Chiral Garden

La Verrière (Brussels, Belgium)
November 7–December 14, 2013

Chiral Garden

On the invitation of curator Guillaume Desanges, I developed a new project that was exhibited at La Verrière (Brussels, Belgium) from November 7 to December 14, 2013. The project enabled me to resolve an existing process and line of research into form.

In 2010 I visited the Naturalis Biodiversity Center in Leiden, the Netherlands, to meet with the evolutionary biologist Prof. Dr. Menno Schilthuizen, whose research focuses on the evolution of mirror images in snails and beetles. He introduced me to the subject of chirality, and it was through him and his research that I realized that these mirror (or chiral) images form a widespread phenomenon in nature. An object or a system is chiral if it is not identical to its mirror image, that is, if it cannot be superposed onto it. Many organisms, like orchids, microfossils, and even humans, contain a (usually very small) percentage of mirror-imaged individuals. The most familiar example of a chiral object is a hand, from which the term chirality derives. [Greek: χειρ *(kheir)*].

> *I call any geometrical figure, or group of points, "chiral", and say that it has chirality if its image in a plane mirror, ideally realized, cannot be brought to coincide with itself.*
> Sir William Thomson, 1893

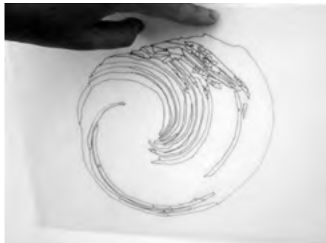
Chirality* – Menno Schilthuizen

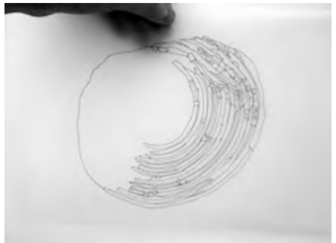
The term 'chirality' was introduced in 1883 by Sir William Thomson (later Lord Kelvin), to refer to any three-dimensional form "[whose] image in a plane mirror... cannot be brought to coincide with itself." The human hand is a perfect example of a chiral form; there is no way to turn or twist our right hand to make it look identical to our left hand, except by viewing it in a mirror. Chirality is found everywhere around us. When different kinds of atoms, for example, are compounded into a complex molecule, their mirror-image form — even though composed of the same atoms — is chemically non-identical. A chiral form and its mirror image thus are in some sense completely identical, and yet, they are utterly different in shape. They are not superimposable, not even partly.

This dual nature of chiral forms — being the same and yet entirely different — provides insights when viewing asymmetries in the living world. Symmetry is an adaptation, caused by the demands of gravity or of moving through the environment. An asymmetric tree would fall over; an asymmetric bird would fly in circles or not at all, and an asymmetric suckerfish would get dislodged from its rock in a fast-flowing stream. Since most plants and animals that we are familiar with either are large and heavy, fast-moving themselves or living in a fast-moving aerial or watery medium, their forms are dictated by the need to balance friction on both sides of the body, which is solved by bilateral symmetry.

* Extracted from: M. Schilthuizen, "On mirror images in nature: How identical forms can be completely different" in: M. Andrews & M. Canépa Luna, eds., *Amikejo: A series of Exhibitions at Laboratorio 987, Museo de Arte Contemporáneo de Castilla y Léon, MUSAC, Spain.* Milan: Mousse Publishing, 2012. pp. 98-108

drawings inspiring garden shape



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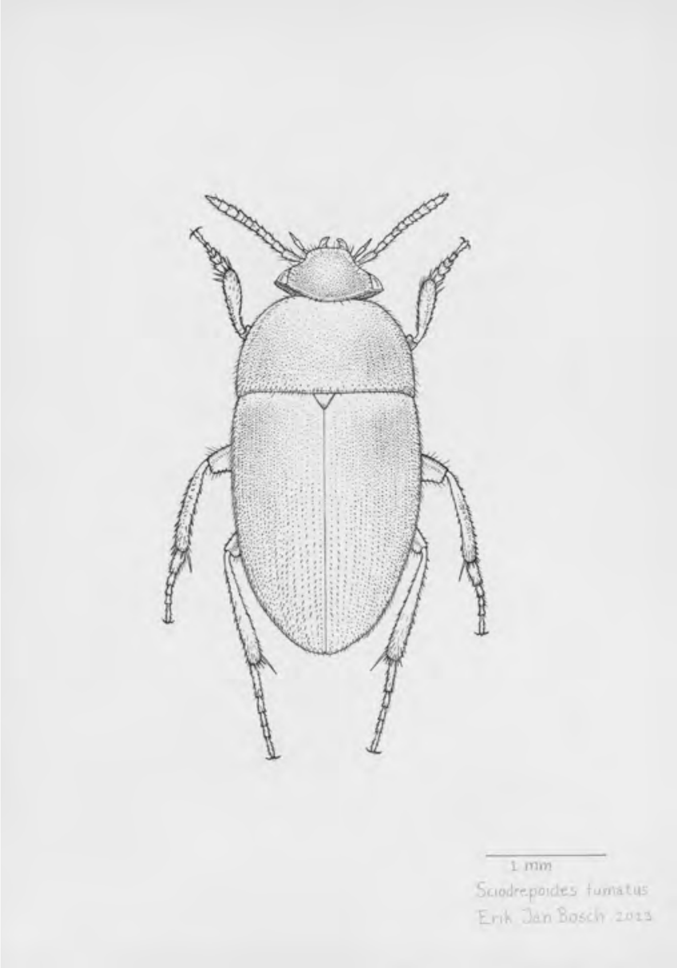
Sciodrepoides Fumatus

Drawing made by Erik Jan Bosch. Collection: Naturalis Biodiversity Center, Leiden, the Netherlands. Material made available by Prof. Dr. Menno Schilthuizen, Naturalis Biodiversity Center, Leiden, the Netherlands

pencil on paper, 29 × 21 cm

Sciodrepoides fumatus is a species of beetle that has asymmetric genitalia. This phenomenon remains a mystery for scientists, as symmetry is normally preferred in sexual signaling. A hypothesis for this asymmetry would be that the male developed this way to deposit its semen directly on the storage organ that the female uses for her preferred male.



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Uca capricornis

Drawing made by Erik Jan Bosch. Collection: Naturalis Biodiversity Center, Leiden, the Netherlands. Material made available by John Christy, Smithsonian Tropical Research Institute, Panama

pencil on paper, 21 × 29 cm

Claw asymmetry is common among otherwise bilaterally symmetrical decapod crustaceans, such as lobsters and crabs. They have one massive crusher claw, tooled to break shells, and another slim cutter claw that is used to tear the flesh of their preys. But competition for mates, not food, has led to the most extreme claw asymmetry, as exhibited in male fiddler crabs living mostly in the tropics. Male fiddler crabs have a single, greatly enlarged "major" claw that may weigh as much as the rest of their body, and is tolled as much to attract females as it is used as a weapon to fight other males. This particular typology of chirality holds the interesting characteristic that right- and left-handed males are equally abundant among these species. Males begin life with symmetrical claws, then lose one at random. The lost one regenerates as the minor claw as the crabs molt and grow. This process and pattern, referred to by Richard Palmer as "random asymmetry", explains most known cases of equal frequencies of handedness (another word for chirality).

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Samples of* Amphistegina guraboensis *(family of Foraminifera)

Material was made available by Dr. Willem Renema, Naturalis Biodiversity Center, Leiden, the Netherlands

The Foraminifera are unicellular organisms that produce a shell which can have either one or multiple chambers, some quite elaborate in structure. Because of their diversity and abundance, they are important in fossils studies. The form and composition of their shell were identified and classified by Alcide Dessaline d'Orbigny (1802–1857) (see illustration). They are usually less than 1mm in size, but some are much larger, the largest species measuring up to 20cm. Amphistegina guraboensis is one of the rare types that coil in both directions (left and right).

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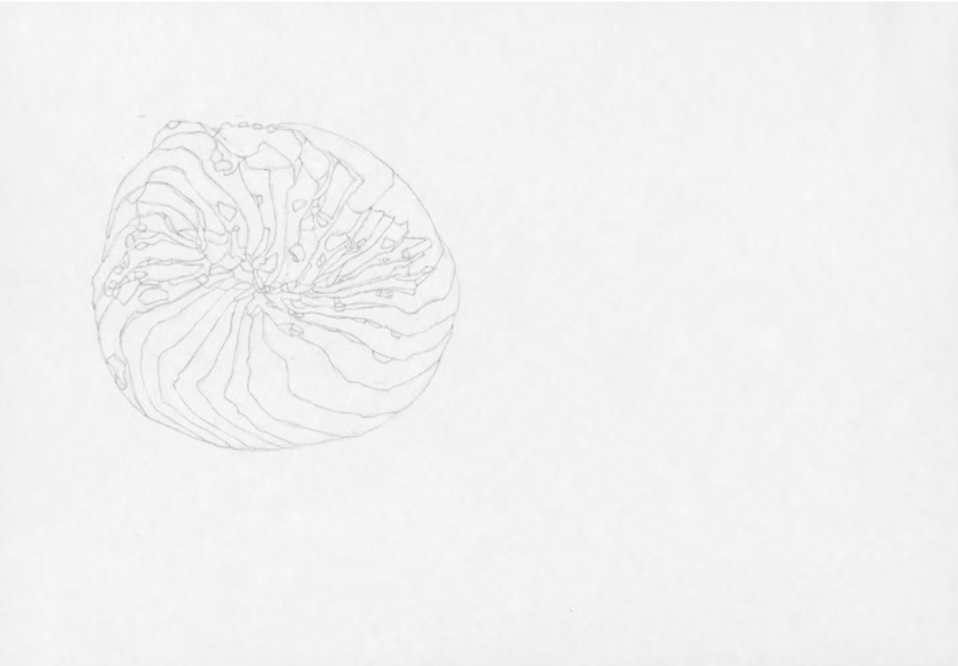
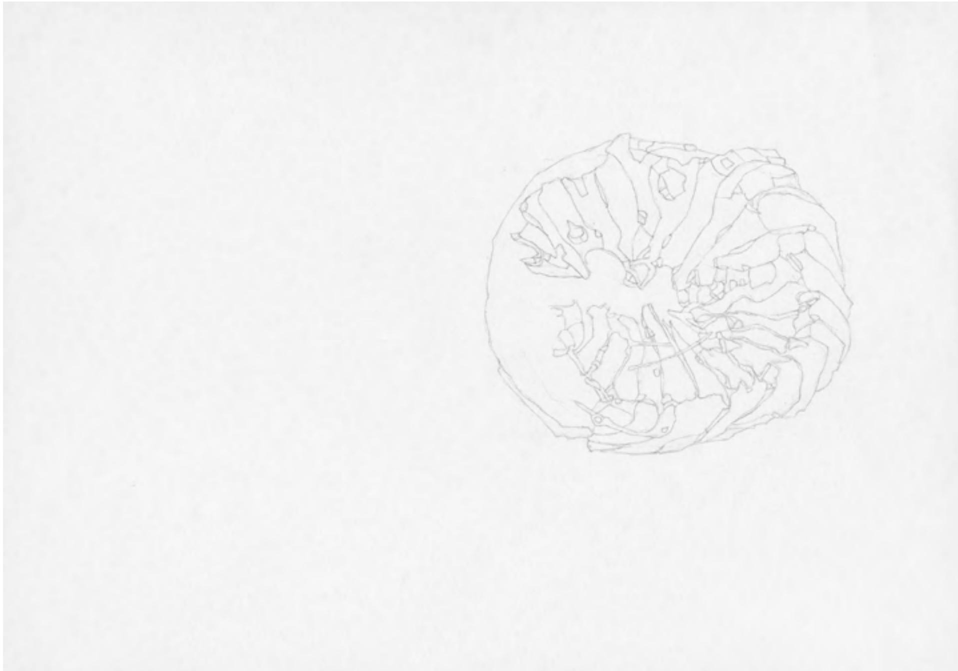
***Dessins of* Amphistegina guraboensis**

Irene Kopelman
pencil on paper, 21 × 29 cm



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Left- and right-handed quartz crystals

Made available by Prof. Dr. E. Vlieg, Director of the Institute for Molecules and Materials (IMM), Solid State Chemistry & Applied Materials Science, Radboud University Nijmegen, Nijmegen, the Netherlands

In 1949, a revolution took place in the understanding of crystal growth on an atomic level, caused by the spiral growth theory put forward by F. C. Frank. Spiral growth layers advance outward starting from the inner portion of a crystal face that is not perfect. The outer shape of a crystal reflects its internal structure. If the internal structure of a crystal is chiral, the outer shape should hence also be chiral. This is the case with quartz crystal growth, which occurs in two versions: left-handed and right-handed. The large block on display has many quartz crystals, although none of these have enough facets to see the difference between left- and right-handed growth. This becomes clear if you look carefully at the orientation of the seven different facets of the two small top parts that have been cut off from larger crystals. The facets are strictly similar but their organisation around their center is inverted.

v

Amphidromus inversus

Material was made available by Prof. Dr. Menno Schilthuizen, Naturalis Biodiversity Center, Leiden, the Netherlands

Like all helices, a snail can coil clockwise (right-handed or dextral) or anticlockwise (left-handed or sinistral). In nature, almost 99% of all snail species are right-handed. In many ways, when a mutant snail develops as an anticlockwise animal in a population that is otherwise clockwise-coiled, it enters a parallel universe, where everything is the same, yet completely different. In such a parallel universe, a vital activity such as mating, for example, will face insurmountable problems. Which is one of the reasons why, over hundreds of millions of years of snail evolution, so few snail species have managed to reverse their coiling direction to become entirely anticlockwise. The snails presented here come from a rare species, found in Malaysia, which strangely has an inverted and more balanced repartition (35% right – 65% left).

(Adapted from Menno Schilthuizen's text published in the journal of the exhibition)


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***Fruits of* Medicago orbicularis**

Material was made available by Dr. Barbara Gravendeel, Naturalis Biodiversity Center, Leiden, the Netherlands

Medicago orbicularis is a plant species of the genus Medicago. It is found throughout the Mediterranean basin. The chirality of its fruit is known to be coded for by a single gene, the identity of which is not yet discovered.

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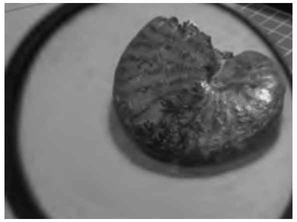
Platylenticeras gevrilianum ***(Ammonites)***

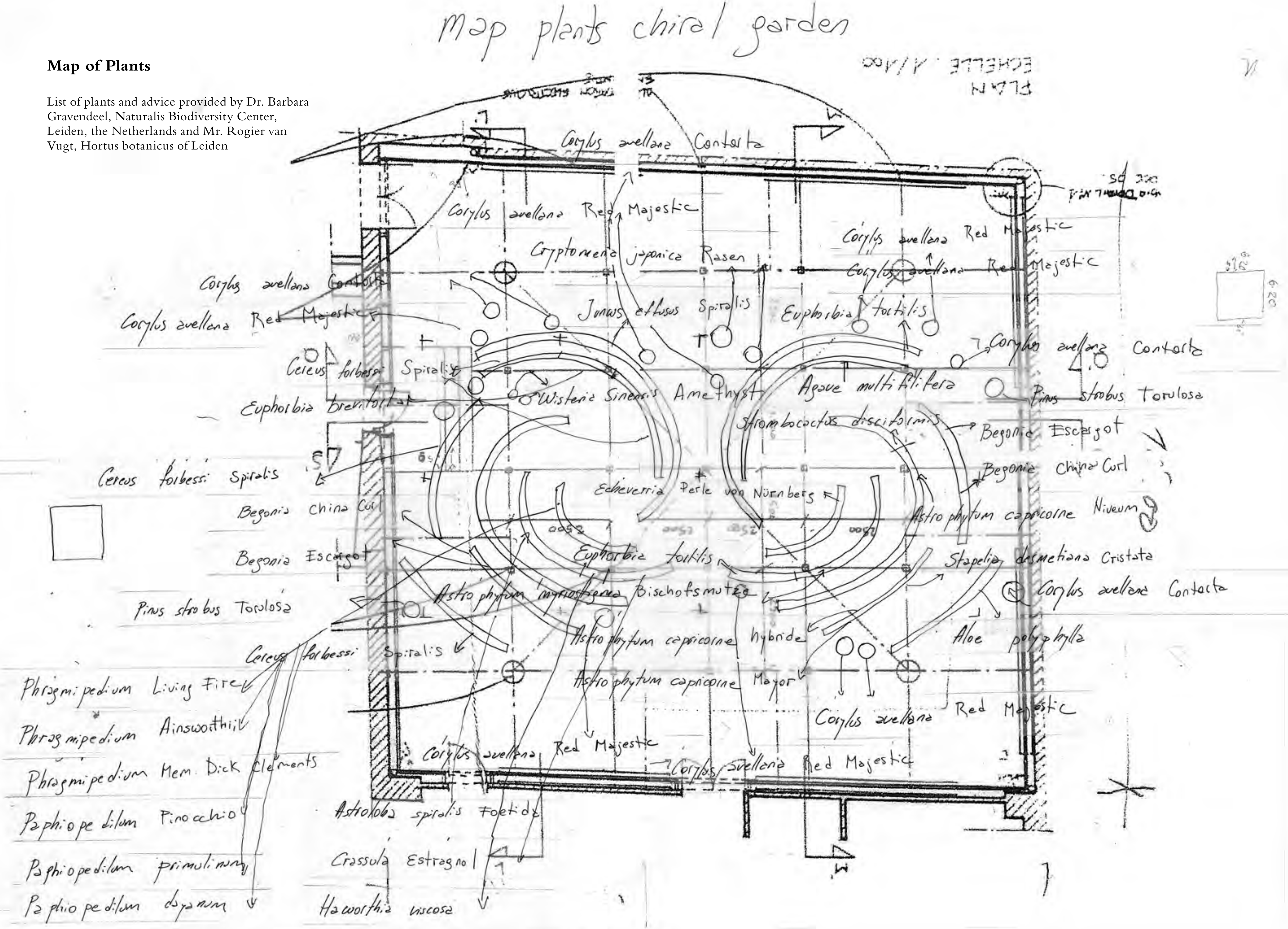
Material was made available by Philip Hoedemaeker, Naturalis Biodiversity Center, Leiden, the Netherlands

An ammonite is a fossil squid with a shell. Ammonites became extinct 65 million years ago. The symmetric shell of an ammonite is normally coiled within the plane of symmetry. The ammonite showcased here is 140 million years old. The siphonal tube is not situated in the plane of symmetry but just outside this plane, resulting in suture lines on either side that aren't mirror images. The reason for the asymmetric position of the siphon is unknown. It means the animal has turned a little within its shell, possibly to safeguard the right or left gill against inflowing mud.



Map of Plants

List of plants and advice provided by Dr. Barbara Gravendeel, Naturalis Biodiversity Center, Leiden, the Netherlands and Mr. Rogier van Vugt, Hortus botanicus of Leiden





1 Euphorbia brevitorta
2 Cereus forbessi spiralis
3 Euphorbia Tortilis
4 Aloe polyphylla S Africa
5 Agave multifilifera
6 Crassula cv. ‘Estragnol’

installation process









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Irene Kopelman
Chiral Garden

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