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# Darwin's scientific women

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Activity 1a: Attracting moths at night

Subject: Science

In class: 20 minutes for tasks 1-3.

At home: 15 minutes to set up,  
2 hours to observe and record; can be repeated over  
several nights to compare results.

## Suggested preparation

Presentation:

[Darwin's scientific women](#)

## What do I need?

Letter 8113: Mary Treat to Charles Darwin, 20 Dec 1871

Letter 8146: Charles Darwin to Mary Treat, 5 Jan 1872

Letter questions: Attracting moths at night  
Who's who?

2 white sheets

A bright torch or camping lamp

Several egg boxes or (ideally) egg trays

A washing line with pegs

A moth identification guide (download from the internet) or buy from the Field Studies Council.)

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Both Mary Treat and Darwin used their homes as scientific labs for performing experiments and carefully observing the natural world. The letters show how Mary Treat carried out observational work on butterfly larvae and reported her findings to Darwin. Your experiment helps you to observe, monitor and identify moth species. It needs to be carried out at night.

## What do I do?

1. Read through the letters and 'Who's who?', and answer the questions below the letters.
2. Discuss what is necessary to conduct a meaningful scientific experiment.
3. Design a moth data recording chart, include space to note weather conditions, number of species and varieties, landing sites, and time.
4. At home: hang up one white sheet on the washing line and spread out the other on the ground.
5. Shine the lamp towards the hanging sheet.
6. Spread the egg boxes/trays on the sheet on the ground.
7. After dark, watch for the moths: some will land on the sheet and some will settle in the egg boxes.
8. Record how many species and numbers you see on your chart, and photograph the moths.
9. Once the moths have been counted, release them in different locations, away from predators.
10. Use the guide to identify moths from your photographs.
11. Compare your results with the rest of your class.

**Note: Ideal conditions are a warm, cloudy, dry, humid night with little or no breeze and no moon. The cloudier and more humid it is, the more moths you will catch.**

# Letter 8113: Mary Treat to Charles Darwin, 20 Dec 1871

Dec. 20, 1871 Vineland, New Jersey

Mr. Darwin:



Dear Sir,

Experimenting with *Papilio asterias*, Cramer, I learned to distinguish the sex in the larva state—the female being larger than the male—and this led me to try to control the sex.

My first experiments were a year ago last summer, some three or four hundred miles inland, where I had much better success than I had here last summer near the coast.

The larvae of my first experiment were of the first brood, so that I only had to wait a few days for their final transformation. These larvae fed on two quite dissimilar Umbelliferous plants—the Poison Hemlock (*Conium maculatum*), and the Caraway of the gardens (*Carum Carni*). I could always distinguish the larvae that fed on the Poison Hemlock from those that fed on the Caraway; but with the butterflies there was little or no marked difference in their general appearance...

## Letter 8113: Mary Treat to Charles Darwin, 20 Dec 1871

I noticed that the female larva fed longer than that of the male. So taking several larvae of the same age, I found some specimens were inclined to leave their food several days earlier than others, and these always proved to be males. It then occurred to me to try to induce some of these male larvae to feed longer; so, after they had wandered from their food, and even selected places for their transformations, (of course not fixed), if I disturbed them, made them leave their places, and coaxed them with a fresh supply of their favorite food, I could almost invariably induce them to eat from ten days to two weeks longer, when all such ones would be females— ...

On the other hand, when a larva had become the right size to produce a male, if I cut off its supply of food, even when it was eating greedily, it would wander about perhaps a little longer, as if in search of food, but finally it almost always changed to the chrysalis, and such a chrysalis always produced a male butterfly...

I do not know that my experiments can be of use to you, but I thought perhaps they might interest you. A life time of observation and experiments could not repay the debt of gratitude we owe you.

Yours most respectfully,

Mrs. Mary Treat.



## Letter 8146: Charles Darwin to Mary Treat, 5 Jan 1872

Jan 5. 1872  
Down,  
Beckenham, Kent.

Dear Madam



Your observations and experiments on the sexes of butterflies are by far the best, as far as known to me, which have ever been made. They seem to me so important, that I earnestly hope you will repeat them & record the exact numbers of the larvæ which you tempt to continue feeding & deprive of food, & record the sexes of the mature insects.

Assuredly you ought then to publish the result in some well-known scientific journal.

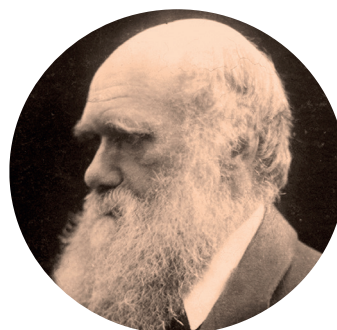
I am glad to hear that your observations on *Drosera* will be published.

I have attended to this subject during several years, & have almost M. S. enough to make a volume; but have never yet found time to publish it.

I am very much obliged for yr courteous letter & remain dear Madam

Yours faithfully

Charles Darwin



## Letter questions:

1. Describe Mary Treat's experiment with larvae: what results did she get?
2. How was the experiment conducted and with what materials?
3. Why might it be significant that Darwin congratulates Treat on her experiments, given the context of the nineteenth century?
4. Why might Darwin want Treat to repeat and record her experiments?

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# Darwin's scientific women

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## 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](http://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