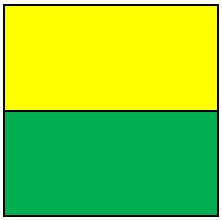
Walk of Life

explore the Linnaeusborg

Walk of Life

Welcome to the Walk of Life, where the spectacular new building of Life Sciences 'Linnaeusborg' comes alive.

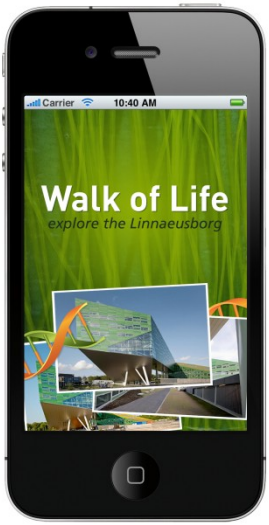
Walk the Walk of Life!



All you have to do is follow the **yellow green striped walking marks**: these will be your guide through the building.
On your way, you will find **markers** all over the Linnaeusborg. Each marker holds an icon, which corresponds to the chapter with the same icon in this booklet.
From DNA to lovely architectural details…. and you'll even be visiting a designer toilet!

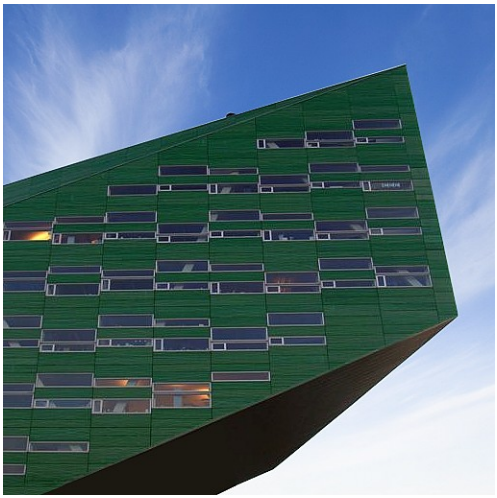
Download the Walk as an app!

The Walk of Life is also a virtual tour on your smartphone: download the app 'Walk of Life' and by scanning the markers with your camera, you will discover the daily world of this building and its inhabitants in 3D.



Enjoy the Walk of Life!

Building seen as a body



The building could be described as a body. A large silhouette of a reptile with limbs, head and trunk rising up from the ground and disappearing to an extent due to perspective and the surrounding landscape. An extensive list of requirements does not necessarily result in an impenetrable mass. The impact of the gateway, the dynamic shape and the visual axes accentuate open space rather than mass, making the building dissolve into the scenery.
The building accommodates three major research areas: the 'animal' research, safely isolated from the city in the northern section, the plants on the sunny south side and finally, in between, the fundamental research, less down-to-earth, forming the bridge.

Some facts & figures

- The steel construction weighs 3500 tons
- and is held up with 41,000 bolts and nuts
- The building surface is 36,000 square meters

1. Linnaeus

You have found your roots

The new building had to be named after a renowned scientist in biology or *life sciences*; that much was clear. Therefore, the Faculty of Mathematics and Natural Sciences organised a contest amongst her students and staff members. From the names submitted by 177 people, the name of **Carl Linnaeus** was chosen.

Linnaeus (1707-1778) is the founding father of modern taxonomy, the science of classifying, defining and describing plants and animals. He was professor of Botany at Uppsala University, Sweden from 1741 to 1778, after having gained his PhD in 1735 in the Netherlands, at the University of Harderwijk.

2. Toilets

** You have found Urea**

These sinks in the lavatories are a wink at the openness and interaction to which the building invites its users. This creativity inspires to think beyond borders (but also saves space!).

3. Walkways

** Look up!**

Interaction is the foundation of the building's internal organization.
In a scientific environment where cooperation and chance encounters between colleagues are of great importance, the quality and organization of the 'walkways' play an important role.
The building is designed in such a way that it can be traversed in many different ways. Traditional corridors have been replaced by light, open walkways along the voids.
On each floor the offices and labs have consistently been placed in two specific zones opposite one another, with the third supportive zone alternating with voids in between.
The addition of the crossovers and stairs in this area results in the spatial coherence of the walkways around and across the floors.

4. Nicotine

You have found Nicotine

Nicotine is one of the components of tobacco. A cigarette contains about 1 mg of nicotine. It is found in the leaves of tobacco plants and keeps insects and cattle away. It is the substance in cigarettes that causes addiction. Smoke also contains tar and other substances, which are mainly carcinogenic.

Nicotine is a stimulant and has a direct effect on the nervous system. It is quickly absorbed into the blood stream via the lungs.

On this balcony, smoking is not allowed… although it is the perfect place for a cigarette!

The research of the Behavioral Physiology group involves the physiological mechanisms underlying social behavior and stress. Want to know more? http://www.rug.nl/fmns-research/behavioural-physiology

5. Being Human

You have found Caffeine

Sociology student **Jet Langerak** is 'poet laureate' of the University of Groningen in the academic year 2011-2012. Especially for the opening of the Linnaeusborg, she wrote the poem *De Wijze Mens* (Being Human).

De wijze Mens

In woeste doodse duisternis was stof
wat niemand had kunnen vernemen.
Willekeurig muterend en streng geselecteerd
ontstond een lichaam als machine,
tot een lichaam dat dit waar kon nemen

en zelf ook waargenomen wordt,
het is. Verlangende naar kennis,
noemde het zich; de *wijze Mens*,
en dacht, wat kan ik weten?

Tastend lerend was
de aarde droog en koud,
het water koud en vochtig,
de lucht was vochtig, warm
en het vuur dan warm en droog.

Al was levenloos en leven;
in tal van taxa in te delen.
Behorend tot domein, een rijk en stam,
dan klassen, ordes van familie en geslacht,
allen algemeen en specifiek gebracht.

Chaotische verwondering geordend
in een ladder van het leven.

De wetenschap bouwt voort
en ontrafelt regenbogen.

Systematisch ordent het een ruim
geheel van weten. Met wetmatigheden, regels,
theorieën, hypotheses en systemen,
waarmee steeds meer kennis wordt verkregen.

Op de rug van reuzen staan we stevig,
met hun woorden als een lamp,
kan verlicht worden gewerkt
aan de grenzen van het weten.

Wij weten meer en meer dat wij niets weten
en des te gulziger men wordt.
Nog steeds zijn wij niet meer dan, ook
gemaakt van stof waar honger uit ontstond.

Verantwoording
Geel, van Chr. J. (gedicht) *Tuin op komst*. In: Goudsblom, J. (2009) Stof waar honger uit ontstond, van biologische evolutie naar sociaal culturele ontwikkeling. Amsterdam: Augustus.

6. H-Bridges

You have found DNA

A hydrogen atom can build a bridge between a nitrogen or ogygen atom to which it is attached and a nitrogen or oxygen atom of another group. Between two DNA-strands two or three hydrogen bonds are formed between two basepairs. In a schematic design the hydrogen bonds are the steps in a ladder or stairway that can be followed.

Breaking a hydrogen bond costs quite some energy. The enzyme 'helicase' functions more or less as a zipper, unzipping the DNA, so that it can be replicated.

Here you take the steps to the research institute GBB: Groningen Biomolecular Sciences and Biotechnology. The institute has a strong multidisciplinary approach, building bridges between different research groups.

- www.rug.nl/fmns-research/gbb

7. GFP

You have found GFP

Fluorescent animals have become reality since the discovery of green fluorescent protein, or GFP. Originally isolated from jellyfish in the '60s, it was soon found that GFP can be expressed in living organisms and cells. Many different variants of blue, yellow and red fluorescent proteins have been discovered in other organisms or can easily be made. These discoveries, awarded the Nobel Prize in 2008, revolutionized molecular biology as researchers were now able to fuse any gene to the DNA of GFP, making proteins visible and trackable in living cells and organisms.

Here you pass the Fluorescence Microscopy lab of the Molecular Genetics Department.

8. Chronobiology

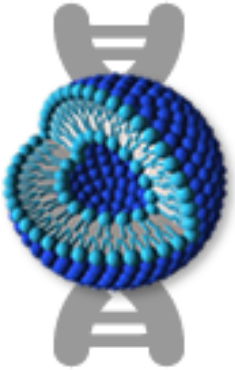
You have found time

Does everything have a biological clock? The daily biological clock maintains rhythms in many living organisms even in the absence of an apparent environmental stimulus. This so-called circadian (circa= approximately, dian=day) rhythm has a frequency of approximately 24-hours, although in nature it is typically synchronized to exactly 24h by the light/dark or temperature cycles that result from the rotation of the Earth. Within each individual, an orchestra of rhythms conducts essential biological processes. The clock creates a temporal framework in fungi, plants, and animals, and in at least some bacteria. In the case of humans, the timing program dictates when we sleep and awaken.

- Get information on your own phase of entrainment – your chronotype – and how you are timing your behaviour relative to others: www.euclock.org
- Or reset your biological clock by looking at the photo gallery of the past…

9. Liposome

You have found a liposome



Ever asked yourself why tuberculosis is so contagious and difficult to treat? One of the reasons is that the tuberculosis bacterium armours itself with an impenetrable cell wall. This wall is so waterproof, that the bacterium behaves like a duck-in-a-pond. Bio-organic chemists mimic this cell wall by synthesizing the tuberculosis' lipids and preparing artificial cell membranes and cell walls, such as this liposome here. It turns out that, although the bacterium uses ingenious molecular architectures, the lipids do leach out, are recognized by the body, and give an immune response. This could lead to an effective vaccine against TB.

- Want to know more? Check the research group Bio-organic Chemistry: http://minnaard.fmns.rug.nl/

10. Carbohydrate Competence Center

You have found a sugar molecule

Sugar belongs to the carbohydrates and it plays an important role in our metabolism. It is composed of glucose and fructose. Glucose is crucial in the energy supply of human beings. It is also the main component in, for example, starch.

Carbohydrates are the basis of our daily food, and also of many unhealthy food products like snacks, icecream and softdrinks. Researchers of the Carbohydrate Competence Center are developing carbohydrates which are more slowly digestible, and therefore healthier. They might help to prevent diseases like diabetes, obesity and cardiovascular diseases. Researchers are working on a variety of topics, ranging from healthy food to new materials and biofuels.

- Want to know more? www.cccresearch.nl

11. Space, colours and glimpses

You have found a Lead chromate molecule

Lead chromate is a yellow, solid substance that was used by Vincent van Gogh as a yellow pigment. Looking down you can notice the different shades of yellow on the floors below.

The shape of the building and glimpses of daylight the voids provide, define the spatial qualities of the interior. The prominent presence of the heavy steel structures contrasts with the refined detailing of the repetitive elements such as doors, balustrades and stairs. The ducts are left partly in view, nicely exposing the vital workings of this complex organism.
The floors have a shiny finish that slowly transmutes from green shades in the plant research areas in the southern part, through yellows for the fundamental research groups along the bridge, into orange and red in the animal research areas in the northern section. Walking along the voids, the colour shifts on several floors can be observed.

12. Microbiology

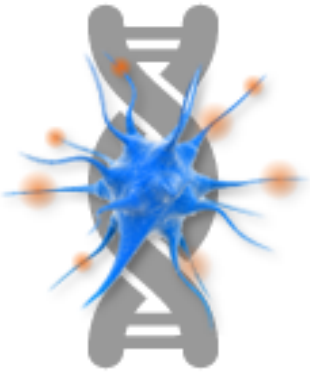
You have found a micro-organism

Microbiology is the study of micro-organisms, such as bacteria and yeast. Some bacterial facts: 1) number of species, estimated at 5 x10^{30}. 2) spreading: bacteria are found everywhere. In soil, bodies and food, but also in extreme environments like polar ice or vulcanic lakes. 3) harmful or useful? Both! *Bacillus anthracis* causes deadly anthrax, while *Bacillus subtilis* is important for industry, for the production of very important enzymes.

The department of Molecular Microbiology investigates protein export across the cytoplasmic membrane at a mechanistic level, using the model organisms *Escherichia coli* and *B.*subtilis, but also the extremophile *Sulfolobus solfataricus*, which prefers to grow at 80°C and at pH3.

- Want to know more? www.rug.nl/fmns-research/molecular-microbiology

13. Molecular Neurobiology



You have found a neuron

The department of Molecular Neurobiology tries to understand the molecular and cellular processes underlying mood and memory, both in the intact brain and in pathological conditions. We try to unravel molecular pathways in nerve cells and cells of the immune system of the brain that can tell us how we store memory and how memory is affected by ageing and is destroyed in Alzheimer's disease. Also we study which molecular mechanisms are responsible for development of depression. Knowledge of these mechanisms is our starting point for development of treatments and drugs that can serve to protect the brain against these damaging processes in ageing and Alzheimer's disease.

- Want to know more?
  www.rug.nl/fmns-research/molecular-neurobiology

14. Birds

You have found a Godwit

The pieces of art you find here are made by Herbert Koekkoek, former staff member at the Groningen Center for Biology, but now an artist in the Groningen village of Thesinge. Inspired by nature as well as by human behavior and human relations, he prefers to work with weathering steel.
You can find more of his birds in the building, and you can find Herbert Koekkoek at www.herbertkoekkoek.nl

The Animal Ecology Group has a long standing tradition of long-term studies on wild birds, in combination with elegant laboratory and field experiments. Our research aims to link individual level behaviour and physiology, population dynamics and micro-evolutionary changes in response to environmental variation. We study the ecology of avian migration, dispersal, and reproduction in a variety of systems all over the world. We expect that this understanding will also help underpinning nature conservation efforts worldwide.

- Want to know more?
  www.rug.nl/fmns-research/animal-ecology

15. Electron microscope

You have found a virus

An electron microscope uses an electron beam with a very small wavelength and magnetic lenses to make an image of objects, as small as a ten-millionth of a millimeter (0.1 nm), such as proteins, protein-complexes, cell organelles, viruses but also self-assembled nano structures. The Electron Microscopy group focuses on the structure determination of complex macro-molecular assemblies by transmission electron microscopy and electron tomography. The main study objects are membrane proteins. Most of these proteins are involved in photosynthesis and bioenergetics. For these investigations we often use cryo-electron microscopy: objects are embedded in a thin layer of ice, which preserves their ultra structure.

- Want to know more?
  www.rug.nl/fmns-research/electronmicroscopy

16. Climate rooms

You have found LED light

This climate room belongs to the Plant Ecophysiology group. This group studies the interaction between plant and environment. The completion of the life cycle of plants depends on optimally adapting to the physico-chemical changes in the direct environment. The physico-chemical changes are for instance, changes in light quality, quantity and direction, and harmful UV radiation. These climate rooms are equipped with energy-friendly LED lightning, which facilitates our group to perform these kinds of studies. In addition, these rooms are used to study the acclimatization of plants to changes in temperature, pressure, salinity, water and nutrient availability, CO_2 concentration and presence of air pollutants under nearly fully controlled growth conditions.

- Want to know more?
  www.rug.nl/fmns-research/plant-physiology/research/index

17. Technical installations

You have found a water molecule

Everywhere in the building, the technical installations (cables, pipes etc.) hang clearly visible from the ceiling.

First, they were designed on the computer. To be able to produce optimally, 3D-visualisation was used: at the High Performance Computing and Visualisation department, the whole building was first monitored in 3D before the installations were produced.

In a factory in Nieuwegein, 1,600 modules of 3,6 meter each were assembled, sometimes with 4, often with up to 20 pipes and cables, as well as a similar amount of modules in other dimensions.

Once in Groningen, the modules were simply clicked to the ceilings. In total, 200 kilometers of pipes were mounted, 100 kilometers of data cables and 500 kilometers of electrotechnical cables.

18. BioBank

You have found a chromosome

Have your way at the Science LinX BioBank: biologists have special DNA, and so has their building. Here gene expression brings clips to life of pupils, students and staff.

What do you expect scientists to discover or students to learn? Touch one of the active sites and find out.

The 'BioBank' houses a database of video clips covering subjects from molecules to ecology, but it will only stay alive if you record your own video here too. Please do! Be part of Groningen life sciences and leave your trace in the Linnaeusborg.

19. ‘Cabinet of Naturalia’

Inside this cabinet you find tangible objects used in research and education in the Linnaeusborg.

20. What’s next..?

We hope you have enjoyed the Walk of Life.

The Walk of Life will stay alive when the content will grow. Therefore we invite you to add your own story to the Walk of Life.

- Interested? Ideas? Let us know at sciencelinx@rug.nl

university of groningen

Walk of Life

Developed by **Science LinX**, the science centre of the Faculty of Mathematics and Natural Sciences of the University of Groningen, in cooperation with the **University of Groningen Art Committee**

- www.sciencelinx.nl
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