Plant in Focus, February 2025

Amorphophallus titanum Corpse Flower

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Public Interest

The flowering of the Titan Arum, as it also called, attracts great public interest because the 'flower' is huge, flowering is infrequent and it is acompanied by a strong smell that humans find repulsive.

Flower size

This is, by no means, a large flower. The Corpse Flowers are quite small. The largest flower on earth (*Rafflesia arnoldii*), also called a Corpse Flower, has flowers more than 130 times the size of the Titan Arum flower.

The actual flowers are inside the big sheath (called a **spathe**) near the bottom of the yellow column (the **spadix**). There are between 450 and 5,000 separate male and female flowers, each only 2-3 mm across. The other individual corpse flower, below, is 700-1100 mm wide. The Titan Arum flowers are shown on page 2. This whole display, including all the small flowers is called an **inflorescence**.

This inflorescence is also not particularly large. You have probably seen others and not given them a second thought. Just outside the windows of the Conservatory here, there is palm tree, *Livistona australis*, Cabbage-Tree Palm, which has bigger flowers and just as many. Before it flowers, these are held in a large, stiff, brown sheath that you will often see under a tree in flower.

The plant with the largest inflorescence is the Talipot palm *Corypha umbraculifera*, from southern India and Sri Lanka. This plant dies after setting seed. (**monocarpic**).

Top: *Amorphophallus titanum* in flower, in its wild habitat, Sumatra, Indonesia. This photo shows its size. Photo: Luke Mackin, Flickr CC BY-NC-SA 2.0
Bottom: *Rafflesia arnoldii* Corpse Flower in Batang Palupuh Nature Reserve, Sumatra, Indonesia. Photo: LukeTriton, Wikimedia Commons CC BY-SA 4.0

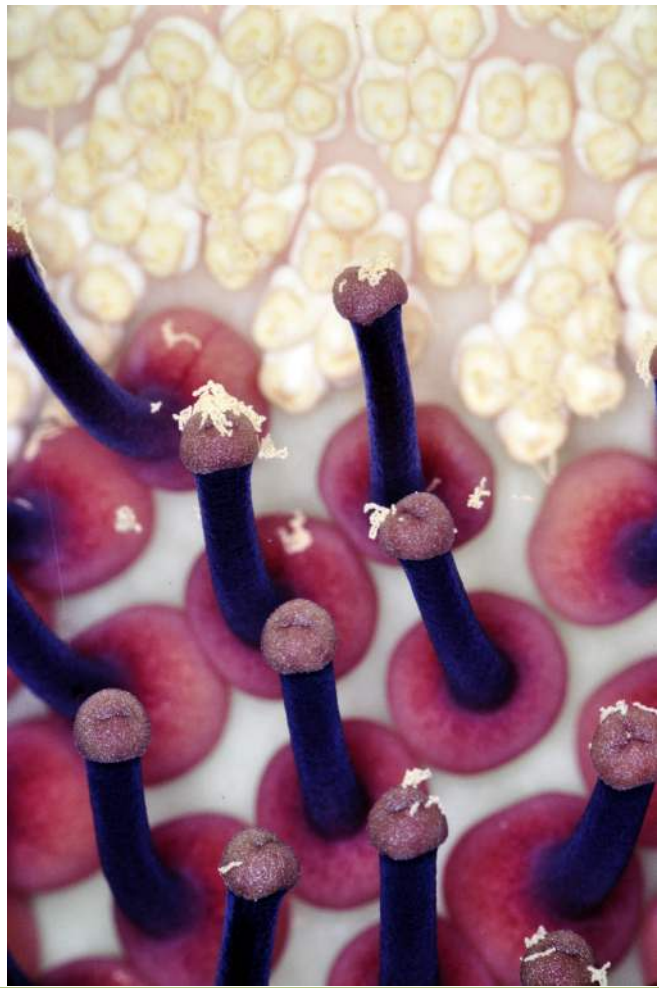
This palm's inflorescence, of up to 24 million flowers, grows up to 9 m long and 12 m wide.

The flowers

If you could see from high above the *Amorphophallus* inflorescence, looking down into the red spathe, you would see rows and rows of white male flowers, with red female flowers below. None have need of petals.

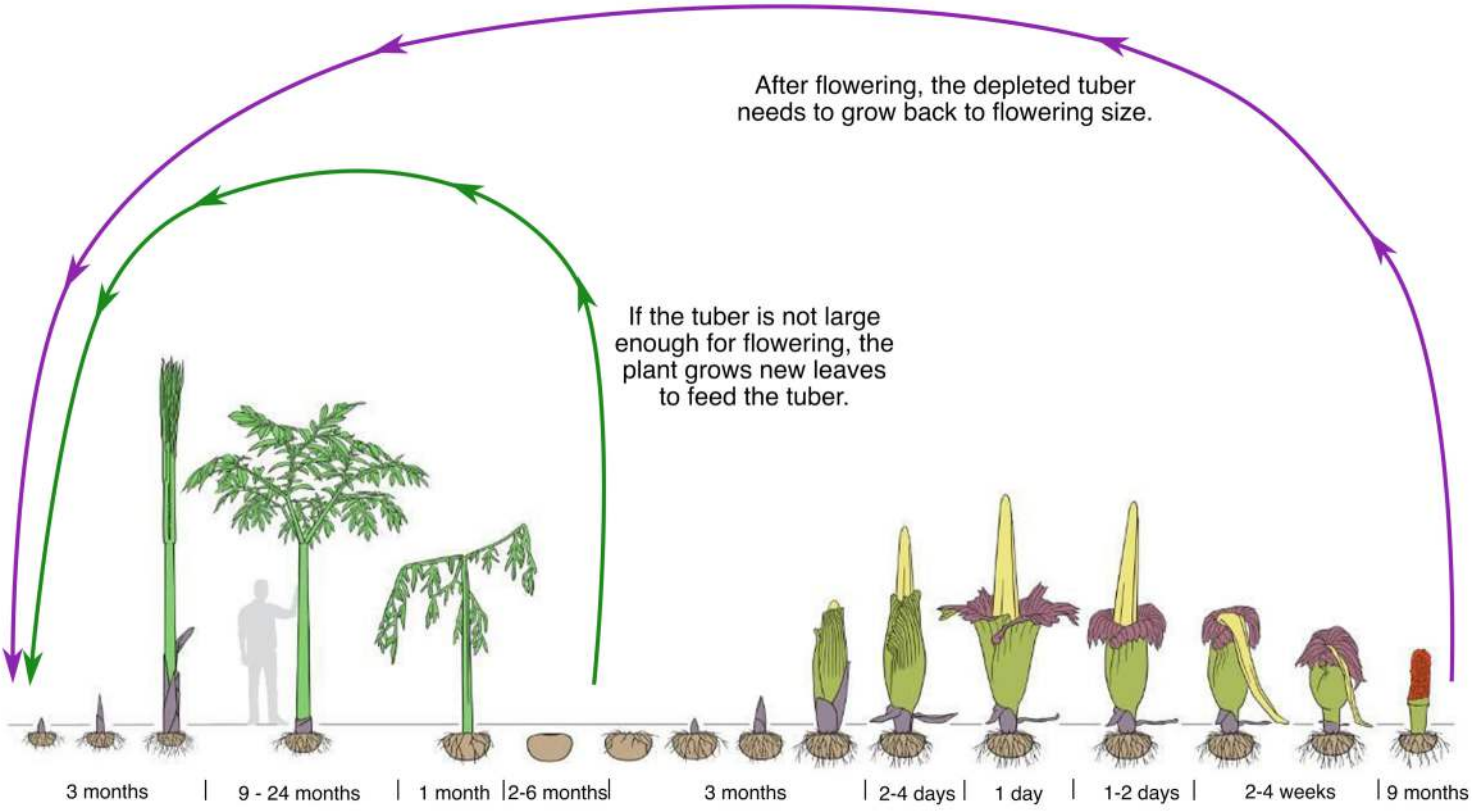
Above, right: Talipot Palm *Corypha umbraculifera*. Shyamal, Wikimedia Commons CC BY-SA 3.0

Above, left: Inside the spathe, below the visible part of the spadix are the white male, then red female flowers. Photo: W. Barthlott, Botanical Gardens Univ. Bonn, Wikimedia Commons CC BY-SA 4.0
Below, Left: Inside the spathe, the visible yellow part of the spadix (Brown tinge) at the top, with male flowers immediately below and female flowers at the bottom. Photo: T Gray Photography, Wikipedia CC BY-SA 3.0
Below right: A closer view showing pollen attached to some stigmas on female flowers (red). Photo: W. Barthlott, Bot. Gard. Univ. Bonn, Wikipedia CC BY-SA 4.0



Deciduous Corpse Flower

Like many plants with bulbs and tubers, this plant dies down between growing seasons. Like the Illawarra Flame tree, when it is in flower, it has no leaves. After the fruit has ripened, the Corpse flower plant is just a tuber (like a potato or bulb). Being a tropical plant growing in a heated glass house it does not have a distinct season for shedding its leaves. The sequence is shown in the following diagram.



Life Cycle of the Titan Arum
Amorphophallus titanum

The life cycle of the Titan Arum. Original image: Desarrollo de la planta. I Sabine Hirsig/Konzept Heinz Schneider, Basel Botanic Garden, Jose M. Bazán. Translated from German using Google Translate and arrows added CC BY-SA 4.0.

The tuber is a store of energy-giving starch and other nutrients needed by the plant for growth, flowering and the development of its seed-containing fruit. The huge leaf captures energy from sunlight, water and carbon dioxide to produce sugar and starch. Flowering takes a lot resources from the tuber. The tuber can lose 20 - 30 kg during flowering. If grown from seed, it can take more than 10 years for the tuber to reach flowering size.

Following the green arrows on the diagram, the tuber grows one huge leaf. For 9 months to 2 years the leaf send its starch into the tuber, and then dies and is shed. After a period of rest, this is repeated until the tuber reaches flowering size. It then proceeds along the right hand part of the diagram. The pollination occurs in 1 or 2 days. After flowering and fruiting, it takes 3 to 7 years for the tuber to reach flowering size again (purple arrow then multiple times following the green arrows).

The odour and pollination

The flower produces its odour at night to attract the insects that are most effective pollinators. It produces a range of chemicals (shown on the next page). Have you every smelt a dead possum or dead rat? That odour is similar to what this plant smells like for a few hours when its flowers are ready for pollination, ie. its scent smells to us like a rotting animal.

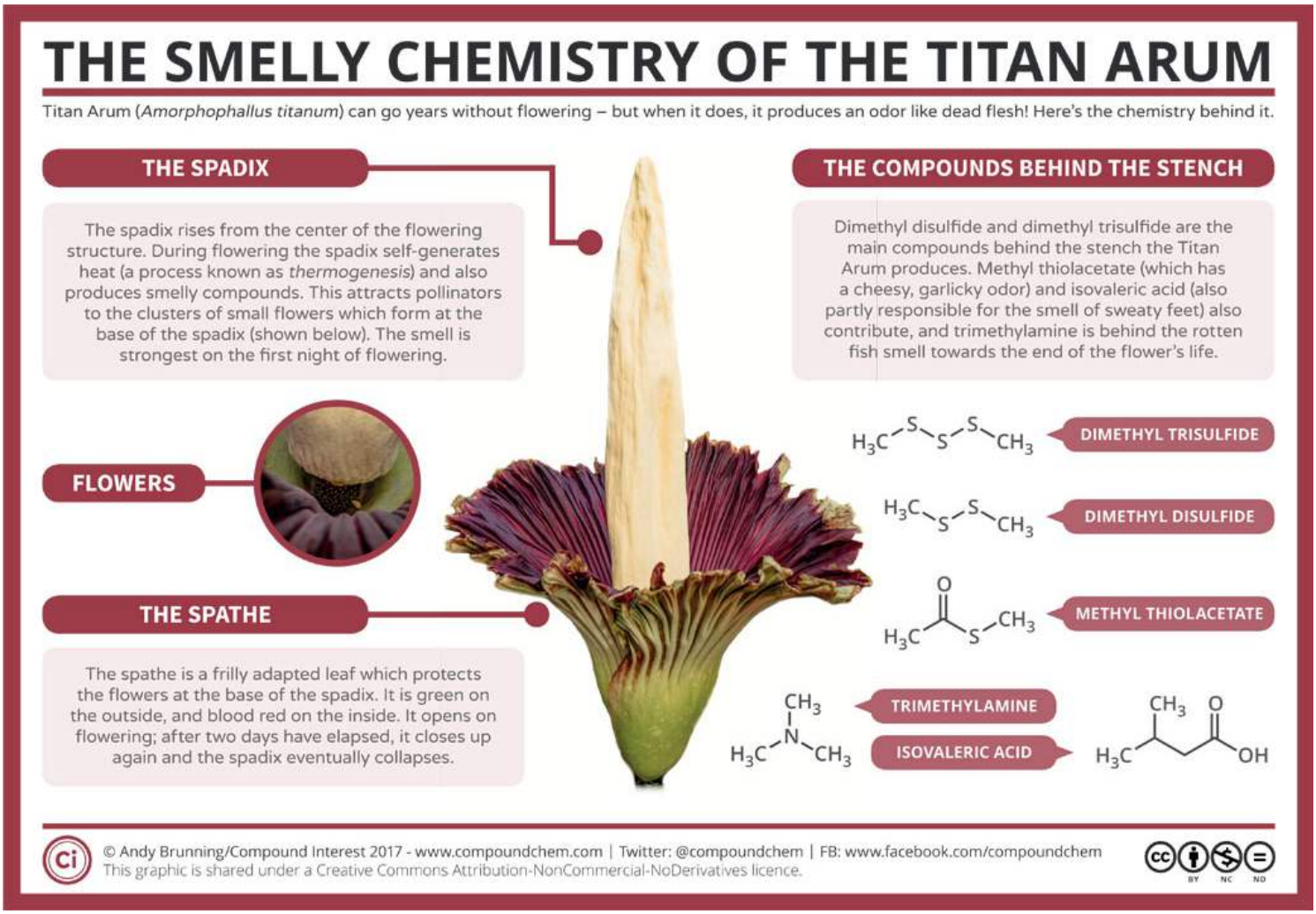
It smells so horrid to us humans because our ancestors developed an acute sense of smell for chemicals called thiols. These thiols have a Sulphur atom bonded to a Hydrogen atom, with a place where other collections of atoms can attach to the Sulphur atom. You might have smelt, heard or learned bout Rotten Egg gas. This gas has a second Hydrogen atom bonded to the Sulphur, forming Hydrogen Sulphide.

Thiols are produced by rotting flesh, amongst other undesirable foods. If we ate a food with this smell there is a strong chance of food poisoning and possible death. So, this sense of smell is a life-saver. Our noses can detect as little as 3 parts in 10 billion of many thiols. So we can detect this smell from some distance away. There are few other plants whose scent seems so strong. (eg. Jasmine).

Insects that are attracted to the smell of dead animals come to these flowers. In our environment that may be blow flies, but, in Sumatra it is oftne carrion beetles. They fly into the flower and then start walking around searching for the rotting flesh. While the thiols are being produced, either the female flowers are receptive to pollen or the male flowers are releasing pollen. During female pollination, the spathe closes over the flowers making it difficult for the pollinators to escape. After that stage, the spathe releases the captives, which then crawl out picking up pollen as they leave.

After flowering, the spadix collapses quickly and the spathe falls away. The pollinated female flowers then continue their development to produce a column of orange fruit, with seeds for the next generation.

Right: After pollination, the dark brown spathe withers and the yellow spadix collapses draping the plant like a grey bridal train. Photo: RBG Melbourne flowering Jan 2013, DJ CC BY-SA.

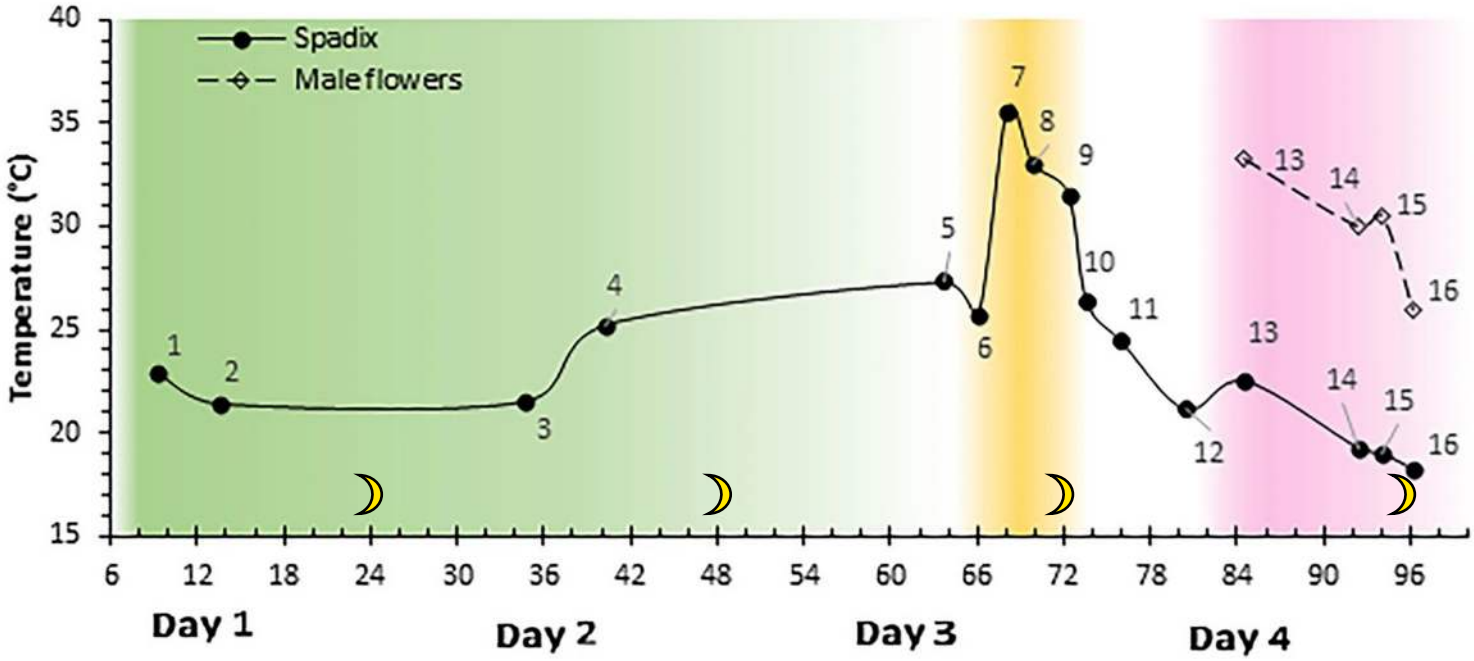


One or two visitors asked about the chemistry of the smell. This poster gives part of the story. It doesn't show the way the smell varies during flowering. Human noses can detect these changes. In addition there are some chemical differences between the times of female receptiveness and the later male release of pollen.

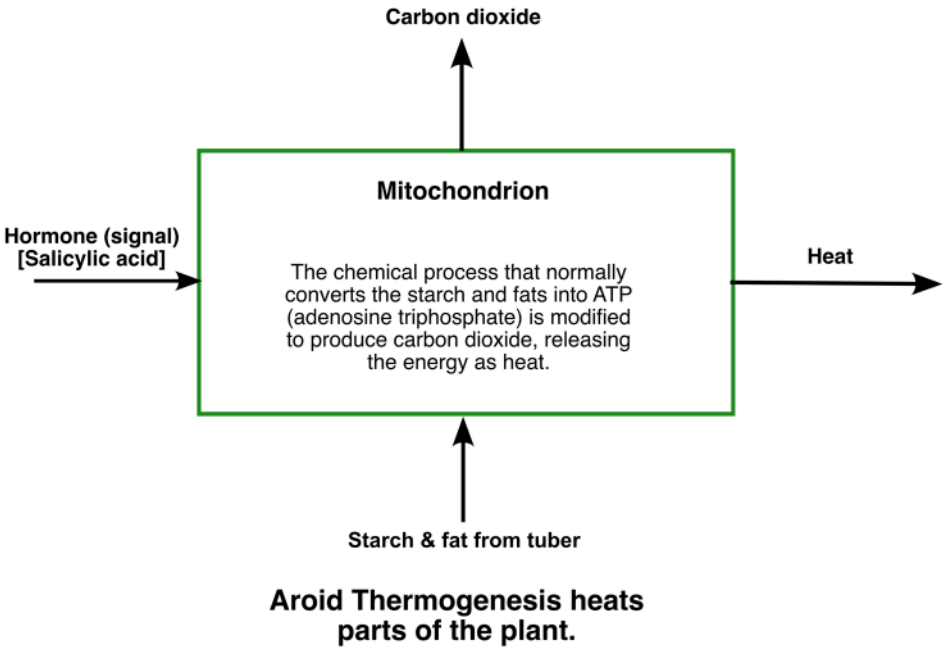
Poster by Andy Brunning/Compound Interest 2017, Compound Chem CC BY-NC-ND-SA 4.0

Heating the Spadix

To ensure that the smell is spread widely the plant needs to produce a lot of the odour chemicals and to disperse them widely. The amount of these chemicals in the air is increased by heating the chemicals to evaporate them faster. This is where the spadix comes into it own.



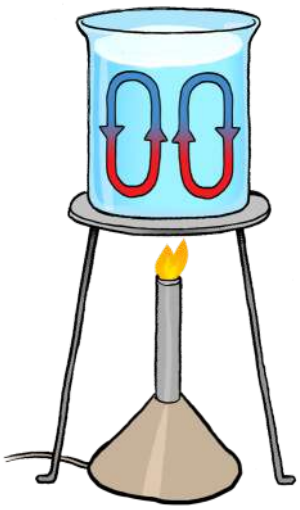
Above: During flowering the Spadix heats by up to 17 °C. The male flowers heat during the male stage of flowering in the night following female receptivity. The crescent moon symbols indicate midnight. Diagram by Lili Kang et. al, from 'How the volatile organic compounds emitted by corpse plant change through flowering' CC BY.



Aroid Thermogenesis heats parts of the plant.

Right: Aroids use the same chemistry as do mammals to keep their bodies at a constant temperature.
Diagram: DJ CC BY-SA.

Below: The shape of the spathe and the spadix of the Corpse flower, set up micro-convection in which the stream of odour-laden warm air is lifted high by the heated air rising. This increases the area experiencing the odour. Convection currents in water illustrate how a heat source causes warm fluid to rise and flow away at the top of the rising column. Image: Megan Beckett, Siyavula Education, Flickr CC BY 2.0



Many aroids produce heat in the spadix. There is a remarkable aroid that sustains its heat production for days to melt its way through the thawing snow and provide a comfortable habitat for the fertilising insects (next page).

Above: The sustained heat from Eastern Skunk Cabbage *Symplocarpus foetidus* melts snow during the spring thaw.
Photo: Sakaori, Wikimwedia Commons CC BY-SA 3.0.
Below: *Amorphophallus titanum* is native to the island of Sumatra, Indonesia.
Map: Abhijitsathe, Wikipedia CC BY-SA 2.5

Some aroids in the GBG: Above left: *Alocasia*. Above right: *Colocasia esculenta* Elephant Ears.
Below left: Yellow flowers: *Zantedeschia*, Calla Lily. Cream flower: *Monstera deliciosa*? Swiss Cheese plant.
Below right: *Dracunculus vulgaris* Dragon arum heats up to encourage insects to seek refuge in cool weather.
All photos: GBG DJ, CC BY-SA.

Some aroids in the GBG Conservatory: Above left: *Philodendron*? Below: *Anthurium*,
Photos: DJ CC BY-SA.
Above right: There are several *Spathiphyllum* species in the Conservatory.
This photo: JJ Harrison, Wikipedia CC BY-SA 3.0