
Darwin's scientific women



Activity 1b: What does an insectivorous plant eat?

Subject: Science

30 minutes for task 1

40 minutes for tasks 2-4

40 minutes for tasks 6-8

(plus set-up time and time to monitor progress
and outcome over several days)

Suggested preparation

Presentation:

[Darwin's scientific women](#)

What do I need?

Letter 8719: Charles Darwin to Mary Treat, 1 Jan 1873

Letter 9485: Mary Treat to Darwin, 28 July, 1873

Extract from Darwin's book *Insectivorous plants*

Letters questions: What does an insectivorous plant eat?

Who's who?

Observations recording table

1 Venus flytrap (*Dionaea muscipula*) plant per group

Different food types cut into small pieces:

e.g.: ham or other cooked meat,

cooked egg white, cheese, polo mint

A pair of tweezers

Dishes for food

American naturalist Mary Treat exchanged several letters with Darwin about the feeding habits of insectivorous plants. Following their observations and experiments you can find out more about nutrient uptake and then compare your findings with Darwin's own.

What do I do?

1. Read through the letters and 'Who's who?', and answer the questions.
2. Observe and make notes on your chart on the state of your plant before the experiment, e.g. size, position, tilt, colour, health, condition of soil. (Use separate plants for each experiment as the experiments will affect the health of the plant.)
3. Add a sample of a selected food to your plant (make the size of the food consistent). Darwin used egg white, gelatine, cheese, roasted meat.
4. Observe how the plant reacts at intervals over a fixed time, comparing whether leaves of Venus flytrap close fully or partially, and monitor the health of the plant, recording your findings on your chart.
5. Open the leaves after a fixed time (e.g. seven days). Extract the remains of food and observe changes.
6. Record findings on your chart. Compare your findings with the class.
7. Read the extract from Darwin's book, *Insectivorous plants*. Compare your results to Darwin's own findings. Consider why might there be different results and what might be the same?

Letter 8719: Charles Darwin to Mary Treat, 1 Jan 1873

Down,
Beckenham, Kent.
Jan 1. 73

Dear Madam,

... Does the *Dionæa* grow in your neighbourhood? If so I much wish to learn what sort of insects it commonly catches, more especially whether large or small kinds. I have sometimes suspected that its structure and movements favour the escape of small insects.



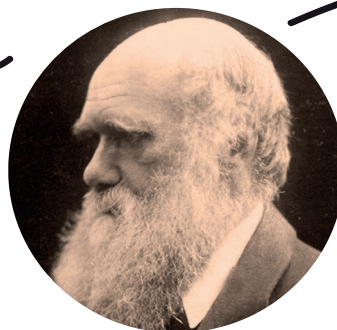
Dr. Gray has given a rather free translation of what I said to him about nerves; and this related only to *Drosera*. I have found that by pricking a particular point in the leaf I can paralyze half of it; but I must make many more trials next summer before coming to any final conclusion.

With my best thanks

I remain Dear Madam

Yours very faithfully

Charles Darwin



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Letter 9485: Mary Treat to Charles Darwin, 8 June 1874

June 8, 1874. Vineland, New Jersey

Dear Mr. Darwin,

Some time ago you asked me some questions with regard to *Dionæa*. I was not at that time prepared to answer, but since the latter part of April I have been giving the closest attention to these wonderful plants—now in their best working condition—I am with them during a large part of each day, while the insects are the most active. I have over thirty good, strong, vigorous plants; twenty-five of these I have numbered, and keep a record of the closing of each leaf, and the kind of insect it captures, and the number of days before it uncloses, with many other items. The remainder of the plants I am working with, with a view to see if there is any other point so connected with the bristles on the upper surface of the leaf-trap—the seemingly nervous centre—so that I can make any perceptible effect upon this centre.

One plant has caught two of the sprawling rose-chafers (*Macroductylus subspinosus*). These beetles are quite strong, and one of the fellows escaped from two traps, but was finally captured by a vigorous leaf that closed over him so quickly, there was no space left for his head to get through.

About two weeks ago a leaf captured a homopterous insect (*Metapodius nasalus*), nearly as large as the squash-bug (*Coreus tristis*). When caught it emitted a disagreeable odor, peculiar to this class of insects; and to my surprise the leaf opened yesterday in good condition, and there was nothing left of the insect but the shell ...

You asked what kind of insect *Dionæa* commonly caught. It most commonly catches Dipterous flies, frequently much smaller than the house-fly. If a fly is large enough to move a bristle, so as to close the trap, I never saw it escape from a vigorous leaf—one that acts quickly ...

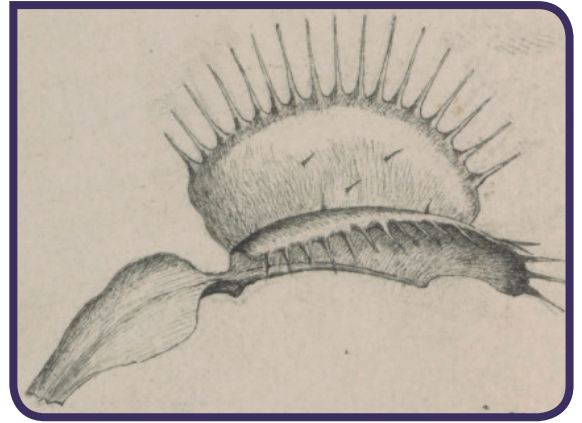
Yours most truly

Mary Treat.



Insectivorous plants, Charles Darwin, 1875, (extracts from pp. 302–303)

Chapter 13: *Dionaea muscipula*



Experiment 2.—A bit of albumen $\frac{1}{10}$ of an inch square, but only $\frac{1}{20}$ in thickness, and a piece of gelatine of the same size as before, were placed on a leaf, which eight days afterwards was cut open. The surface was bathed with slightly adhesive, very acid secretion, and the glands were all in an aggregated condition. Not a vestige of the albumen or gelatine was left. Similarly sized pieces were placed at the same time on wet moss on the same pot, so that they were subjected to nearly similar conditions; after eight days these were brown, decayed, and matted with fibres of mould, but had not disappeared ...

Experiment 7.—A bit of half roasted meat (not measured) and a bit of gelatine were placed on the two ends of a leaf, which opened spontaneously after eleven days; a vestige of the meat was left, and the surface of the leaf was here blackened; the gelatine had all disappeared ...

Experiment 10.—A cube of $\frac{1}{20}$ of an inch of cheese and another of albumen were placed at opposite ends of the same leaf. After nine days the lobes opened spontaneously a little at the end enclosing the cheese, but hardly any or none was dissolved, though it was softened and surrounded by secretion. Two days subsequently the end with the albumen also opened spontaneously (i.e. eleven days after it was put on), a mere trace in a blackened and dry condition being left ...

These experiments are sufficient to show that the secretion from the glands of *Dionaea* dissolves albumen, gelatine, and meat, if too large pieces are not given. Globules of fat and fibro-elastic tissue are not digested. The secretion, with its dissolved matter, if not in excess, is subsequently absorbed. On the other hand, although chemically prepared casein and cheese (as in the case of *Drosera*) excite much acid secretion, owing, I presume, to the absorption of some included albuminous matter, these substances are not digested, and are not appreciably, if at all, reduced in bulk.

Letter questions:

1. What does Darwin ask Mary Treat to observe and why?
2. Describe Treat's observations of *Dionaea* in letter 9485. What is she recording and why?
3. What happened when the leaf captured a homopterous insect (has membranous forewings and hind wings) and what bearing did it have on the plant? What does this show?

Darwin's scientific women

Who's who?

Elizabeth Garrett Anderson

(9 June 1836 – 17 December 1917)

Physician and supporter of women's rights.

Elizabeth Garrett was born in Whitechapel, London. She was initially educated at home but at 13 was sent to boarding school. She was always interested in politics and current affairs but decided to pursue a career in medicine at a time when women were prevented from qualifying as doctors in Britain. She worked as a nurse while studying privately and was eventually allowed to attend the dissecting room and lectures at Middlesex Hospital until a petition by male students forced her to leave. She was refused entry to several medical schools but continued to study privately until taking her Society of Apothecaries exam in 1865, and was awarded a licence to practise medicine. She was the first British woman qualified to do so, but could not work at any hospital so set up her own practice, eventually providing medical care to poor women and children across London. In 1874, she co-founded the London School of Medicine for Women, the only teaching hospital to offer courses for women. A colleague of Darwin's wrote to Emma Darwin to ask her to support Garrett's becoming Professor of Physiology at Bedford College for Girls.



Image of Elizabeth Garrett Anderson ©National Portrait Gallery, London. NPG x8446. CC BY-NC-ND 3.0

Darwin's scientific women: Who's who?

Mary Elizabeth Barber

(5 January 1818 – 4 September 1899)

Naturalist, artist, and writer in South Africa.

Mary Barber (born Bowker) was born in Wiltshire, England, but her family emigrated to South Africa when she was 2 years old. She shared her older brother's keen interest in natural history. Barber studied birds, moths, reptiles, and plants, often creating detailed and accurate paintings. A number of species of insects and plants that she discovered were named after her. She corresponded with leading scientists and exchanged letters with Joseph Hooker at Kew Gardens for thirty years. Hooker read some of her scientific papers at the Linnaean Society and several were published at Darwin's recommendation.



Image of Mary Barber courtesy of Paul Tanner-Tremaine and Ammy Hahndiek

Lydia Ernestine Becker

(24 February 1827 – 18 July 1890)

Suffragist, botanist, and astronomer.

Lydia Becker was born in Chadderton, Lancashire, and was educated at home. She studied botany and astronomy and was awarded a Horticultural Society gold medal in 1862. In 1864, she published *Botany for novices*, which she described to Darwin as being 'chiefly intended for young ladies'. She was founder and president of the Manchester Ladies' Literary Society and persuaded Darwin to send articles for the society to discuss. She was a leading member of the women's suffrage movement, becoming secretary to the Manchester Women's Suffrage Committee from 1867, and later to the Manchester National Society for Women's Suffrage. She was editor of and a regular contributor to the *Women's Suffrage Journal* from 1870. She moved to London and was elected president of the newly formed National Union of Women's Suffrage Societies in 1887. Becker exchanged botanical information, seeds, and plants with Darwin, as well as sharing papers and a copy of her book.



Darwin's scientific women: Who's who?

Antoinette Brown Blackwell

(20 May 1825 – 5 November 1921)

Ordained minister, writer, feminist, and social reformer



Antoinette Brown was born in Henrietta, New York. In early life she began to preach in her local Congregational Church and went on to teach. Throughout her life she was a renowned public speaker. Brown was the first woman to be ordained as a minister in the United States. She was a vociferous social reformer and promoter of women's rights. She later became a Unitarian and remained committed to the idea of that women's participation in religion could improve their status in society. She was also a keen philosopher and scientist. She believed Darwin to be one of the most influential thinkers of her time. After she sent Darwin a copy of her book *Studies in general science*, Darwin's reply to thank the author began 'Dear Sir', as he assumed it had been written by a man.

Image of Antoinette Brown Blackwell from archive.org. Digitised by Wellesley College Library

Emma Darwin

(2 May 1808 – 7 October 1896)

Wife of Charles Darwin and mother of ten children; assisted her husband.



Emma Darwin (born Wedgwood) was born at the family estate of Maer Hall, Maer, Staffordshire. She was the youngest of seven children and was Charles Darwin's first cousin. Her family belonged to Unitarian church and Emma's faith remained important to her. It was something that she explored and discussed with Darwin at length before they married, and it continued to be actively analysed and debated between them. Emma Wedgwood married Charles Darwin on 29 January 1839 and they were the parents of ten children, three of whom died at early ages. Emma assisted Darwin, writing on his behalf during his many bouts of illness, monitoring his press, translating, and editing.

Darwin's scientific women: Who's who?

She also received letters detailing observations (particularly from female correspondents) of the behaviour and emotions of children. She and Darwin kept notebooks on their own children as the children grew up. Such observations informed Darwin's later works on human emotion and behaviour. Emma also wrote on the issue of animal cruelty.

Henrietta Darwin

(25 September 1843 - 17 December 1929)

Assistant to her father and editor of his published work



Henrietta was the third daughter of Charles and Emma Darwin, born at Down House, the family home in Kent. Henrietta and her brothers and sisters worked closely with their father, making observations and carrying out experiments, even as children. As she grew up, Henrietta also liaised with many of Darwin's correspondents requesting specific observations and collating their responses. Most significantly, Darwin entrusted Henrietta to edit a large proportion of his published work, including his book *The descent of man* regarding which Darwin referred to Henrietta as his 'very dear coadjutor and fellow-labourer'. (Charles Darwin to Henrietta Darwin, 20 Mar 1871). In replying to Henrietta's suggested revisions he wrote:

'All your remarks, criticisms doubts and corrections are excellent, excellent, excellent' (Charles Darwin to Henrietta Darwin, 26 July 1867).

In August 1871 she married Richard Buckley Litchfield. Henrietta edited two volumes of family letters after the death of her parents; *Emma Darwin: a century of letters* (1904 and 1915).

Darwin's scientific women: Who's who?

Lady Florence Dixie

(24 May 1855 – 7 November 1905)

Traveller, war correspondent, writer, and feminist

Florence Dixie (born Douglas) was born in Dumfries, Scotland. She was educated at home and in a convent. In 1879, she travelled to Patagonia with her husband and enjoyed big-game hunting (although she later turned against blood sports). She brought home a jaguar and kept it as a pet, describing to Darwin how she had to give it to the zoo as it had grown too big to keep safely. In 1881, Dixie was appointed as a war correspondent of the London *Morning Post* to cover the First Boer War. Dixie was politically active; she was strongly in favour of Irish home rule and women's suffrage. In the preface to her utopian feminist novel, *Gloriana* (1890), she wrote:



'Nature has unmistakably given to woman a greater brain power. This is at once perceivable in childhood ... Yet man deliberately sets himself to stunt that early evidence of mental capacity, by laying down the law that woman's education shall be on a lower level than that of man's ... I maintain to honourable gentlemen that this procedure is arbitrary and cruel, and false to Nature.'

Dixie wrote to Darwin of her observations on Patagonian animal life.

Image of Florence Dixie ©National Portrait Gallery, London. NPG. D16189. CC BY-NC-ND 3.0

Marianne North

(24 October 1830 - 30 August 1890)

Botanical artist and traveller

Marianne North was born in Hastings, where her father became a Liberal MP. Her family supported Marianne's attempts at singing and painting as suitable activities for a Victorian lady.



After her parents died, Marianne sold the family home and began travelling with the aim of painting the flora of different countries. Between 1871 and 1885, Marianne North visited America, Canada, Jamaica, Brazil, Tenerife, Japan, Singapore, Sarawak, Java, Sri Lanka, India, Australia, New Zealand, South Africa, the Seychelles, and Chile. During this time she travelled alone through the interior of Brazil for a year and through India for eighteen months, often exploring areas unknown to Europeans. Darwin recommended to North that she visit Australia. On her return she visited Down House in 1881, to show the Darwins her paintings of Australian flora. Back in England, she approached Kew Gardens to show her work and paid for a gallery to be built to house the collection. It is part of the attractions at Kew today.

Image of Marianne North ©National Portrait Gallery, London. NPG x128767. CC BY-NC-ND 3.0

Clémence Royer

(21 April 1820 – 6 February 1902)

Scholar who wrote on economics, philosophy, science, and feminism and translated *On the origin of species* into French.

Royer was born in Nantes, Brittany, and was mainly educated at home. She taught herself French, arithmetic, and music to qualify as a teacher in a secondary school, living in Paris and then England. Royer moved to Lausanne, Switzerland, and in 1859 gave a series of lectures aimed at women; she was a great advocate of women's rights. She was a strong supporter of Darwin's ideas and is most known for her French translation of *On the origin of species* in 1862. Her preface was a strongly expressed sixty-page essay against organised religion and she added her own footnotes to Darwin's text. Darwin wrote to his friend and colleague Asa Gray:

'I received 2 or 3 days ago a French translation of the Origin by a Madelle. Royer, who must be one of the cleverest & oddest women in Europe: is ardent deist & hates Christianity, & declares that natural selection & the struggle for life will explain all morality, nature of man, politicks &c &c!!!'



Image of Clémence Royer from the Biodiversity Heritage Library. Digitised by University of Toronto | www.biodiversitylibrary.org

Darwin's scientific women: Who's who?

Mary Lua Adelia Treat

(7 September 1830 – 11 April 1923)

Naturalist, botanist, and writer



Mary Treat (born Davis) was born in Trumansburg, New York, but after her marriage moved to Vinelands, New Jersey. Her studies of the natural world brought her respect and a good reputation as an observer during her lifetime. As well as travelling to collect specimens, she worked part of the year at home, like Darwin, 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 five 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.' Darwin encouraged Treat to publish her results in an academic journal, but she remarked: 'You may wonder at my selecting a literary magazine rather than a scientific one, but I am wholly dependent on my own exertions and must go where they pay best,' Darwin acknowledged Treat's work in his book *Insectivorous plants* (1875.)

Image of Mary Treat © Vineland Historical and Antiquarian Society

What does an insectivorous plant eat? Observations and record of digestion process

Date and time	Action taken (e.g. addition of food sample and subsequent observations)	Description of leaves	General health of plant	Additional notes
Day 7 - open up leaves				

