



‘On Aerial Navigation’ – Correspondence between Cayley, Carlisle & Nicholson at the Royal Aeronautical Society Archives

William Nicholson (1753-1815) published six articles by Sir George Cayley in the *Journal of Natural Philosophy, Chemistry & the Arts*, between 1807 and 1813.

Sir George Cayley's (1773-1857) three articles ‘On Aerial Navigation,’ published in November 1809, February and March 1810, have been described as ranking among ‘the most important aeronautical documents in history’¹

Anthony Carlisle (1768-1840) was an ambitious surgeon, a member of the Royal Society, and in 1809 had obtained the position of Professor of Anatomy at the Royal Academy.

Nicholson and Carlisle are best known for their experiments in May 1800, when they used a voltaic battery to generate an electric current to separate water into hydrogen and oxygen – a technique later named electrolysis. Their experiments showed that electricity could trigger a chemical reaction – giving birth to the field of electrochemistry.

But Carlisle had long held a passionate interest in the possibility of manned flight, which he had kept secret after being ridiculed for an early experiment.

On searching the NAL for correspondence between Cayley and Nicholson, I discovered these seven letters from Carlisle to Cayley which provide a fascinating insight into Carlisle's studies and his ambitions. They also provide a glimpse of the reputational risks for anyone who wished to associate themselves with experimental flight at that time, and helped identify a previously unattributed article by Carlisle in Nicholson's *Journal*.

Acknowledgements

I am extremely grateful to the Cayley family, for agreeing that I can publish these letters on the NicholsonsonJournal.com website, as only small extracts will be included in Nicholson's biography.

I would also like to express my thanks to Tony Pilmer MCLIP FRAeS and Anne Hayward MCLIP at the National Aerospace Library, Royal Aeronautical Society for all their kind and patient assistance.

Sue Durrell, September 2026

¹ Anderson, John D., Jr. *Inventing Flight: The Wright Brothers and Their Predecessors*. Johns Hopkins University Press, 2004.



Cayley's articles in Nicholson's Journal of Natural Philosophy, Chemistry & the Arts.

William Nicholson (1753-1815) published six articles by Sir George Cayley in the Journal of Natural Philosophy, Chemistry & the Arts, between 1807 and 1813.

These articles can be accessed via links to Google Books on the website:

<https://www.nicholsonsjournal.co.uk/nicholsonsjournal-index.html>

And search by the author's name:

Search by

Author

Cayley

Category

Any category

Date

from

MM/YYYY

to

MM/YYYY

Keywords

Search

Results (6 found, page 1)

Search results will appear in date order, followed by author, then by title.

Date	Title	Author	View online
December 1807	Description of an Engine for affording Mechanical Power from Air expanded by Heat.	Cayley, Sir George, 6th Baronet of Brompton	
April 1809	Plan for an improved Theatre.	Cayley, Sir George, 6th Baronet of Brompton	
November 1809	On Aerial Navigation.	Cayley, Sir George, 6th Baronet of Brompton	
February 1810	On Aerial Navigation.	Cayley, Sir George, 6th Baronet of Brompton	
March 1810	On Aerial Navigation.	Cayley, Sir George, 6th Baronet of Brompton	
July 1813	Observations respecting the Figure of a drowned Man formed in the Ice of the Pond in Hainaker Park, and upon the explanations which have been offered of that singular Phenomenon.	Cayley, Sir George, 6th Baronet of Brompton	



7 September 1809

Sir George Cayley, Brompton, to William Nicholson

Sent his first paper 'On Aerial Navigation'

Published in Nicholsons Journal – November 1809, February 1810, March 1810

1809, 22 September

William Nicholson to Sir George Cayley, in Malton, Yorkshire²

Sir

I have received your interesting [paper] on arial Navigation & as the Engravings will retard its Insertion into the journal to be published Nov 1. I have time to beg the favor that you would say whether your Name is to be put in the title or head. I hope so; but this not being clearly signified I have thought it best to trouble you with a line.³

I have the honour to be, Sir, Your most obliged servant

Wm Nicholson

Charlotte Street, Bloomsbury

November 1809

'On Aerial Navigation' – Published in Nicholsons Journal of Natural Philosophy, Chemistry & The Arts,

Page 164

<https://books.google.co.uk/books?id=meI3AQAAIAAJ&printsec=frontcover&dq=editions:gEL4pC4xw5kC&hl=en&sa=X&ei=hvDEU4DhFaeL7AaKj4HIDQ&ved=0CCYQ6AEwAjge#v=onepage&q=Cayley&f=false>

² *Royal Aeronautical Society – Sir George Cayley papers cay/2 (Cayley A0)*

³ Nicholson gave contributors the option to have their articles published anonymously.



2 November 1809

Anthony Carlisle to Sir George Cayley⁴

Sir

The communication which you have so liberally given in the last Number of W Nicholson's Journal induces me to wish for the honour of your acquaintance.

I have meditated upon Arial Navigation as it relates to the Animal Powers for several years & having collected some facts and made observations which do not appear in your Published Letter, it is probable that they may be new to you.

Should you pass my door any morning & honour me with a call, I might explain the leading points of my enquiries.

I should not ask this, if I could spare time to call on you, but professional occasions are unusually pressing at this moment.

Sir, your obedient servant.

A. Carlisle

⁴ *Royal Aeronautical Society* - Sir George Cayley papers cay/2 (Cayley A2)



15 November 1809

Anthony Carlisle to Sir George Cayley⁵

Sir

I have to regret that your distance from London seems to forbid our communication. What I have done in the scheme for Arial Navigation have been private, my profession excludes me taking open measures on a subject so liable to derision & ill natured remark.

The favourite project of seventeen years⁶ of my life has fallen into better hands, you have no cause to fear injuries from the envious, or from rivals in a gainful profession. The experiments and researches which I have pursued were directed to determine the surfaces of Winged Insects & Birds compared with their weights & specific gravities, then to ascertain the ultimate velocity of fall in various substances of a globular form, & then to measure the frequency & direction of the strokes in the Wings of Insects & Birds compared with their bulk and weight.

I then contrived an apparatus to prevent the velocity of descent, & to enable the Aeronaut to exert his whole force upon a projectile motion. The various manipulations ...

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for surfaces of expansion, for levers of support, & for employing the whole half of the muscular force of a Man alternately, without an intermediate descent, were ascertained.

To explain the machinery, the precautions which have occurred in using them, the modes of balancing in the air, & the number of failures in my first crude experiments would be difficult if not ineffective by words.

Had you been in London, the liberality of your communication would have induced me to give up some time in working with you to complete this dual purpose.

It is rather curious, that I should have applied to Wm Nicholson & divulged the leading features of my plan twelve years ago.⁷ Then I had thoughts of gaining fame or profit by it & enjoyed secrecy, but I perceive you are destined to complete it.

I wish you would work at the subject to completion before you divulge it, as you ought to gain the credit, & you will prevent ignorant men doing themselves injuries both in body and Estate.

Wishing you success

I am dear Sir, your obliged servant

⁵ *Royal Aeronautical Society* - Sir George Cayley papers cay/2 (Cayley A2)

⁶ c1792 – Carlisle became surgeon at the Westminster Hospital in 1793.

⁷ c1797 – Some time previously, Carlisle had invented a flying apparatus. According to Robert Southey: 'The late Sir Anthony Carlisle invented a flying apparatus, which he fitted upon his shoulders and tried from the top of his house' but 'with the success of Icarus' - Southy, Cuthbert, *The Life and Correspondence of Robert Southey*, London, Longmans, 1849.



A. Carlisle

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The forces of Animal Muscles do not depend upon their physical strength as Cords, but on a Chemical change, something like condensation of their particles arranged in parallel lines, the force of which is incalculable.

Perhaps electricity produced the conservation. I suspect that your opinion respecting the concavity of the under surfaces of the wings of Birds is not well founded because Birds, Rooks for example, fly with great care when large chasms appear in their wings by moulting or on being shot at.



6 November 1809

Sir George Cayley, Brompton, to William Nicholson

Sent his second paper 'On Aerial Navigation'

Published in Nicholsons Journal –February 1810

6 December 1809

Sir George Cayley, Brompton, to William Nicholson

Sent his third paper 'On Aerial Navigation'

Published in Nicholsons Journal –March 1810

February 1810

'On Aerial Navigation' – Published in Nicholsons Journal of Natural Philosophy, Chemistry & The Arts, Page 81-87

<https://books.google.co.uk/books?id=zhMAAAAAMAAJ&printsec=frontcover&dq=editions:gEL4pC4xw5kC&hl=en&sa=X&ei=eBnFU7uMNMG9Oa7ngcAB&ved=0CCUQ6AEwAjge#v=onepage&q=Cayley&f=false>



24 February, 1810⁸

Anthony Carlisle to Sir George Cayley

Dear Sir

I have read with a mixed feeling, your communications to the Publisher on flying. Excuse the unauthorised candour of my address. If we could write exclusively to scientific & judicious Men, there would be no danger of ill consequences. But in submitting ourselves alike to the wise & the foolish, to the speculative Philosopher & to the desperate adventurer, we may unwittingly do mischief.

I fear that the freedom of your suggestions on flying, may instigate some weak minded persons to precipitate their own ruin, & to bring further disgrace upon an attempt, which Nature constantly urges us to imitate, & which the most ingenious of Men have thought practicable.

If you had been near London, I should have gladly stolen some hours from my profession, to labour with you. Accept my crude suggestions as the other alternative.

The defects in the former projectors of flying have arisen from their limited view of the mechanism of Birds; & they have in vain attempted to employ the human muscular powers upon mere Wings, the alternate collapses of which must ...

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... ever permit an irrecoverable descent. To remedy this radical defect, I thought of making an artificial expanse of light materials, by which the rapidity of gravitation in a Man would be reduced to that of a body whose superficies⁹ had their proportion to the weight of a Man, or in other words, I proposed to alter the specific gravity of the human body by augmenting the surface of its resistance during its descent.

To adapt this expanse to the act of flying, I proposed that the volant should be suspended rather behind its centre, so as to give the floatage the effect of an inclined plane: the dimensions of such floatage to be adapted to the weight of the person & the propelling force to urge it in the line of its inclination upward, by which the direct lift of the weight of the human body would be reduced to the power required for urging it up a line of given inclination, thus:



Under such circumstances, the powers of the human arms & legs are sufficient to move ariel oars alternately in the direction backward of the inclined floatage; & forward either edgeways, or to open like venetian blinds. The arms to be employed after the manner of rowing, the legs as if swimming - & their forces only required to urge the apparatus up the ...

⁸ Royal Aeronautical Society - Sir George Cayley papers cay/2 (Cayley A2)

⁹ the outer surface or exterior



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... inclined plane with such rapidity as would overtake the intermediate fall by gravitation.

I think the floatage would be better without a Tail like that of Birds, as the balancing of the weight under the floatage might be adapted to preserve a continued line of obliquity to the horizon without an apparatus demanding especial management; & besides I consider the tails of birds more used for stopping their progress as you see when ducks light on a pond, or for turning as in the pheasant flying through Trees.

The materials for constructing the whole apparatus for flying are of the first importance. I once made some conical levers of strong paper pasted over a smooth conical pole, & laid on longitudinal layers of hemp with glue, so as to make a very light and strong lever. To prevent it bending and collapsing, I turned some light discs of willow wood & fixed them at 6 inches distance within so as to imitate the bamboo canes, with such I proposed to construct a floatage, rigging it & bracing the cross beams with light plaited sash line, this sort of kite was then covered with a coarse net, & underneath a thin canvas, the meshes of which were filled up by gauze paper.

I have measured the floatage of the flying Squirrel, & kept Bats tame several months under a course of experiments in order to ascertain some leading ...

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... facts. My engagements, my situation in life and a prudent view of my worldly affairs have coerced my inclination to pursue this object, but I hoped to have the means for devoting the leisure of my declining life to prosecute it vigorously – If the preceding remarks accord with your views, I shall be glad to communicate fully on this subject & to cooperate with you in making out between ourselves whether this scheme be practicable or not.

Your truly obliged servant

A. Carlisle



1 March 1810

Anthony Carlisle to Sir George Cayley¹⁰

Dear Sir

I am forty two years of age & I suspect you are at least ten years younger. Do not hurry this scheme, do not commit your claims to every solicitor. The Noble in question is neither strong in the head, nor in the arm. I communicated my scheme to him and his father at Ramsgate Twelve years ago and the maggot is now hatching under the incubating heat of your publications.

If you will come to Town & take a bed & the &c's of my house, I can show you the Lions¹¹, & then you may chuse for yourself to whom you would like to communicate this plan.

I can bring all the solid & true bored Guns of large Calibre together for your inspection & you will be near the great fortress of Science (Sir Joseph) where we may reconnoitre or poach as we like best.

There is more of trick & intrigue in Science than you seem to be aware of; and the cry of the hour is as often quackery, as anything else. Men are like hounds, they love to hunt in Packs, & often the most noisy Dog carries the followers falsely. Whether it be the Real Game or the scent of a red Herring, you may see the whole posse equally eager and vociferous, nor does the shame of being deceived operate more on Men than on Dogs when they take to hunt in Packs. But this is not the worst ...

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... for in all combined operations, the pretenders make themselves the most prominent, cheating those of real merit out of their dues, & turning their efforts into the means for self aggrandisement or vulgar fame. Nor is this all. Such men do not willingly part with their money unless for a secure moneys worth. Men capable of little minded schemes and actuated by narrow views are never generous. They dole out their aid under restrictions, & with conditions that honest Men ought never to submit to.

The love of Science is fashionable, it is a cheap equipage, but like the cut of Clothes it is liable to sudden caprice, & it may be cut off or cut so short, or into such shapes, as would neither suit your Taste nor mine in the present instance.

If you cannot go on without support and cooperation come up to London & have it of intrinsic worth. My invitation is as frank as your Letters deserve. Your company for a fortnight would be equally desirable & convenient to me - & the present season is favourable to meet all the Ability of the Country.

I do not perceive the hazard of great expense in any attempts to construct arial Machines on the principles now suggested, & had not the needful attentions to a lucrative profession occupied my present time, I should not have felt any dread of imprudent expenditure in those experiments - As it is, the Time is my chief property & that I cannot now sacrifice as a principal workman. As an Adviser & instructor I might be useful, but since every part ...

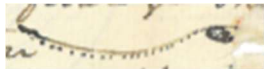
¹⁰ *Royal Aeronautical Society* - Sir George Cayley papers cay/2 (Cayley A2)

¹¹ Possibly Wombwell's Menagerie, where the first lion was bred in captivity



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... of the Machinery must be made different from any manufactured Substance, it requires the Scheme to be likewise a skilful Artificer.

The floatage should bend up at the sides as in this Section  & by strings braced along the cross beams it might be made very secure. You will perceive that all Sailing birds have this figure, especially the Sea Gulls & that they often rest themselves in windy weather by gliding down an inclined plane against the wind & rising up again without moving their Wings. I am obstinate in thinking my scheme for preserving the horizontal position a better one than yours, & I do not like men to have Tails.

I have not yet had the Journal nor the Hull Man's Book¹², but I have sent for both. I am thus hasty in writing to bespeak your deliberation as to Committee.

The person who you have named is not very promising. Whatever experiments are made they should be carried on by one person destined for exhibition & he should be trained like a Slaiter¹³ or Equestrian Tumbler to gain a perfect command of balancing. The exercise might be done in a large Room or suspended to a Tree. I once had a Sailor Boy under a course of education for this purpose, but he turned Thief & I was obliged to recommend him to the Navy.

Dear Sir, your truly obliged & obedient servant

A. Carlisle.

¹² Possibly Thomas Walker, who lived in Hull, and whose book '[A treatise on the art of flying](#)' was published in 1810 and printed in Hull.

¹³ Roof slater



March 1810

‘On Aerial Navigation’ – Published in Nicholsons Journal of Natural Philosophy, Chemistry & The Arts,

Page 161-173

<https://books.google.co.uk/books?id=zhMAAAAAMAAJ&printsec=frontcover&dq=editions:gEL4pC4xw5kC&hl=en&sa=X&ei=eBnFU7uMNMG9Oa7ngcAB&ved=0CCUQ6AEwAjge#v=onepage&q=Cayley&f=false>

5 March 1810

Anthony Carlisle to Sir George Cayley¹⁴

Dear Sir

I should not trouble you with such a hasty answer but it is probably your want of the Bamboo Canes may delay some experiment. I have for 15 years endeavoured to get some Bamboo of the kind required & have rummaged all the E.I.¹⁵ ships as they arrive without any success.

The canes are either thick & heavy & used for stowage, or slight & weak for Cockney fishing Rods.¹⁶ The case is so hopeless for our purpose, nevertheless I have bored the Surgeons to the E.I. Co's ships to bring some suitable canes home & it is possible, tho' not probable, that such may yet come.

This difficulty put me upon making them of pasteboard, & as you & I may conceive that providence only made Bamboo as a hint to Flyers let us try to make better levers.

You ask about the Opinions of the learned. I can only give you a bad report. Nicholsons two Journals laid on Sir Joseph's Levee table for two successive Sundays with your paper uncut. The Wise, the prescient and the Cunning Classes of the Philosophers are too wary to commit themselves on subjects not backed by the cry of the multitude, & had I been able to write such papers as you have printed, I should have been ridiculed & abused to my irreparable inquiry.

You escape because you are not in the Chain of rival contention, or employed in a mercenary profession. When Dr. Harvey published his discovery of the ...

¹⁴ *Royal Aeronautical Society* - Sir George Cayley papers cay/2 (Cayley A2)

¹⁵ East India Company

¹⁶ 'Cockney fishing rod' was a slang term in the 1800s referring to anything long and slender used to steal items from shops or street vendors, particularly common among thieves in London. A cane or rod might have a hook or some adhesive material attached to the end, allowing a thief to reach into a shop window or over a counter and "fish" for small items such as watches, jewellery, or food, typically out of sight of the shopkeeper. (Later Cockney rhyming slang for PC Plod).



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... circulation of blood¹⁷, he lost all his business, & was obliged to retire in poverty & disgust; The popular outcry was, that he was a visionary, & the two Universities reviled his works for full 40 years after he first divulged them.

I meant the injured lines in my last, to supersede what you have drawn, & that is should represent a cross section of the floatage. If the whole were fixed upon a Sliding Lever attached to the back of the Volant he might adjust the inclination of the plane to the horizon by pushing it forward or backward during the course of his flight. I am sure the Levers of support, as well as the oars must be made of pasteboard as before described, & the expanse of their canvas slightly papered and stretched beneath a netting. The whole bound together & strengthened by cordage like ship rigging. Whether two pairs of wings, one for the swimming action of the Legs, the other for rowing, or whether the united force of both limbs may be needed to give the vis a tergo¹⁸ I cannot say, or whether the alternate rowing of one pair of Wings between the actions of the Arms & Legs may be sufficient is perhaps only to be determined by experiment.

I still hope to see you in London & that you will be my Guest. I wish your Estate was in Surrey. Pray

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... think of belonging to the R.S;¹⁹ & I shall think of something beyond that on your acc't.

I have read your paper on the Greek Arts with the greatest of pleasure, but I have not yet had the Journal from the repeated neglect of the Bookseller.

If you have read Knight on Taste²⁰, he is my neighbour & may be your acquaintance at least. The Elgin Collection, Townleys & Knights Bronzes are worth a jolting in the Mail if you had no other motive.

I do not see the probability of an Arial Mail, but that solitary passengers (wind permitting) might come from Yorkshire to London in five hours is to me quite certain.

I have an additional objection to the free communication of your researches, & that is the instruction of foreigners who will execute the scheme first, & give you no sort of credit. The description of Garnerin's²¹ parachute in Nics Journal²² & his descent was mine. I then saw the advantages of an expanse to stop rapid gravitation; he did not fall at the rate of 15 feet pr second.

¹⁷ Dr William Harvey proved in 1628 that the heart acts as a muscular pump to circulate a fixed amount of blood continuously in a closed circuit through the body.

¹⁸ A force from behind.

¹⁹ Sir George Cayley did not join the Royal Society, but was a founder of the Yorkshire Philosophical Society.

²⁰ Richard Payne Knight was a neighbour of Carlisle in Soho Square, and wrote '*An Analytical Inquiry into the Principles of Taste*'. His London house had a special gallery of Greek coins, bronzes and artifacts.

²¹ André-Jacques Garnerin (1769-1823)

²² 'Experiment with a Parachute, Nicholson's *Journal of Natural Philosophy, Chemistry and the Arts*, February 1798 p523 – [see pages 16-17](#)



I once thought of boring conical Poles of light wood as supports & Levers & the machine for boring Telescope Tubes would answer. I hope to be one of your Agents in any large experiment.

Yours truly obliged.

A. Carlisle.

17 April 1810

Sir Anthony Carlisle to Sir George Cayley²³

My dear Sir

A project is on foot, for an ascension in a Balloon at the Installation Festival at Oxford the first week in July²⁴. If you have any parachute scheme in forwardness, or any other exhibition in the Aerial line, this might afford a good opportunity to display.

The Man who is to ascend is perfectly bold, very handy, & willing to enterprize anything.²⁵

What think you of a Voyage to Town, & let Nicholson, Dr. Wollaston²⁶ & ourselves form a party to execute something.

I have long wished for a Committee of Science in aid of Government, to receive & examine all projects & schemes for improvements & to suggest remedies for existing difficulties.

When Old Sir Joseph's Wheels come to a stop, we shall be grievously astray for a President at the R. S.²⁷

Your truly obliged servant

A. Carlisle.

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P.S. I shall be three days fly fishing in Hampshire next week, & should be disappointed if you came when I was from home.

²³ *Royal Aeronautical Society* - Sir George Cayley papers cay/2 (Cayley A2)

²⁴ James Sadler (1753-1828) and his son John ('Jack') Sadler (1779-1838) ascended from Merton Field, Oxford to mark the installation of Lord Grenville as Chancellor of the University.

²⁵ John ('Jack') Sadler acted as chemical assistant to Nicholson during his lectures and features in *The Life of William Nicholson*.

²⁶ William Hyde Wollaston (1766-1828).

²⁷ Referring to Sir Joseph Banks at the Royal Society.



26 July 1817

Anthony Carlisle to Sir George Cayley²⁸

My dear Sir

I delayed answering your former letter from despairing to do any service in the cause until I felt the affair to be too late. The open dignified & independent intellects of the Yorkshire Hills know little of the grovelling motives and narrow conduct of Middlesex Philosophers Since the death of poor Nicholson, I have not ventured to speak to any man about those very probable discoveries which may give new physical powers to the human race.

I am myself too dependent on my vocation to hazard the abuse & ridicule which a published avowal of such hopes would inevitably afford to my rivals & enemies. When my worldly independance is secured I may possibly peep out, but as to cooperation here, that is an idle phantom.

You can have no idea of the littleness, the shabbiness & the moral cowardice our soi-disant Philosophers, in all matters of this & that, of vulgar calculation, & of worldly interest, they are competent Clerks, but as to boldness ...

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... or poetical philanthropy they know them not.

Knowing these petty scavans as I do there is not one of them which you can trust, or who w'd risk a feather of his present plumage to forward any scheme for general good, or any plan which did not point blank serve a sordid purpose. The thing is altogether hopeless – you must work on a small scale, with your own wits & your own hands.

You know that my views are founded on Anatomical and Mechanical desiderata, while yours rest upon the higher & more complex computations of figures. You think as every man is intitled to do (who devotes his mind specially) that your plan is the best & most practicable, By the same rule I indulge the same sort of vagary.

I shall be always happy to correspond with you privately on these matters, & shall soon send you a little Tract on the crafts & subtleties of my profession for the conservation of health & lengthening the days of old persons.²⁹

My dear sir, your most truly

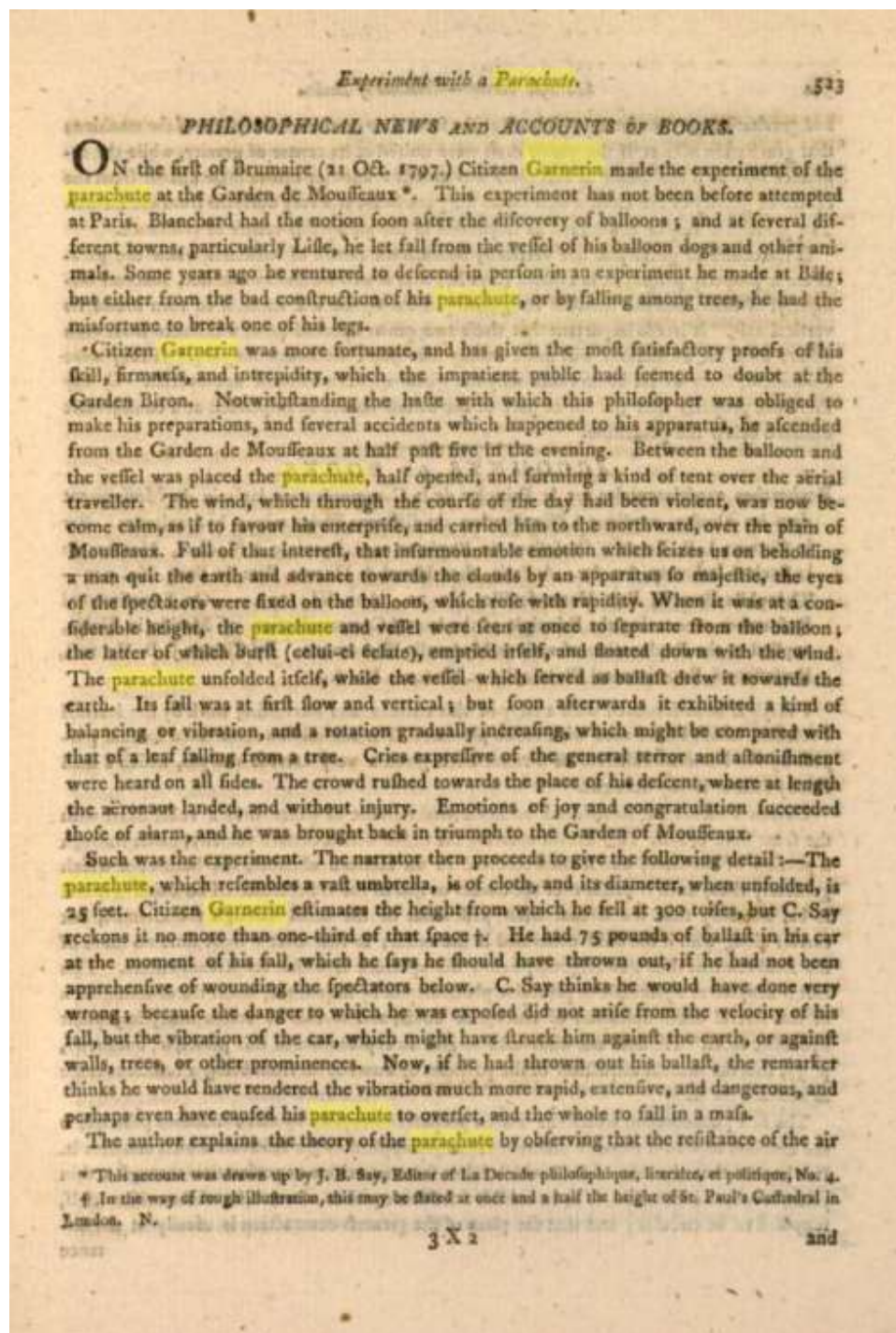
A. Carlisle

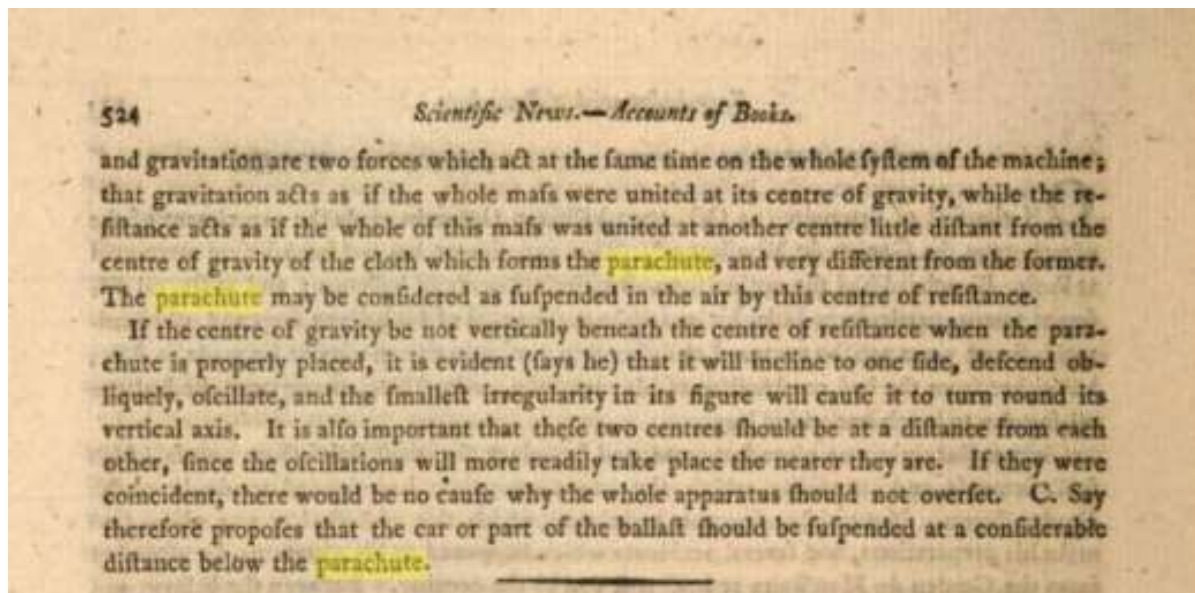
²⁸ *Royal Aeronautical Society* - Sir George Cayley papers cay/2 (Cayley A2)

²⁹ 'An essay on the disorders of old age and on the means for prolonging human life' by Anthony Carlisle. Anthony Carlisle, 1817, Longman, Hurst, Rees, Orme, and Brown, 1817.



Experiment with a Parachute, by Anthony Carlisle [previously unattributed] in
Nicholson's *Journal of Natural Philosophy, Chemistry and the Arts*, February 1798 p523





Anthony Carlisle claimed to be the author of the above article, in his letter to Sir George Cayley of 5 March 1810.

In 1835, Joshua Bates, a partner at Barings Bank, recorded in his diary that 'Sir Anthony Carlisle writes me that his machine for flying is nearly brought to perfection and he wants only a clever person to bring it out.'

In 1849, one of Sir George Cayley's flying machines made the world's first manned heavier-than-air flight at Brompton Dale, near Scarborough, and Cayley's 'governable parachute' was flown in 1853 at Brompton Dale, carrying Sir George's coachman, who on coming back to earth said, "I wish to give notice, I was hired to drive not to fly". A replica can be seen at Yorkshire Air Museum.

Sue Durrell, September 2026.