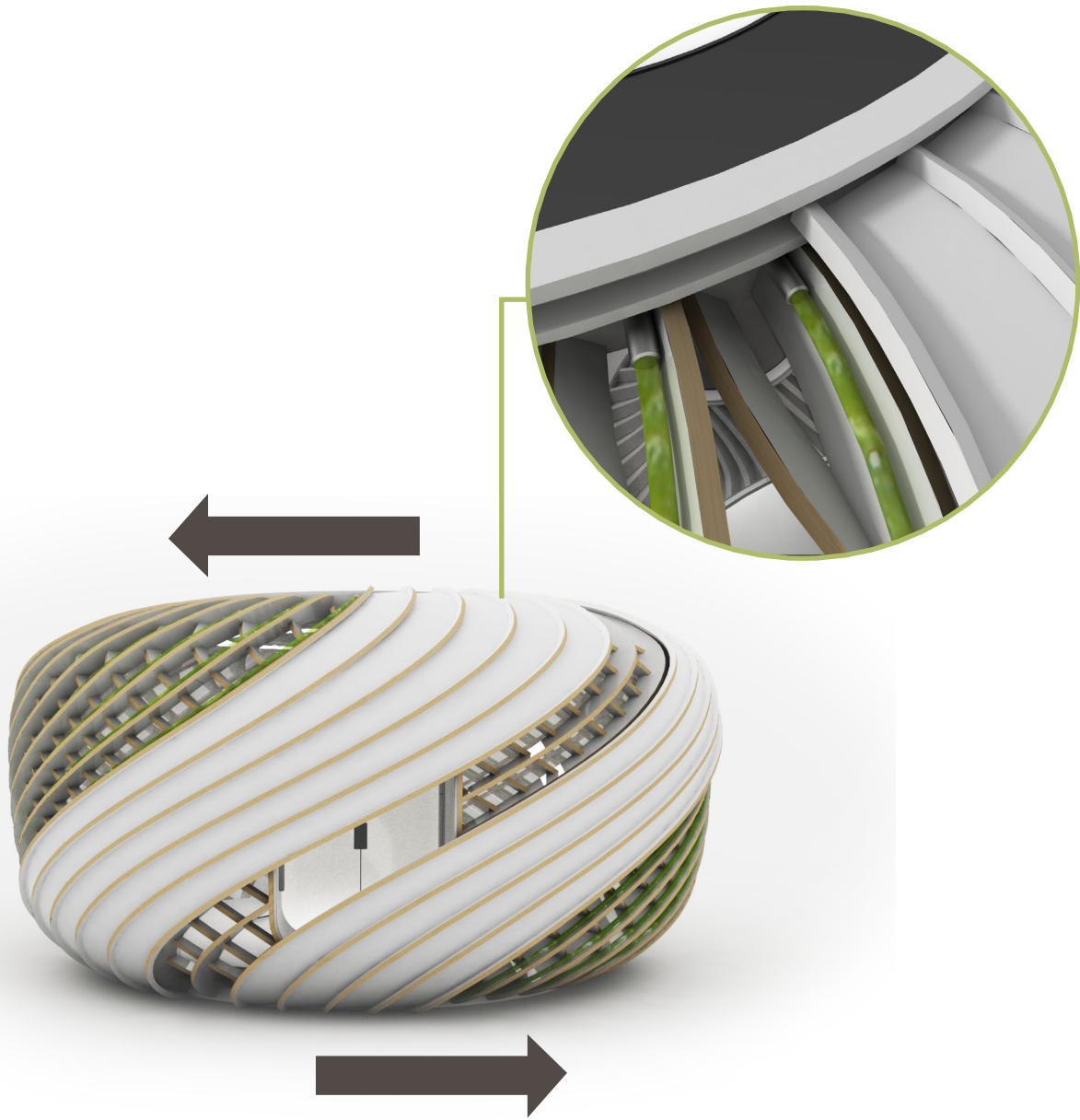




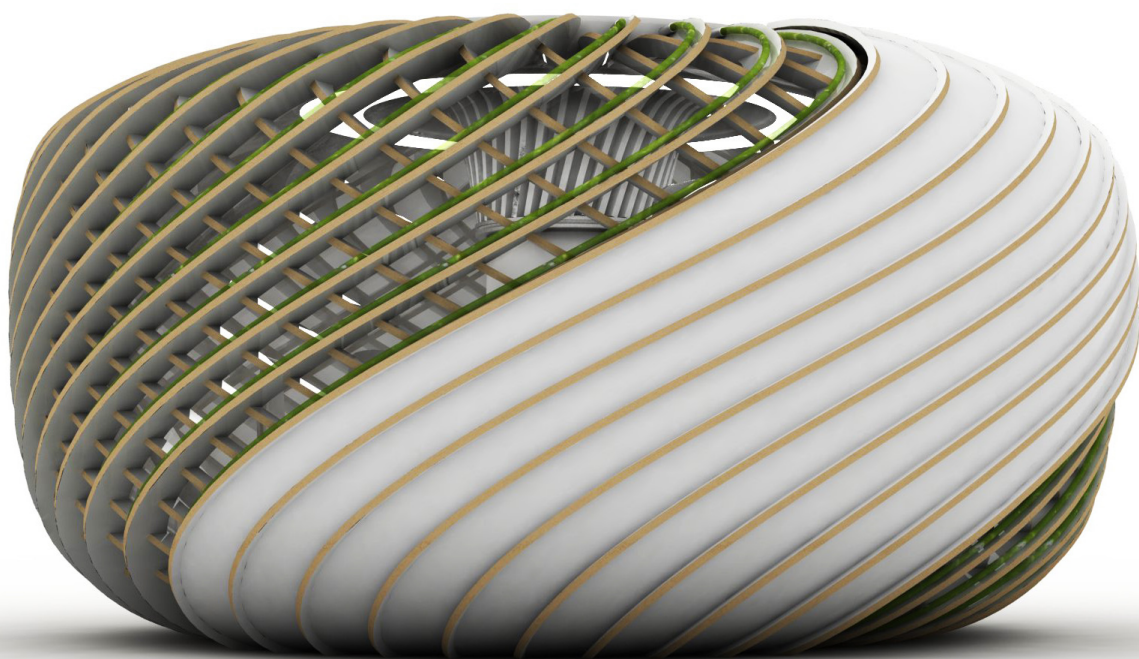












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