
Doing Darwin's experiments



Survivor seeds

Activity 2a: Saltwater seeds

Subject: Science

45 minutes for task 1, 40 minutes for task 2-3, 20 minutes for task 5. Plus observation and recording time

Suggested preparation

Presentation:

[Doing Darwin's experiments](#)

What do I need?

[Letter 1661](#) Charles Darwin to Joseph Hooker

[Letter 1667](#) Charles Darwin to Joseph Hooker

[Letter 1681](#) Charles Darwin to Joseph Hooker

[Letter 1783](#) Charles Darwin to Gardener's Chronicle

[Letter 1962](#) Charles Darwin to Philip Gosse

[Letters questions](#): saltwater seeds

[Who's who?](#)

[5 different types of seed](#): Darwin used oats, corn, broccoli, radishes, flax, spinach, pea, capsicum and lettuce

[Saltwater seeds recording chart](#)

[Small vial of salt water](#) (average salt content of sea water = 3% but varying strengths could be tried)

[5 small pots of moist compost](#)

Darwin was fascinated by how seeds might travel great distances and experience extreme conditions and yet still germinate. In this experiment he used commonly found vegetable seeds and soaked them in salt water for different periods of time to see whether they would still germinate afterwards. Try it out and compare your results with his.

What do I do?

1. Read through the letters and answer the questions.
2. Write down the name and a description of your seeds, predict which you think will survive the salt water and why.
3. Place the seeds in small vial of salt water for 1 week.
4. Monitor during the week and record findings on the chart.
5. Plant the seeds in small pots of moist compost.
6. Observe the seeds at regular intervals for 2 weeks.
7. Record the number of seeds that have germinated on a graph.

Letter 1661, Charles Darwin to J. D. Hooker 7 Apr 1855

Down Ap. 7th

My dear Hooker

I wrote this morning to thank for the Rhododendrums.—

I have begun my seed-salting experiments, & I shd. be extremely much obliged if you would tell me what kinds you would expect to be most easily killed by sea-water besides the Cruciferæ, which I had thought wd. be so, & which you confirmed; I had meant to have asked, but quite forgot, when I last saw you.—



If you can mention any that are easily procured, as Agricultural or Garden or flower seeds,—please enumerate Just a few.— Secondly will you tell me, at a guess, how long an immersion in sea-water you shd. imagine wd. kill the more susceptible seeds? Should you expect a week's fair immersion wd. destroy any of them?...

Adios

C. Darwin



Charles Darwin

Letter 1667, Charles Darwin to J. D. Hooker 13 Apr 1855

My dear Hooker

....Fourthly. Thank you very much for the information about the seeds. I had fancied you had some definite opinion that seeds of certain groups could not possibly withstand salt-water. I am not yet prepared to try the experiment on so large a scale as you suggest: indeed I have hardly the means; but I am glad to find I have commenced very much on the principles you suggest, but on a much smaller scale. I have had one experiment some little time in progress, which will I think be interesting, namely seeds in salt water immersed in water of 32o–33o, which I have & shall long have, as I filled a great tank with Snow...

I have in small bottles out of doors, exposed to variations of temp., but in shade, exposed to light, as yet only Cress, Radish, Cabbages, Lettuces, Carrots, Celery, & Onion seed; 4 great Families.

These after immersion for exactly one week, have all germinated, which I did not in the least expect, (& thought how you wd. sneer at me) for the water of nearly all & of the cress especially, smelt very badly, & the cress-seed emitted a wonderful quantity of mucus (the Vestiges would have expected them to turn into tadpoles) so as to cohere in a mass; but these seeds germinated & grew splendidly. The germination of all (especially Cress & Lettuces) has been accelerated, except the cabbages, which have come up very irregularly & a good many, I think, dead. One wd. have thought from native habitat that cabbage wd. have stood well.

The Umbelliferæ & onions seem to stand the salt well. I wash the seed before planting them... To day I replant the same seeds as above after 14 days immersion. As many sea-current go a mile an hour: even in a week they might be transported 168 miles: the Gulf-stream is said to go 50 & 60 miles a day.—So much & too much on this head; but my geese are always swans.—...

Goodbye
My dear Hooker
Most truly yours
C. Darwin

I plant my salted seeds in glass tumblers (having first tried & recorded rate of germination of same seeds unsalted) so that I can see the seed all the time, before & after germination, on the chimney piece.

Letter 1681, Charles Darwin to J. D. Hooker, 15 May 1855?

15th Down

My dear Hooker

... Everything has been going wrong with me lately; the fish at the Zoolog. Soc. ate up lots of soaked seeds, & in imagination they had in my mind been swallowed, fish & all, by a heron, had been carried a hundred miles, been voided on the banks of some other lake & germinated splendidly,—when lo & behold, the fish ejected vehemently, & with disgust equal to my own, all the seeds from their mouths.—



But I am not going to give up the floating yet: in first place I must try fresh seeds, though of course it seems far more probable that they will sink; & secondly as a last resource I must believe in the pod or even whole plant or branch being washed into sea: with floods & slips & earthquakes; this must continually be happening, & if kept wet, I fancy the pods &c &c wd. not open & shed their seeds.—...

Goodbye my dear Hooker

Ever yours

C. Darwin



Charles Darwin

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Letter 1783: Charles Darwin to Gardeners' Chronicle, 21 Nov, 1855

As you have published notices by Mr. Berkeley and myself on the length of time seeds can withstand immersion in sea-water, you may perhaps like to hear, without minute details, the final results of my experiments.

The seed of Capsicum, after 137 days' immersion, came up well, for 30 out of 56 planted germinated, and I think more would have grown with time. Of Celery only 6 out of some hundreds came up after the same period of immersion. One single Canary seed grew after 120 days, and some Oats half germinated after 120; both Oats and Canary seed came up pretty well after only 100 days. Spinach germinated well after 120 days.

Seed of Onions, Vegetable Marrow, Beet, Orache and Potatoes, and one seed of Ageratum mexicanum grew after 100 days. A few, and but very few, seed of Lettuce, Carrot, Cress, and Radish came up after 85 days' immersion. It is remarkable how differently varieties of the same species have withstood the ill effects of the salt water; thus, seed of the "Mammoth White Broccoli" came up excellently after 11 days, but was killed by 22 days' immersion; "early Cauliflower" survived this period, but was killed by 36 days; "Cattell's Cabbage" survived the 36 days, but was killed by 50 days; and now I have seed of the wild Cabbage from Tenby growing so vigorously after 50 days, that I am sure that it will survive a considerably longer period. But the seed of the wild Cabbage was fresh, and some facts show me that quite fresh seed withstands the salt water better than old, though very good seed...

Charles Darwin, Down, Nov. 21....



Charles Darwin

Letter 1962: Charles Darwin to Philip Henry Gosse, 28 Sept, 1856

... I am very anxious to get all cases of the transport of plants or animals to distant islands. I have been trying the effects of salt water on the vitality of seeds—their powers of floatation—whether earth sticks to birds' feet or base of beak, and I am experimenting whether small seeds are ever enclosed in such earth, etc. Can you remember any facts? But of all cases whatever, the means of transport (and such I must think exist) of land mollusca utterly puzzle me most. I should be very grateful for any light....



Charles Darwin

Letter questions:

1. Using letters 1681 and 1962, describe the ways in which Darwin is exploring how seeds are transported. How else might seeds be transported?
2. Using letter 1783 to the Gardener's Chronicle magazine, create a chart for the different types of seed that Darwin used, recording how long he immersed the seeds in salt water and what the results were.
3. Looking at letters 1661, 1667, 1681 and 1962, what questions does Darwin asks his correspondents regarding his research and what issues does he experience when carrying out his experiments?

Saltwater seeds recording table

Week 1	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Seed type 1 Name:							
Seed type 2 Name:							
Seed type 3 Name:							
Seed type 4 Name:							
Seed type 5 Name:							
Week 2	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Seed type 1							
Seed type 2							
Seed type 3							
Seed type 4							
Seed type 5							

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.



The Gardeners' Chronicle

The Gardeners' Chronicle was a British horticulture periodical, founded in 1841 by the horticulturalists Joseph Paxton, Charles Wentworth Dilke, John Lindley and William Bradbury. It lasted as a title in its own right for nearly 150 years. It originally took the form of a traditional newspaper, with both national and foreign news, but also with vast amounts of material sent in by gardeners and scientists, covering every conceivable aspect of gardening. Its first editor, John Lindley, was one of the founders. Darwin regularly contributed notes and letters to the journal.

Philip Henry Gosse

Philip Henry Gosse (1810–88) was a zoologist, traveller and writer. He collected zoological specimens in the West Indies for the British Museum (1844–6). He studied marine invertebrates and Darwin approached him for information on dispersal and survival of seeds in a coastal context.



Image of Philip Henry Gosse ©National Portrait Gallery, London. NPG P120(51). CC BY-NC-ND 3.0

Doing Darwin's experiments: Who's who?

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.

