

# Nepenthes

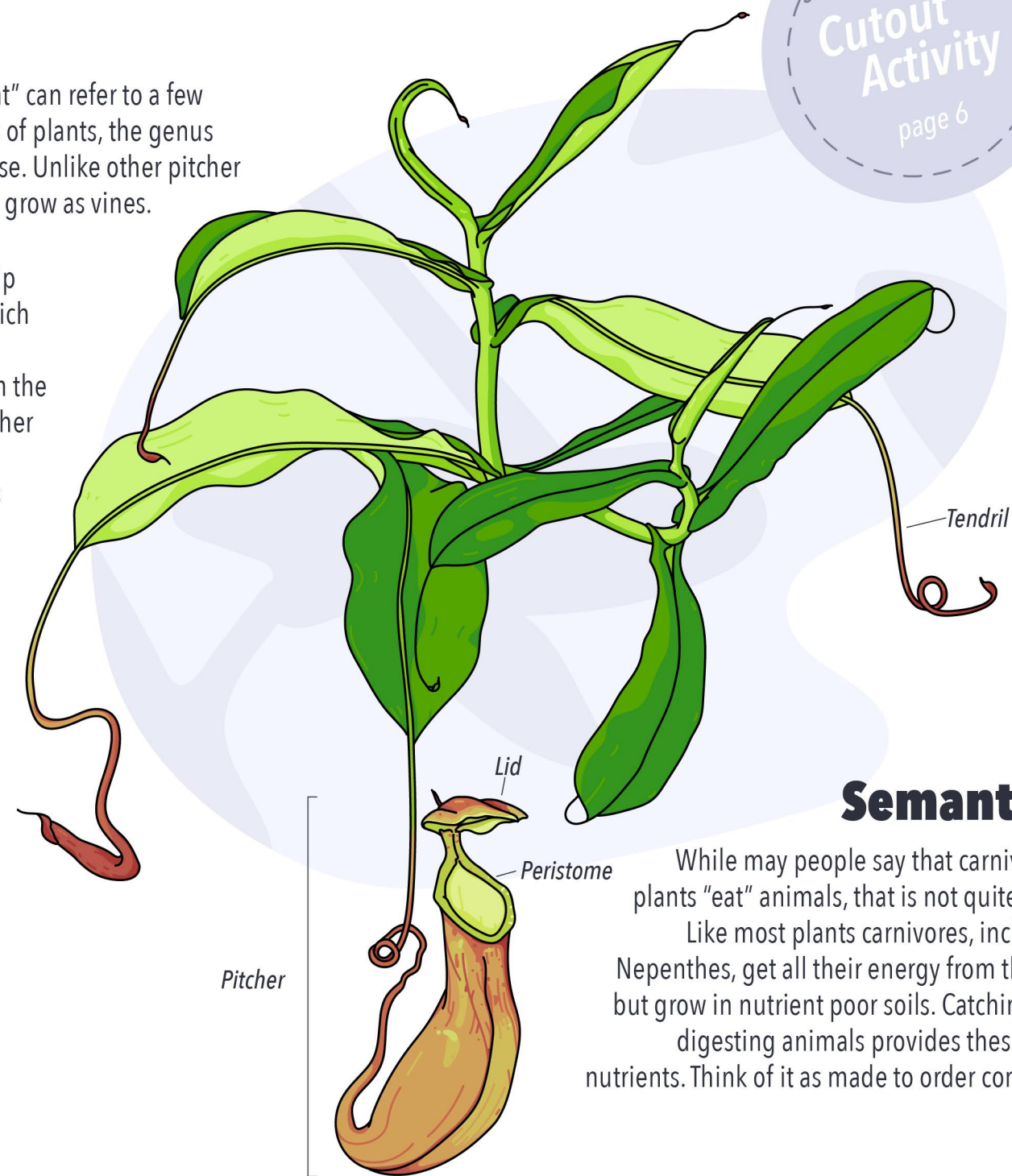
Nepenthes are some of the most iconic carnivorous plants of the tropics, capable of catching everything from mosquitoes to treeshrews. But how do they trick animals into supplying their next meal, and why would a plant even bother? Are they all killers, and how would they survive if they weren't?

## The Basics

While the term "pitcher plant" can refer to a few similar yet unrelated groups of plants, the genus *Nepenthes* is the most diverse. Unlike other pitcher plants, *Nepenthes* generally grow as vines.

As new leaves emerge, the tip extends to form a tendril which whips around searching for something to climb on. From the end of the tendril a new pitcher starts to grow, swelling and stretching until the top pops open.

The peristome and the inside of the pitcher are waxy, causing prey to slip and become trapped within. The lower portion of the pitchers are filled with digestive fluid converting prey into nutrients which the plant can then absorb.



## Semantics

While many people say that carnivorous plants "eat" animals, that is not quite right. Like most plant carnivores, including *Nepenthes*, get all their energy from the sun but grow in nutrient poor soils. Catching and digesting animals provides these trace nutrients. Think of it as made to order compost!

## Biogeography

*Nepenthes* are found across the old world tropics, primarily in the Malay Archipelago. While a high level of genetic diversity between and within species makes it hard to say exactly where *Nepenthes* first evolved, there are clear bursts of diversification on the islands of Borneo, Sumatra, the Philippines where 84%, 87%, and 98% of *Nepenthes* species are found nowhere else.



## Fatal Attraction

It might seem hard to think a plant could successfully catch animals without moving, but plants are experts at manipulation. Consider flowers, which are capable of attracting pollinators using a range of sensory signals and directing them to perform tasks beneficial to the plant. *Nepenthes* pitchers similarly use many of the same strategies as flowers, but for a much more nefarious purpose.

### Taste

Many *Nepenthes* attract animals using droplets of sugar. This nectar is typically found on the underside of the lid or around the peristome, both places where a slip could prove fatal. Some plants go even further and produce a breadcrumb trail of droplets from the stem and up the outside of the pitchers to direct crawling insects like ants.

### Sight

In the past decade scientists have discovered that multiple species of *Nepenthes* fluoresce around the rim of their traps in response to UV light. In turn, insects are attracted to this beacon like well... moths to a flame. When scientists blocked out this fluorescence, insect capture was drastically reduced. Interestingly, similar fluorescence has been found in unrelated North American pitcher plants, further suggesting the usefulness of this adaptation for insect capture.

### Smell

Many insects are highly sensitive to airborne chemicals, and in this regard *Nepenthes* can be real tricksters. Some give off the same smell as flowers, luring would-be pollinators to their deaths. Others mimic decomposing material or the breath of animals by enriching the air within and around their pitchers with carbon dioxide, trapping unsuspecting scavengers and bloodsuckers.



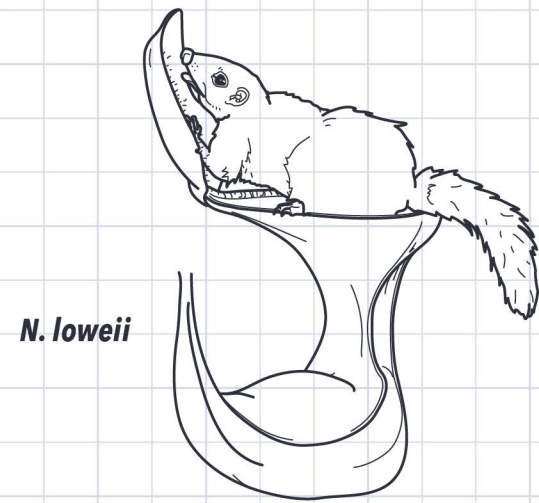
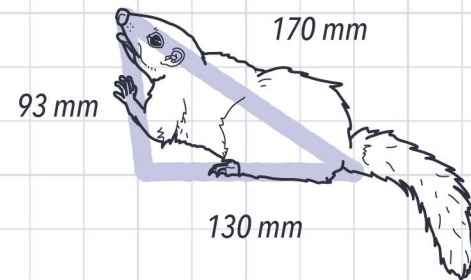


# If you can't eat em, join em!

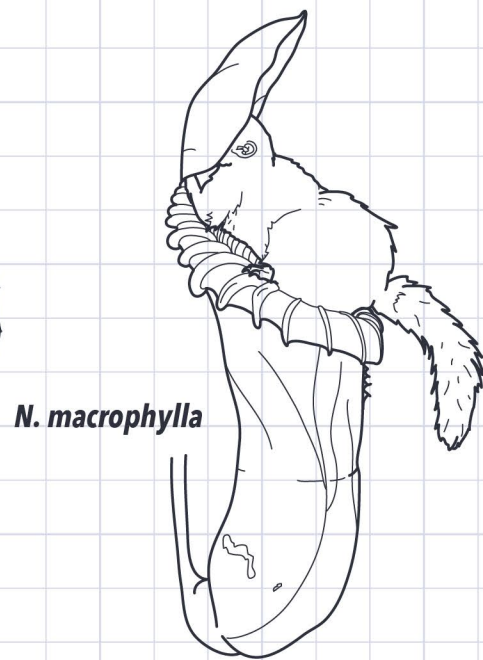
Not all *Nepenthes* are killers. Alright if something happened to die in their pitchers they wouldn't complain, but these "reformed" carnivores build close and sometimes long-term relationships with animals. While what *Nepenthes* offer animals varies from species to species, the payment they seek usually comes down to a regular supply of fresh manure.

## Some crappy geometry

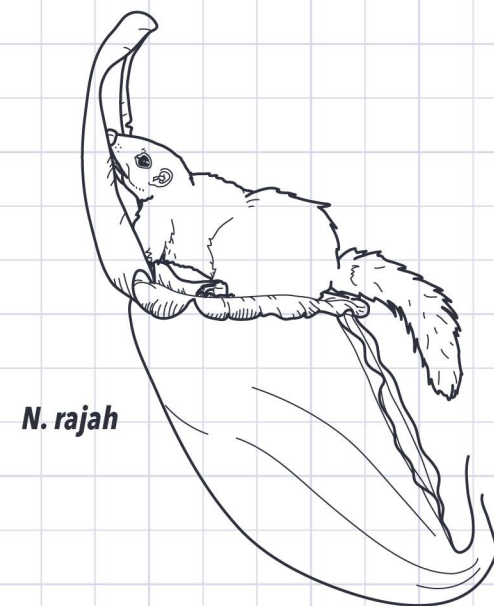
Working on the old adage "if you build it they will come," three different *Nepenthes* from Borneo have evolved traps to match the dimensions of the perfect treeshrew (*Tupaia montana*) toilet. All feature a sugary lid angled back for an easy access reward, which conveniently positions the shrew's backside right over the opening of the pitcher.



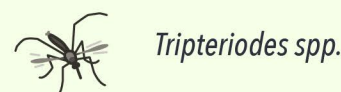
*N. loweii*



*N. macrophylla*



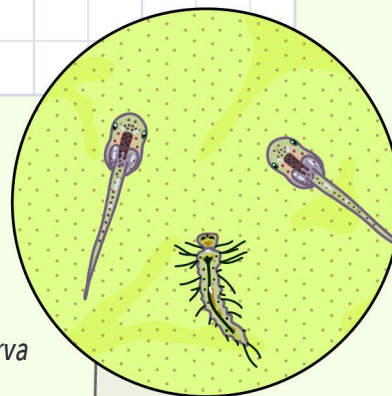
*N. rajah*



*Tripteriodon* spp.

*Geosesarma perracae*

Tadpole & Mosquito Larva

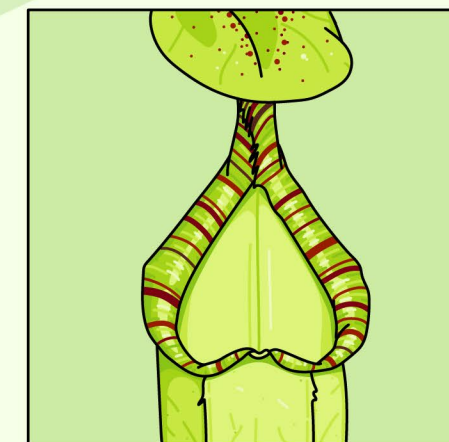


*Microhyla borneensis*

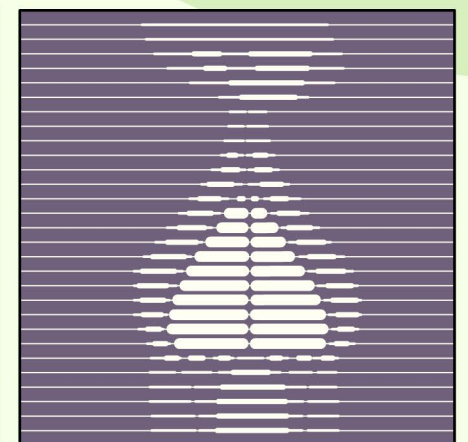


## The loudest house on the block

The pitchers of *Nepenthes hemsleyana* have evolved to be sonic reflectors, bouncing sound off the elongated back wall of the pitcher opening. This enables bats (*Kerivoula hardwickii*) to easily locate the pitchers and roost within, paying the plant for its hospitality with guano. This interaction is the first recorded example of plants using sonic attraction for anything other than pollination.



Human View



Bat View

## Pitchers contain multitudes

Not everything that takes a dip in the fluid of a pitcher becomes a *Nepenthes*'s next meal, creating tiny ecosystems containing anything from bacteria and yeast to insects and small vertebrates. A total of 59 different species have been found living within the pitchers of *Nepenthes ampullaria* (left), which uses these inhabitants to break down the leaf-litter it captures. Pitcher fluids vary widely between species of *Nepenthes*, with some close to water, some thick and viscous, and others as acidic as stomach acid. In this way, *Nepenthes* actively control what can live within their pitchers, cultivating communities which best support their own needs.



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# From leaf to pitcher:

How have *Nepenthes* gone from having normal leaves to leaves with pitchers? Try “evolving” a leaf for yourself by cutting out the whole leaf **1**, then transforming it into a pitcher **2**. What side of the leaf is on the inside of the pitcher? Try colouring this side (top) green.

