



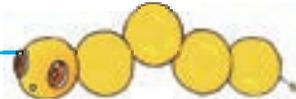
What is Humanosphere?

vol.1





What is Humanosphere?



This pamphlet is the first to collect our manga pieces that were issued on “Seizonken Dayori (Research Institute for Sustainable Humanosphere Newsletter)”, an informative magazine that we publish. This collaboration between Kyoto University’s Research Institute for Sustainable Humanosphere (RISH) and Kyoto Seika University’s Manga Department allows our research activities to be introduced in ways that are easily understood.



We hope that you read with ease, and that you understand a great deal more about the “Humanosphere Science.”

Ready? Let’s explore this Humanosphere together!



We’ll clear your “?”s on Humanosphere with manga!



Has everybody heard of the word “Humanosphere” before?

Living in the 21st century, we are facing many issues threatening our very survival such as global warming, the diminishing of resources and energy, etc.

Humanosphere is a word describing the area and space needed for the survival of us humans.

We also have **the human living environment** in which we live, **the atmosphere** that covers us all, in which **the forest sphere** that breaths its air, and **outer space** that connect us to the outside.

These spheres coexist in accordance with one another, and therefore a new school of thought needed to emerge in order to address the issues stretching across separations between many specialized fields.

And that is the “**Humanosphere Science**”
With “**Science for the sake of sustainable human development**” as a motto, a variety of researchers from the astronomical to the genetic study beyond disciplinary boundaries.

What's this big strap for?

The trick was, there were micro-waves radiated into the room!

In that situation, run into this room, and how magical!?

For example...! "my cell-phone's about to die!"

What would you use microwave-transmitted energy for?

As electric-ity!

You now have full battery!

Ubiquitous power source

A weak microwave is transmitted

Amazing!

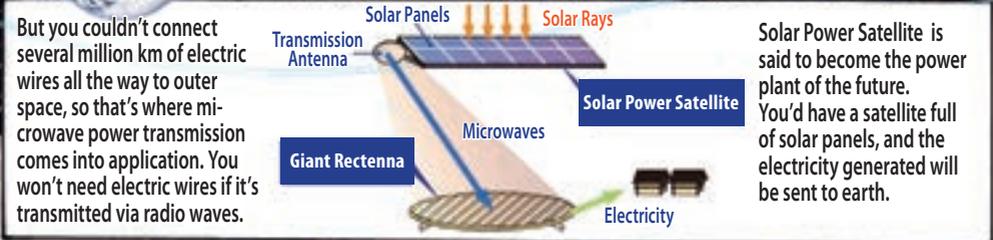
There is an even bigger plan, and that is...

Solar Power Satellite!

make it cool, please

This is known as a **rectenna**, a device to convert microwaves into electricity that we can use.

We can now charge our phones anywhere!



I wonder if they've eaten...?

Aren't they really...?

Micro-waves are amazing!

Of course the energy sent via radio waves are thinned and diluted not to affect you.

Generates even at night

Transmits even through clouds

This is a groundbreaking power plant that generates clean solar electricity 24 hours a day, 365 days a year.

Thinned and diluted microwaves

Check out this website for more details on Solar Power Satellite! >>> <http://space.rish.kyoto-u.ac.jp/sps-e.html>

What is "Microwave Power Transmission!"

Written by : Tomohiko Mitani
Illustrated by : Chikako Noshi



without fire

But...

Yep! You can warm up food in an instant.

Yummy~

How does food warm up in a microwave?

What an efficient tool a microwave is!

Your dinner?

Beep!

radio waves

microwaves

AM radio

cell-phones

ETC

microwaves

TV

How long are microwaves then?

Many radio waves of different wavelengths are used in this world, and a microwave is one of them. For example, the radio wave used for television broadcasting measures to be about 0.5 to 3m.

The food is warmed due to the radio wave "microwave" radiated inside the machine.

Great question!!

costume change...

And it is beginning to be used for something new! that is...

1~30cm roughly. They're about 12cm in the machines.

Length of a microwave

Haha

no, it's because the waves are shielded by a box that a microwave oven can warm up food.

You mean, we are being warmed by gadgets everyday?

TVs and cell-phones transmit information carried by radio waves, yet what they're doing essentially is transmitting energy.

microwave power transmission!

but what is microwave power transmission now?

The fact that you can warm up food in a microwave proves that radio waves themselves carry energy.

Power density of radio waves in daily life is very low, ...

warm up...!

phew.

What is Humansphere?

Written by : Takeshi Horinouchi/
Masayuki Yamamoto
Illustrated by : Chikako Noshi

We can measure air temperature, water vapor, wind, clouds and even yellow sand. Another lidar can detect the amount of CO₂!

This is called a "lidar". Instead of using radio waves like radar, lidar uses laser light to observe. Like radar, lidar does detect faint reflections bounced back from the atmosphere. But we use telescopes instead of antennas.

Let's eat!! After dinner...

Huh! What's that? and outside

Lidar: Light Detection and Ranging
Radar: Radio Detection and Ranging

How can we know that the atmosphere reflects radio waves and light?

Wait wait! Aha! convinced.

Radio wave reflects at fluctuations of air temperature or water vapor, and light does the same when it comes across molecules in the air (such as Nitrogen and Oxygen), dust, or clouds. We can measure the atmosphere by the reflected radio wave and light.

Fluctuations of the atmosphere

Scattered wave Transmitted wave Receiving scattered wave

Dust Atmospheric molecule Cloud particle

Scattered light Laser light Laser

Telescope Lidar

How can you measure the atmosphere using light or radio waves...?

As we know the nature of light and radio waves, we can use it to measure many things.

Fluctuations of the air Light

Hot air! Air fluctuations let the light refract and scatters. Transmits almost straight

Heat haze Look blurry Looks normal

Heat haze seen near the ground on hot summer days, too.

People in the past were puzzled, and they found out why from studies.

That's right.

Stars shimmer when the air density fluctuates.

It definitely looked like a secret lab.

Truly I would've loved to tell them about observing the atmosphere using GPS...

Thank you so much, it got so late... no problem

Oh, it's mom's car!

I handed you the cell-phone this morning. It has GPS.

bye bye see you

The End

What's "measure the atmosphere using radio waves and light"?



Hello! What is this sound?

Hello When we got closer,

What is this sound? A sudden rumbling!

Vmmmm...

Oh, a turtle

While counting raccoons in the mountains of Shigaraki, Masao and Moe got lost in what seemed like a secret laboratory.

Wanna actually see it? Yes!

Why do you want to measure the speed of sound? Isn't the sound speed always the same??

But, wait! Aha! convinced.

Front of sound wave

Sound wave Radio wave

haha Here here... Oh...it's a person

RASS: Radio Acoustic Sounding System

We're actually measuring the speed of emitted sounds using radar.

Sound travels faster when the air is warm, and slower when it's cold. Therefore by measuring the speed of sound, you find distribution of warm and cold air.

warm cold

... and are measured by radar over here.

Sounds are generated over there,

Vmmmmmm...

Wind?

You there,

The Yagi antennas used here for our MU radar are the same as T.V. antennas. We connect 475 of them to work as one antenna. But unlike T.V. antennas they transmit as well as receive.

We use them to measure winds, too. Changing timing of wave transmission, The surface of observation can be slanted.

MU: Middle and Upper Atmosphere (10~100km) (100~500km or more)

Aha! Good guess! You're correct.

Radar...? This one looks like the one on my roof! T.V. antenna?

Let's make bioethanol from uneatable "trees and grass"!

Yep, and that's why we decided.

At current stages, bioethanol is created mainly from food people eat, like corn and sugarcane.

This leads to an increase in food, making people's lives more difficult in developing countries.

How brilliant! My lovely wife has a unique perspective.

Can anything be done?

what all of a sudden?

but before that, you need an important step known as saccharification.

Saccharification?

ethanol

yeast

fermentation

sugar

ethanol

Ethanol is created through a process known as fermentation, using yeast,

If you could, they won't be using corn in the first place, huh?

But how?

Right.

we can also create things that we used to make from oil such as plastic and synthetic fabric.

Furthermore! From trees and grass,

The only thing is, unlike "starch" contained in corn, the sugar in trees and grass—cellulose—is surrounded by stiff structures called lignin, making it difficult to saccharify if not broken down.

Saccharification is the breaking down of sugar so that the yeast can ferment.

enzyme

Have a feast, yeast!

chop chop

monosaccharide

Yes, growing them is the first step!

We have to plant more if we cut them.

But we won't have trees in our forest if we use 'em up!

Yes, growing them is the first step!

lignin

enzyme

rip

microwave

mushrooms

slice slice

hemicellulose

cellulose

sugar (polysaccharide)

So here at Research Institute for Sustainable Humanosphere, we're studying the ways we can break lignin down using mushrooms and microwaves.

Let's all try to come up with ways our whole entire planet and communities stay wealthy.

We must construct a human society that is in harmony with the rhythms of nature.

They're pretty at night too!

sorry...

I didn't realize so much time passed...

The End

What's Bioethanol!?



Written by : Yuichi Setokawa/ Takashi Watanabe
Illustrated by : Chikako Noshi

Sorya sorya

boom boom

By the way
Do you know that corns are used for purposes other than food?

So sweet and yummy!

Hey you guys, wanna eat those?

The drums speak to my heart.

For what?

isn't it

They're so cool...!

But once they're used, they aren't so reusable

oil

CO₂

natural gas

methane hydrate

uranium

coal

fossil fuel

underground resources

Fuel used to always come from buried matter such as oil and gas...

I've heard of that, "renewable energy" right?

aha

For fuel!

no idea...

Hey, what's "renewable energy"?

For producing bioethanol.

Yes, therefore even if we use bioethanol made from plants, we're only emitting CO₂ that was once in the atmosphere. The CO₂ in the air doesn't increase.

Plants bathe in sunlight and create sugar and oxygen out of carbon dioxide and water.

CO₂

oxygen

sunlight

sugar

photosynthesis

water

You learned about photosynthesis in class?

So that's where the corn comes in.

umm...

The recent global warming is said to have been caused by the great amounts of CO₂ emitted from burning fuel like oil.

Shock!

nooooo...

But if you make bioethanol from corn, there'd be none left for us to eat...

The recent diminishing of fossil fuel is making the development of renewable resources an immediate goal.

fossil fuel

continuous decrease

Hence "renewable resources" huh?

The Xylarium Story

The Xylarium was officially registered as a facility for International Xylarium Index in 1978, and the current station was founded in 1980.

Written by : Junji Sugiyama
Manga Production by :
Kyoto Seika University Graduate School of Art
Illustrated by : Kim Unhi
Edited by : Haduki Ishida

Whoa, so this is where the xylarium exists!

Wow, what a woody fragrance!

rattle rattle

Welcome to our Xylarium

Sugi floor, huh...

Feels like we're in a forest...

We are the children of wood-culture. In the Japanese mythology, the thread of beard that Susano-o no Mikoto pulled out became the Sugi (cedar) tree. We have been planting trees to sustain our lives for as long as we can remember.

It has 350 annual rings! This is the real thing, right here.

Long-living trees last long too! Hinoki has been used for building structures.

Even the Horyuji is Hinoki built. Do you know about the centre pillar?

wow tell me!

The use of wood varies by type. You know the old saying, "correct wood for the correct use"?

Lasting strong for a 1,000 years, white cedar is used for large construction such as the Horyuji temple.. They're used for building baths too, for their fragrance and water resilience

What else do you find out?

Objective is to learn and hand down "Japanese wood culture"!!

These are some of the unique ways wood are used.

杉 Cypress wood

桐 Geta; our wooden clogs Paulownia wood

檜 Abacus beads Holly wood

Alrighty, we'll talk about tree rings.

Most trees grow between spring and autumn, and that repetition creates the rings.

Which means it contains tons of information regarding environment such as precipitation, temperature and abnormal weather, and it has been aiding studies on global warming too.

For example!

We can know the age of the tree from the rings. From the center pillar of Horyuji, we can presume that the tree was cut a hundred years prior to the construction.

far out!

Which means that there may have been older temples!

How fascinating! How is it that trees are so long-lasting?

Yeah Was wondering too!

That does depend on the wood itself too, but it really is because people maintain them. The wood itself will slowly age and eventually deteriorate.

Oh yeah?

So we study the mechanisms of wood aging, in order to make use in preservation efforts!

What!? What do you do?

We purposefully age them!

New wood expand or shrink depending on changes in temperature and dampness, which can be dangerous when using in conjunction with the old original timber. Forcefully-aged wood do not morph, and becomes the same colour as the old wood.

The Buddhist statues like 'em too, because it's the right fit!

Studying Japan-specific cultures of wood is one of our missions here at the xylarium.

We are taking on the role of creating a new science around wood, in this 21st century.

See you!

Whoa!
How does it do that all of a sudden!?

acidic — neutral — alkaline

insulator

less conductive to electricity

semi conductor

more conductive to electricity

temperature in which wood was burned at

Once heated up to 600°C, wood that once had an impedance of 10¹² ends up with 10⁻²Ω which means it becomes a trillion times more conductive to electricity!

Do you know of the unit Ω (ohm), used for measuring impedance?

Yep, learned it the other day.

Electron diffraction image of the crystal of the diamond

Nano diamond

When you look closer, the wood carbonized at 700°C contains nanodiamond inside.

Wow... I want to see too!

A trunk of wood is made up of cells, and the carbon in their cell walls rearrange at around 600°C enabling it to be conductive to electricity. Under an electronic microscope, you are actually able to observe the carbon rearrangement.

#ahaha

Well it is a diamond but the size of 10⁻⁶mm. So, you cannot see with naked eyes. It might cost more to observe this tiny diamond than its worth.

Make my racket with diamond!

Please bring me some next time!

DIAMOND!

Diamonds! Diamonds!!

Aahh, it burned!

Ah, our meal also turned into charcoal!

Can anybody smell something?

Ahahahaha

The End

What's Charcoal!?

What is Humansphere?

Written by : Toshimitsu Hata
Manga Production by : Kyoto Seika University Graduate School of Art
Illustrated by : An Hijyun
Edited by : Haduki Ishida

The gas stove fire contains moisture, but charcoal does not.

For sure, the meat is cooked more tender and tasty compared to the gas stove.

Charcoal barbecued meat is tasteful and also perfect with beer...

Hey papa, charcoal barbecue is the best!

My tennis racket is made from carbon too!

You mean carbon which often uses in carbon heaters and handles of umbrellas, that carbon?

Have you heard of "carbon"?

No... how?

By the way do you know that there are other uses for charcoal?

That's a function utilizing the many holes on the charcoal's surface. Other than that they have the quality of conducting electricity after carbonizing it above a certain temperature.

So charcoal and carbon are family, huh? I just remembered hearing in my science class about a project to clean a river using charcoal made from wood and bamboo.

Organic compound mainly comprised of carbon elements, when heated turn into carbon.

Yep, and the charcoal that we're burning is formed from the same element carbon.

What?
I thought wood didn't conduct electricity.

But

Come on!

It suddenly begins to conduct electricity!

After burning it to around 600°C...

Prior to burning, a wood is an electrical insulator

Possibilities of Timber Structure!

Written by:
Akihisa Kitamori/Takuro Mori
Manga production:
Kyoto Seika University,
Graduate School of Manga
Illustrated by: Tamao Nukina



Today, we have come to view the [natural material house] known as the [eco-house].



Wooden houses have such a warm feel!

Welcome to the [Eco-House]!

Teacher!

Wood is more and more important for housing material in the future. Study it well!

Whoa, smells so nice!

Yes!



Wood, despite the light weight, has a structure that is stronger in a longitudinal direction.

Wood is strong in the direction of the fibre, and weaker from the side, yet flexible.

It must be good for the environment as well!

Because wood is a resource that is grown by the solar energy,

Certainly!

Using wood for structure functions to capture and decrease the CO₂ in the atmosphere.

This is a cross-section of a cedar, seen through an electronic microscope. You can see those hollow parts?

If used well, wood can build robust and ductile houses.



But mustn't we preserve our forest?

Hmmm... but wooden houses seem more susceptible to earthquake damage, and concrete or steel structures seem better...

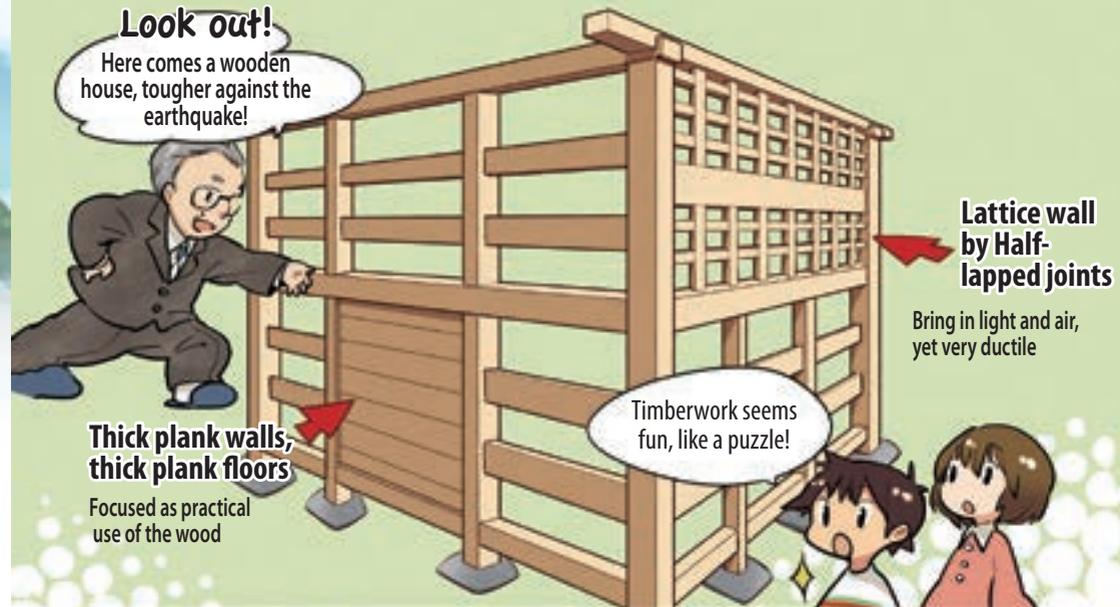
Sure we must. But a planted forest require thinning for its trees to grow, and they won't absorb as much CO₂ without it. There must be effective methods of utilizing the trees that we do cut.

Ping!

mwahaha...

That's why we researchers are here!

If we can merge the traditional architecture and modern-day science...



Look out!

Here comes a wooden house, tougher against the earthquake!

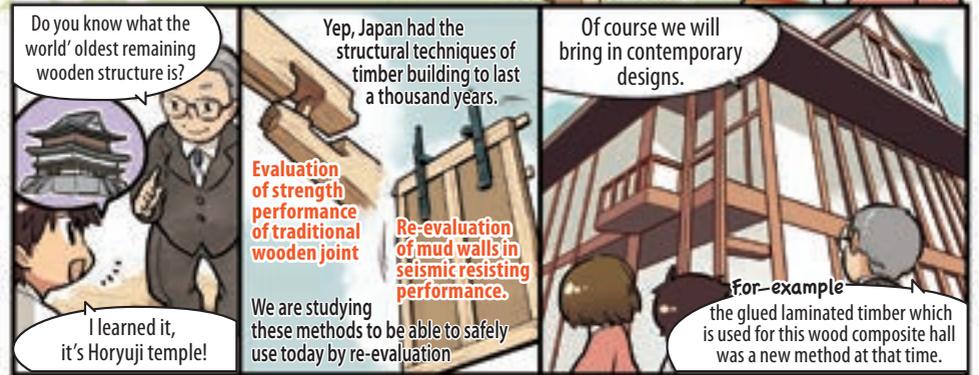
Lattice wall by Half-lapped joints

Bring in light and air, yet very ductile

Thick plank walls, thick plank floors

Focused as practical use of the wood

Timberwork seems fun, like a puzzle!



Do you know what the world's oldest remaining wooden structure is?

Yep, Japan had the structural techniques of timber building to last a thousand years.

Of course we will bring in contemporary designs.



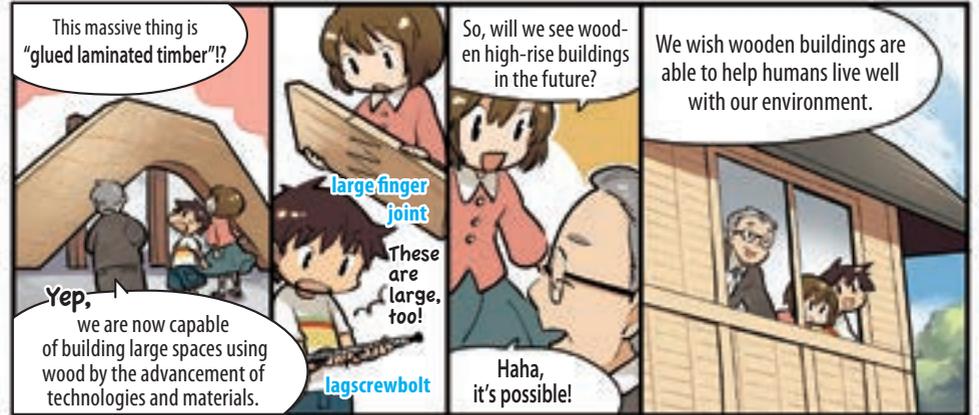
I learned it, it's Horyuji temple!

Evaluation of strength performance of traditional wooden joint

Re-evaluation of mud walls in seismic resisting performance.

We are studying these methods to be able to safely use today by re-evaluation

For-example the glued laminated timber which is used for this wood composite hall was a new method at that time.



This massive thing is "glued laminated timber"!?

So, will we see wooden high-rise buildings in the future?

We wish wooden buildings are able to help humans live well with our environment.



Yep, we are now capable of building large spaces using wood by the advancement of technologies and materials.

large finger joint

These are large, too!

lagscrewbolts

Haha, it's possible!

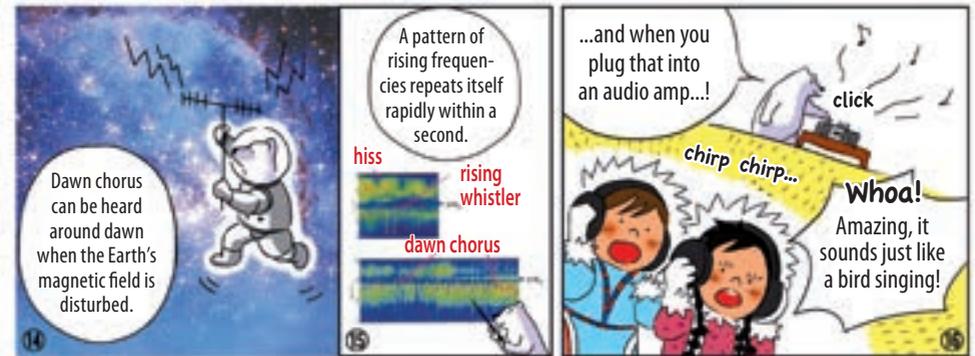
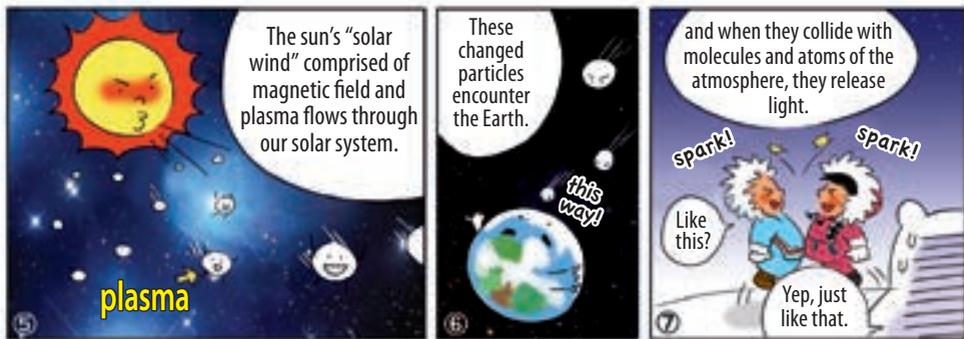
Wow...

What an unbelievably beautiful aurora!!

Singing Melodies from Outer-space

Written by : Yoshiharu Omura
Manga production :
Kyoto Seika University Manga Department
Illustrated by : Kim Jihyon
Edited by : Haduki Ishida

What is
Humanosphere?



Who's the Doctor of the Atmosphere?

Originally written by:
Masato Shiotani / Kenshi Takahashi
Manga production :
Kyoto Seika University
Manga Department
Illustrated by : Mika Ikeda
Edited by : Haduki Ishida

What is
Humanosphere?

How beautiful...

I wonder what's above those clouds?

The ozone layer!

The ozone layer absorbs harmful ultraviolet from the Sun.

But,

Over Antarctica, a significant loss of ozone has been observed, that is called "ozone hole".

grasp

Poke

The ozone layer...?

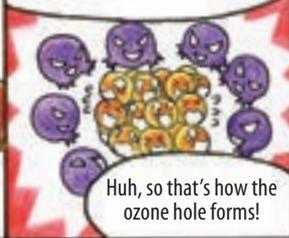
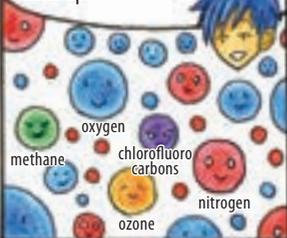
Wow, really!?

Ozone hole!?

The Earth's atmosphere mostly consists of oxygen and nitrogen, and trace gases like ozone takes up less than 1%.

But if the composition changes even slightly, the Earth's environment could be endangered.

For example, as chloro-fluorocarbons increased, they contributed to destroy the ozone.



What? How come!?

Huh, so that's how the ozone hole forms!

Furthermore, the global warming caused by greenhouse gases such as CO₂ and methane is also a serious issue.

Oh no! The Earth's going to be sick!

That's why we "diagnose" the Earth's environment using ground-based and satellite measurements!

"Diagnose"?

First, we measure the amounts of such trace gases using laser spectroscopy techniques.

Wow, so many types of apparatus!

Yep, these observations run throughout the year.

You mean all year around?

Right.

Whether it's boiling or freezing.

summer zap!

winter

That's tough...

Fairbanks, Alaska

Ground-based measurements using laser-based instruments

Exploring atmospheric reaction processes by laboratory experiments

And we do not only watch the Earth's health from land, but from outer-space as well!

The sensor on the satellite detects radio wave that ozone emits.

Then you get this!

Really!?

But how?

Amazing! I see it so clearly!

©JAXA

©NASA

Superconducting Submillimeter-Wave Limb Emission Sounder: SMILES

Boom!

This allows us to clearly observe changes not only in ozone but for other gases too!

These research allows us to diagnose the Earth's environment.

I see! So you examine locally from land, and globally from space!

Wow, the difference is so apparent!

clap

Even if we can't cure her now, the diagnosis will help the future of the planet.

Surely. We must continue to "see her" with care.

Will do!

These observations are important for all of us!

Future

What's Biomass Crop?

Originally written by : Shirou Suzuki
Manga production :
Kyoto Seika University Graduate School of Manga
Illustrated by : Ayayuki Kimiya

Delicious! Why's sugarcane so sweet?

Well, it's sweet when you chew because it stores sugar in its stem!

pop **Wha!**

The sugarcane family is under much attention these days as being biomass crop.

Biomass Crop?

Plants that grow renewable organic resources, such as these four.

- Erianthus** (relative to sugarcane)
- Jatropha**
- Miscanthus** (relative to a Susuki (a Japanese silver grass))
- Poplar**

What can you do with biomass crop?

After harvesting the plant, you can burn or generate electricity with it as an alternative to oil or coal.

or you can break it down to form material for chemical products such as plastic. So many uses!

So many uses!

And that isn't all!

Biomass crop is known for having a resilient characteristic, absorbing lots of CO₂.

zoom! You can grow me anywhere

Therefore plans are to plant them on land that cannot grow food crops, to grow material for fuel and plastic.

and they grow well despite poor soil or small amounts of fertilizer.

But I heard oil is currently the predominant source of fuel and plastic

That is true.

Oil is used even for the glasses I'm using.

mine too!

By using oil we increase CO₂ in the atmosphere. If we use biomass crop instead of oil, then we don't increase CO₂ and we help prevent global warming.

Sounds good for the environment!

It's good for the Earth then.

We should hurry up and start doing it this way!

Biomass crop is just starting to get attention, still in its research stage.

We are continuing to research biomass crop at the RISH, studying their behaviour and genes.

Well yes, but...

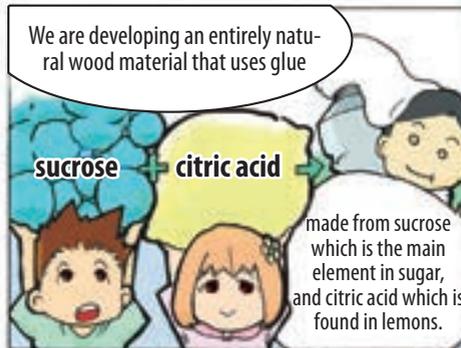
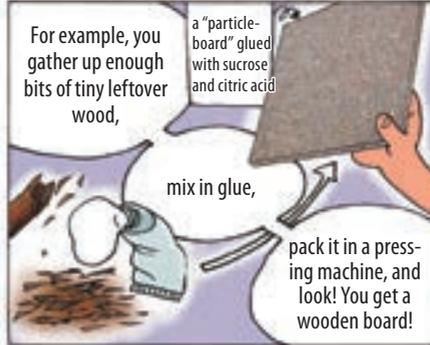
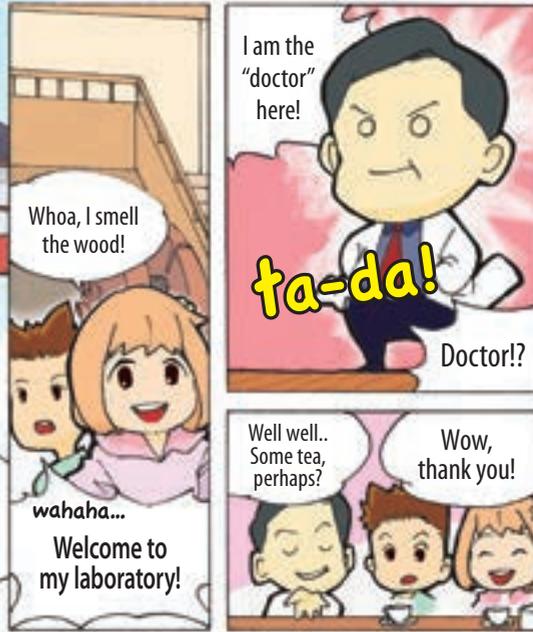
In decades to come, all of our plastic and medicine may be made from biomass crop.

I hope that it becomes a cool and wealthy Earth

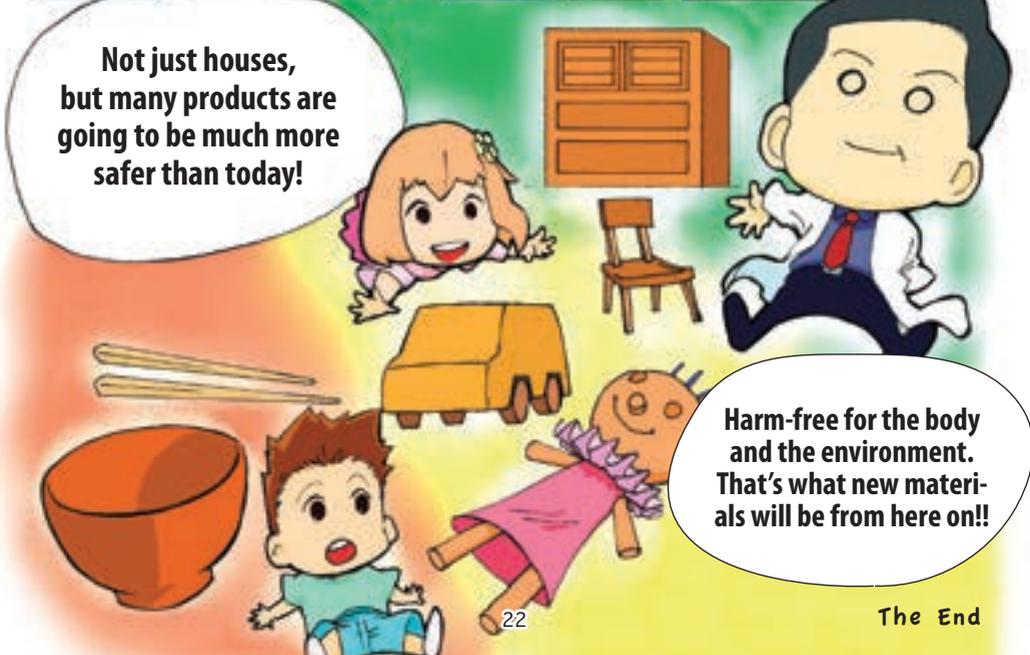
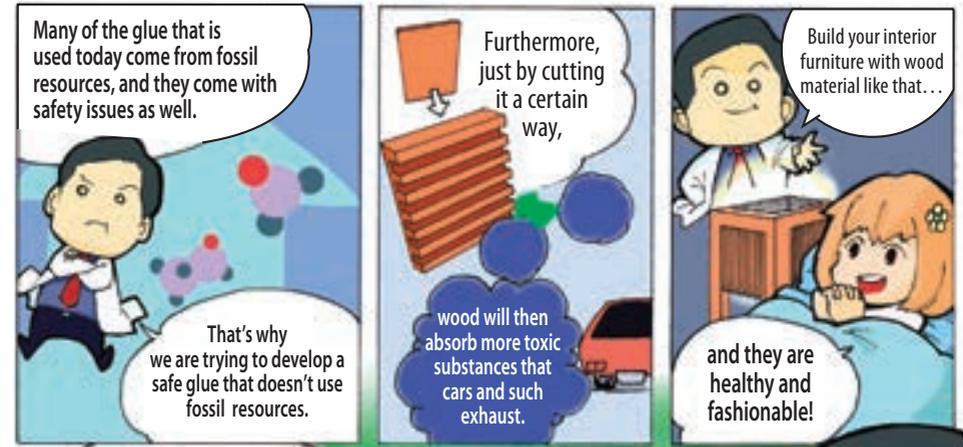
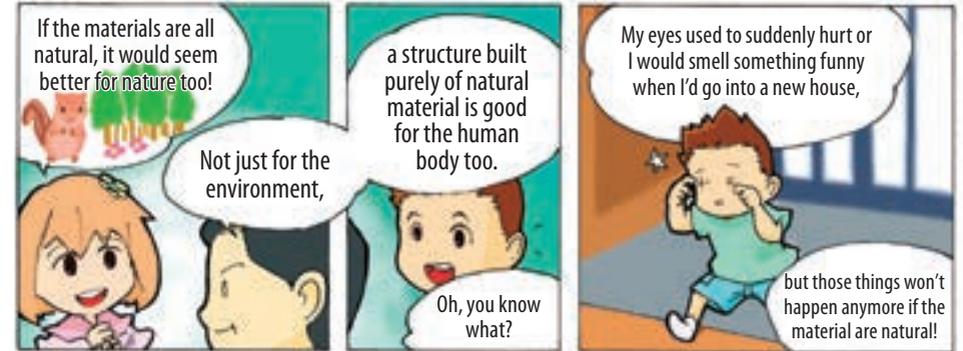
Yes

Development of Environmentally and Body

Friendly Wood-based Material



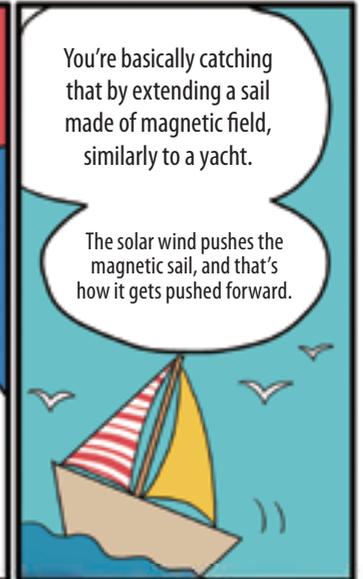
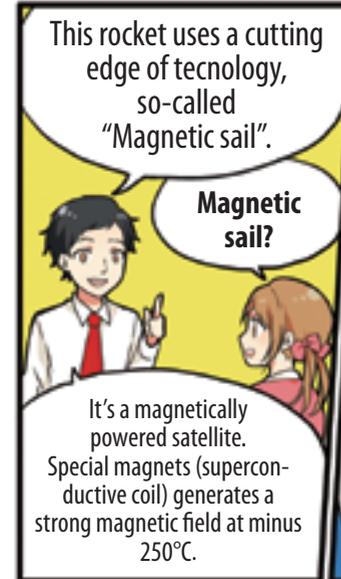
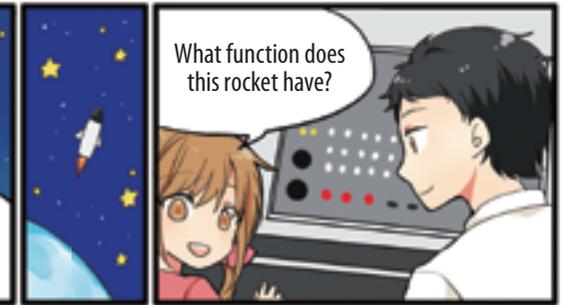
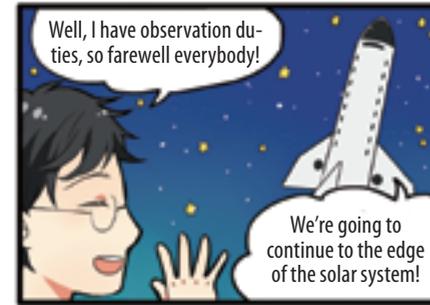
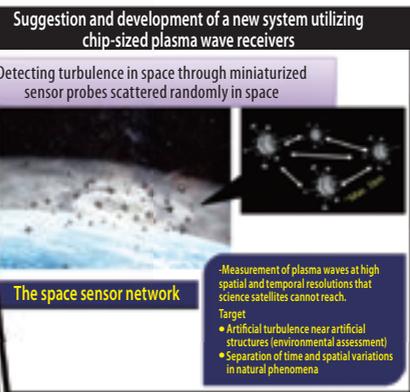
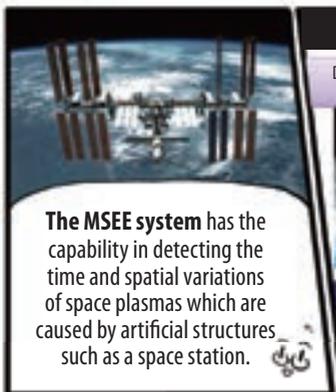
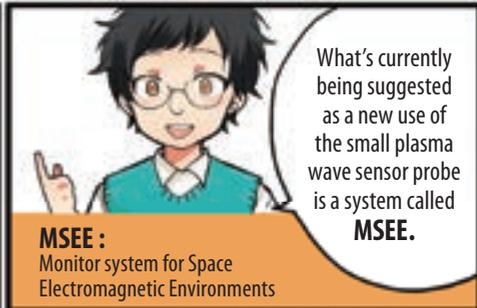
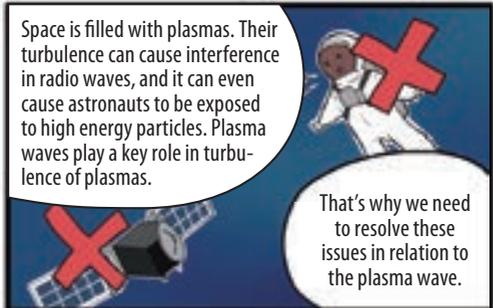
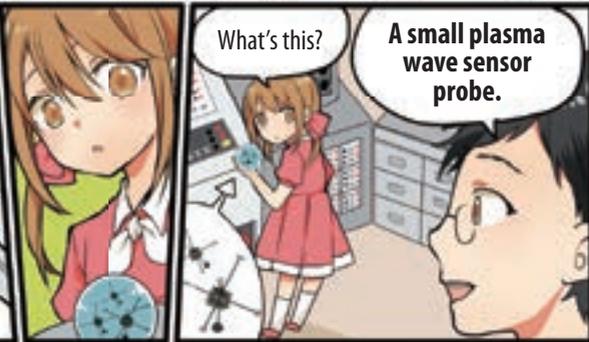
* Industrially, citric acid are produced from starch and sugar.



Space Environment and Utilization

—Developing new flight plans, propulsion, and measuring technologies

Written by : Yoshikatu Ueda
Manga production :
Kyoto Seika University Graduate School of Manga
Illustrated by : Sonoko Fukushima



Medicine from the Hills!

— Defeating sickness with plants

Written by : Kojiro Takanashi
Manga production : Kyoto Seika University Graduate School of Manga
Illustrated by : Sen Shika

Ahh... My stomach is hurting...

Got diarrhea? Use me!

What is this!!

It's me, Berberine!

Berberine?

I can heal your stomach! I look like this in chemical structure, but I'm not an artificial compound.

I come from a plant!

A plant?

Yep, for example there's a tree called Obaku or Kihada (amur cork tree) growing in front of Kyoto University's Uji campus. If you cut off a branch...

Snap!

It's totally yellow on the inside!!

Apart from Obaku, I'm in goldthread too!

Oh, goldthread too huh...?

It's bright yellow because there's a lot of me in there!

~this is a manga event. Please do not break or cut off our branches~

One of the main goals for the researchers in the laboratory of Plant Gene Expression is to figure out how I accumulate in plant cells.

I see...

squish... vacuole

I accumulate in vacuoles, but at the moment I cannot get out of the cell on my own. The cell must be squashed for me to be released!

The professors tell me that if I can go out on my own, then one can collect me up easier without breaking plant cells, and that it will be helpful for mass production as the medicine!

I see... Quite an interesting story...

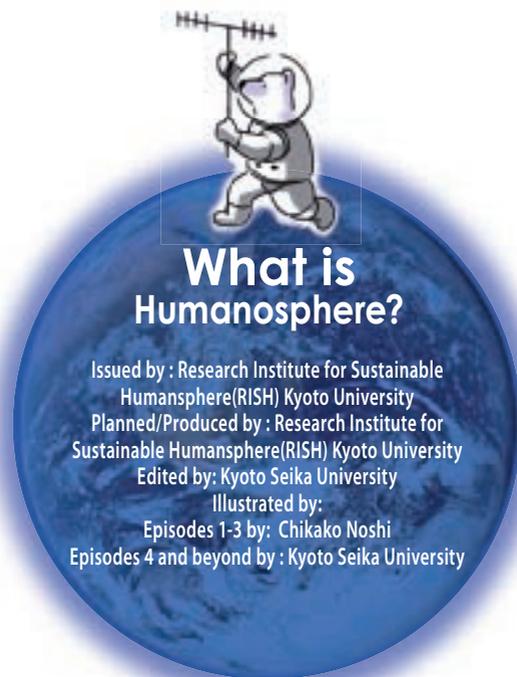
They study other plants that you often see in your daily life too, such as lemon, tobacco, soybean, hops, parsley, etc.

For efficient production of useful substances and for the betterment of people's lives, we are studying plants' cells and genes, meticulously!

Your stomach must be hurting... now eat this!

BITTER!!

Well, it's good for you...! Later...!



What is Humansphere?

Issued by : Research Institute for Sustainable Humansphere(RISH) Kyoto University
Planned/Produced by : Research Institute for Sustainable Humansphere(RISH) Kyoto University
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Illustrated by:
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Episodes 4 and beyond by : Kyoto Seika University

Here at the Research Institute for Sustainable Humansphere (RISH), we unify the human living environment, the forest sphere, the atmosphere and outer space as the Humansphere. Our goal is to understand the great range of phenomena that occur here, and at the same time to contribute to society through advancing basic scientific technologies vital to the construction of a sustainable humansphere.

We are tackling the below four missions, which we consider as some of the most important topics to explore.

Mission 1

Assessment and Remediation of the Humansphere

This mission is based on the reorganization and incorporation of different research field such as observations of the atmosphere, biochemical research on genetics of woody plants, and effective utilization of forest resources. The aim of the mission is to create foundations that permit sustainable ways of using forest resources while maintaining well being environment. This will be made possible by understanding the current conditions and the fluctuations of Humansphere as accurately as possible.

Mission 2

Development of Science and Technology through Biomass and Solar Satellite Research toward a Solar Energy Society

The aim of this mission is to create sustainable societies relying more on renewable energy such as solar and biomass energy. The research on solar power station/satellite (SPS), microwave power transmission, and the conversion of wood biomass to fuels, chemicals and advanced carbon materials are conducted.

Mission 3

Study of the Space Environment and its Utilization

The ultimate goal of this mission is to build research foundations for expanding the Humansphere into space for the future generations. The scope of the research on space plasmas and cosmic rays are now expanded to include this objective. The investigation of the space environment surrounding the Earth, development of new technologies for exploring of the space, quantitative evaluation of artificially perturbed environments around spacecrafts as well as the evaluation of natural space plasmas are conducted. The possible utilization of new wood materials in space environment is also investigated.

Mission 4

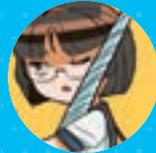
Development of Technology and Materials for Cyclical Utilization of Bio-based Resources

This mission aims to realize sustainable societies by building resource cycling systems of forest resources. Among bio-based resources, forest resources are renewable and have a possible capacity of a large scale production. Through conducting research on forest resources, the development of fundamental technologies with lower environmental impacts on every phase of the biomaterial life cycle involving production, processing, utilization, disposal and reuse is achieved.

For more information, please visit Kyoto University Research Institute for Sustainable Humansphere's website

<http://www.rish.kyoto-u.ac.jp>





**Research Institute for
Sustainable Humanosphere (RISH)
Kyoto University**

