
Doing Darwin's experiments



Fly traps and sundews

Activity 1b: Design your own insectivorous plant

Subject: Science

1 hour

Suggested preparation

Presentation:

[Doing Darwin's experiments](#)

What do I need?

Letter 8719 Charles Darwin to Mary Treat 1 Jan 1873

Letter 8989: Mary Treat to Charles Darwin, 28 July 1873

Letter 2908: Darwin to Joseph Hooker, 6th Sept, 1860

Letters questions: Activity 1b

Extract from: *'Insectivorous Plants'*, Charles Darwin, 1875 on *Drosera rotundifolia*

Who's who?

Darwin was fascinated by insectivorous plants. Demonstrate your understanding of the features and functions of insectivorous plants by designing your own.

What do I do?

1. Read through the letters and the extract from Darwin's book and answer the questions.
2. Based on your reading, design your own insectivorous plant, listing all the special features that enable it to survive successfully and to reproduce.

Letter 8719 Charles Darwin to Mary Treat 1 Jan 1873

Down,
Beckenham, Kent.
Jan 1. 73

Dear Madam,

I am very much obliged for your kind letter; & should esteem it a great favour if during warm weather next summer you will observe two points for me in *Drosera filiformis*. Namely to place some flies within quarter of an inch of the apex of the leaf & observe whether it bends at all after an interval of a day or two. Secondly to rub with a clean needle a few of the glands with some little force, and to touch each gland half a dozen times; & then observe whether in the course of an hour or two the hairs or filaments bearing these glands become incurved. I am glad to hear that *D. filiformis* catches only small insects, as I suspected this. I have observed with care several other species of *Drosera*...



With my best thanks
I remain Dear Madam
Yours very faithfully
Charles Darwin



Charles Darwin

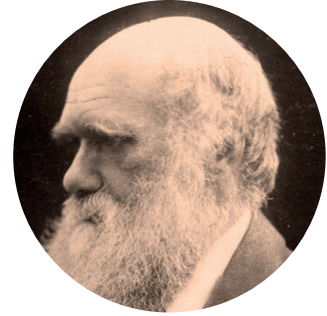
Letter 8989: Mary Treat to Charles Darwin, 28 July 1873

Vineland, New Jersey.
July 28, 1873.

Mr. Darwin—

Dear Sir,

... I carefully removed strong plants away from atmospheric agitation, and found they would bend toward a struggling fly. I pinned living flies within a quarter of an inch of the leaf, in less than an hour the flies legs would become entagled in the filaments. I then tried them three quarters of an inch from the leaves. The leaves bent perceptibly away from the light toward the flies, but did not reach them at this distance. I tried bits of raw beef with the same result. I could see no effect produced upon the glands by rubbing them with a needle; perhaps I did not understand just how you wished it done.



But the most perfect, active fly-trap among these plants is *D. longifolia*. In less than three hours a vigorous healthy leaf will fold completely around a struggling fly, and bits of raw beef will become so enfolded in the leaf as to be completely hidden from view, while mineral substances—dry bits of chalk, magnesia and pebbles made no impression on the leaves. I wet the chalk in water, the filaments soon began to clasp it, but soon unfolded again, leaving it free on the blade of the leaf.

Yours very respectfully

Mary Treat.



Letter 2908: Charles Darwin to Joseph Hooker, 6th Sept, 1860

Down Bromley Kent
Sept 6th

My dear Hooker

With respect to Drosera, there is no doubt that the plant is acute enough & knows what is good. It releases from its grip an inorganic body far sooner than an organic body. But fluids show the difference better than the act of mere releasing. I have tried only the following 14 fluids, made as nearly as possible the same thin consistency, & in most case each fluid on several leaves. Water, syrup of sugar, starch, gum, olive-oil—sherry wine, carbonate of soda; these contain no nitrogen & never cause any inflection of the leaves or hairs. On other hand, milk cold infusion of raw meat, urine, raw white of egg, thin gelatine, thin mucus from lungs, & saliva all cause most powerful contraction & all contain nitrogen.— Saliva contains less than one percent of animal matter. But here comes the really curious case, a solution in proportion of 1 grain of Carbonate of Ammonia to 1 oz of water (ie 1 to 480 parts by weight) & of this solution 1/2 minim being taken, positively & certainly produces great effect. Hence 1/960 of one grain of C. of Ammonia causes contraction. This evening I rerepeated experiment on 5 leaves (on some of which I had put drop of distilled water in morning with no effect) & all are now contracted. Is this not curious? Nor am I got to minimum strength of solution yet.....



Farewell may you prosper

Yours affectionately

C. Darwin



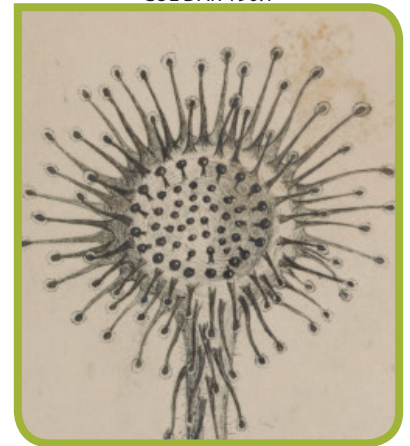
Charles Darwin

Chapter 1: *Drosera rotundifolia* or the Common Sun-dew

During the summer of 1860, I was surprised by finding how large a number of insects were caught by the leaves of the common sun-dew (*Drosera rotundifolia*) on a heath in Sussex.

I had heard that insects were thus caught, but knew nothing further on the subject. I gathered by chance a dozen plants, bearing fifty-six fully expanded leaves, and on thirty-one of these dead insects or remnants of them adhered ... Many plants cause the death of insects, for instance the sticky buds of the horse-chestnut (*Aesculus hippocastanum*), without thereby receiving, as far as we can perceive, any advantage; but it was soon evident that *Drosera* was excellently adapted for the special purpose of catching insects, so that the subject seemed well worthy of investigation...

CUL DAR 190:1



Leaf viewed from above; enlarged four times.

A living insect is a more efficient object than a dead one, as in struggling it presses against the glands of many tentacles. An insect, such as a fly, with thin integuments, through which animal matter in solution can readily pass into the surrounding dense secretion, is more efficient in causing prolonged inflection than an insect with a thick coat, such as a beetle. The inflection of the tentacles takes place indifferently in the light and darkness; and the plant is not subject to any nocturnal movement of so-called sleep....

Not only the tentacles, but the blade of the leaf often, but by no means always, becomes much incurved, when any strongly exciting substance or fluid is placed on the disc. Drops of milk and of a solution of nitrate of ammonia or soda are particularly apt to produce this effect. The blade is thus converted into a little cup. The manner in which it bends varies greatly...

CUL DAR 190:2



(*Drosera rotundifolia* or Common Sun-dew, drawings by George Darwin)

Letter questions:

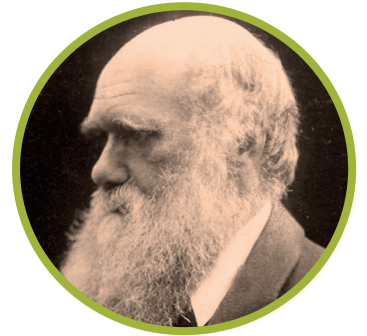
1. What do the letters to Mary Treat and to Joseph Hooker tell us about how Darwin worked?
2. What is he curious about in these letters?
3. How would you describe the extract from Darwin's book '*Insectivorous Plants*' as a scientific account? His book sold well in his lifetime, who do you think it would appeal to and why?

Doing Darwin's experiments

Who's who?

Charles Darwin

Charles Darwin (1809-1882) was a naturalist who established natural selection as the mechanism for the process of evolution. He joined the voyage of HMS *Beagle* when he was 22, a journey he described as the 'most fortunate circumstance in my life'. He wrote to around 2000 correspondents all over the world as a means to inform his research. Most famously he published *On the Origin of Species* in 1859, but he researched and wrote extensively on natural history throughout his life.



Joseph Hooker

Joseph Dalton Hooker (1817–1911) was a botanist who worked chiefly on taxonomy and plant geography. Hooker accompanied James Clark Ross on his Antarctic expedition (1839–43) and later publishing the botanical results of the voyage. He was appointed palaeobotanist to the Geological Survey of Great Britain in 1846. He travelled in the Himalayas (1847–50) and introduced many plants to Britain for the first time. He became Assistant director of the Royal Botanic Gardens, Kew from 1855 to 65 and was made director in 1865. He held the post for 20 years and was knighted in 1877. He was a trusted colleague, close friend and confidant of Charles Darwin for most of his life and exchanged 1,400 letters with him.



Doing Darwin's experiments: Who's who?

Mary Treat

Mary Lua Adelia Treat (1830-1923) was born in Trumansburg, New York but after marriage moved to Vinelands, New Jersey. Her studies of the natural world gave her respect and reputation during her lifetime. Like Darwin she worked at home, creating what she referred to as her 'Insect Menagerie'; an enclosed space from which she observed the minutiae of the natural world around her. After Treat separated from her husband, Dr Joseph Burrell Treat, in 1874, she supported herself by writing popular science articles for widely read magazines and published 5 books. Treat carried out experiments and collected plants and insects for leading naturalists including Asa Gray and Charles Darwin. Darwin commented: 'Your observations and experiments on the sexes of butterflies are by far the best, as far as is known to me, which have ever been made.' Treat exchanged at least 15 letters with Darwin and he acknowledged her work in his book *'Insectivorous Plants'* (1875).



Image of Mary Treat © Vineland Historical and Antiquarian Society