J. B. Reade, letter to Robert Hunt, February 13, 1854

annotated by R. D. Wood (Midley History of Photography)

Robert Hunt, *Researches on Light* (2nd edition 1854), Appendix 2, pp. 371-5 [1]

No. II. ON SOME EARLY EXPERIMENTS IN PHOTOGRAPHY. BEING THE SUBSTANCE OF A LETTER ADDRESSED TO ROBERT HUNT, ESQ., BY THE REV. J. B. READE, M.A., F.R.S.
(*Referred to from Introduction*)

Stone Vicarage, Aylesbury,
February 13. 1854.

MY DEAR SIR,
In giving you the information you require respecting my early researches in photography in 1836 and following years, I may assume that you are already aware, from my letter to Mr. Brayley of March 9, 1839, [sic! *April* 9, 1839 [2]] and published in the "British Review" for August, 1847, that the principal agents I employed, before Mr. Talbot's processes were known, were infusion of galls as an accelerator, and hyposulphite of soda as a fixer.
I have no doubt, though I have not a distinct recollection of the fact, that I was led to use the infusion of galls from my knowledge of the early experiments by Wedgwood. I was aware that he found *leather* more sensitive than *paper*; and it is highly probable that the tanning process, which might cause the silver solution to be more readily acted upon when applied to the leather, suggested my application of the tanning solution to paper.
In your own history of the photographic process, you say "the discovery of the extraordinary property of the gallic acid in increasing the sensibility of the iodide of silver was the most valuable of the numerous contributions which Mr. Talbot has made to the photographic art." It is nevertheless true, as stated by Sir David Brewster, that "the first public use of the infusion of nut-galls, which is an *essential*

element in Mr. Talbot's patented process, is due to Mr. Reade," and in my letter to Mr. Brayley I attribute the sensitiveness of my process to the formation of a gallate or tannate of silver. I need scarcely say, that among various experiments I tried gallic and tannic acid in their pure state, both separately and mixed ; but the colour of the pictures thus obtained with the solar microscope was at that time less pleasing to my eye than the rich warm tone which the same acids produced when in their natural connexion with solutions of vegetable matter in the gall-nut. This organic combination, however, was more effective with the solar microscope than with the camera, though the lenses of my camera were five inches in diameter. It is probable enough that the richer tone - was due to the greater energy of direct solar rays. In using the solar microscope, I employed a combination of lenses which produced a convergence of the luminous and photogenic rays, together with a dispersion of the calorific rays, and the consequent absence of all sensible heat enabled me to use Ross's cemented powers, and to make drawings of objects inclosed in Canada balsam, and of living animalcules in single drops of water. The method I employed was communicated to the Royal Society in December, 1836, and a notice of it is contained in the "Abstracts." [3]

You inform me that some persons doubt whether I really obtain *gallate of silver* when using an infusion of gall-nuts, and that one of Mr. Talbot's friends raises the question. It is sufficient to reply, that though gallic acid is largely formed by a long exposure of an infusion of gall-nuts to the atmosphere, as first proposed by Scheele, yet this acid does exist in the gall-nut in its natural state, and in a sufficient quantity to form gallate of silver as a photogenic agent; for M. Deyeux observes, that "when heat is very slowly applied to powdered gall-nuts, gallic acid sublimes from them, a part of which, when the process is conducted with great care, appears in the form of small white crystals." M. Fiedler also obtained gallic acid by mixing together a solution of gall-nuts and pure alumina, which latter combines with the tannin and leaves the gallic acid free in the solution; and this solution is found, on experiment, to produce very admirable pictures. But what is more to the point, Mr. Brayley, in explaining my process in his lectures, showed experimentally how gallate of silver was formed, and confirmed my view of the sensitiveness of the preparation. It is therefore certain that the use of gallate of silver as a photogenic agent had been made public in two lectures by Mr. Bravley at least two years before Mr. Talbot's patent was sealed.

I employed hyposulphite of soda as a fixer. Mr. Hodgson, an able practical chemist at Apothecaries' Hall, assisted me in the preparation of this salt, which at that time was probably not to be found, as an article of sale, in any chemist's shop in London. Sir John Herschel had previously announced the peculiar action of this preparation of soda on salts of silver, but I believe that I was the first to use it in the processes of photography. I also used iodide of potassium, as appears from my letter, as a fixer, and I employed it as well to form iodide of lead on glazed cards as an accelerator. Iodide of lead has of itself, as I form it, considerable photographic properties, and receives very fair impressions of plants, lace, and drawings when placed upon it, but with the addition of nitrate of silver and the infusion of galls, the operation is perfect and instantaneous. Pictures thus taken were exhibited at the Royal Society before Mr. Talbot proposed his iodized paper. The microscopic photographs exhibited at Lord Northampton's in 1839 remained in his lordship's possession. I subsequently made drawings of sections of teeth; and one of them, a longitudinal section of a tooth of the *Lamna*, was copied on zinc by Mr. Lens Aldous for Owen's "Odontography." I may say this much as to my own approximation to an art, which has deservedly, and by universal consent, obtained the name of Talbotype.

> [The second half of Reade's letter draws attention to Thomas Young's ideas on light and Young's experiment half a century earlier on the spectral rays including his use of silver nitrate paper to record the violet and invisible UV end of the spectrum]

Sir David Brewster, in his "History of Photography," passes immediately from the experiments of Wedgwood to those of Talbot; but the "Transactions of the Royal Society", to which my friend Mr. Gravatt has directed my attention, will enable us to insert, if not a chapter, at least a very pregnant parenthesis. The Bakerian Lecture, in 1803 [4], by Dr. Young, who never touched a subject without leaving his mark upon it, contains a highly interesting and original experiment on the photographic representation of the invisible chemical rays beyond the blue end of the spectrum. This experiment does not happen to be recorded in the first edition of your "Researches on Light;" but no one will refer to it with greater pleasure than yourself, not only because it is the first photographic analysis of the spectrum, but also because it has the higher merit, even as it stands alone, of being the one sufficient fact which establishes the consummation so devoutly looked for, at the conclusion of your work, from the persevering accumulation of facts only; for it is in itself a simple and demonstrative proof, to use the words of Dr. Young, of the general law of interference, and, in your own words, "reconciles the chemical action of the photographic force, *energia*, with the undulatory theory of *light*." Dr. Young's experiment forms the conclusion of his lecture, and is given in the following terms:— "The existence of solar rays accompanying light more refrangible than the violet rays, and cognisable by their chemical effects, was first ascertained by Mr. Ritter; but Dr. Wollaston made the same experiments a very short time afterwards, without having been informed what had been done on the Continent. These rays appear to extend beyond the violet rays of the prismatic spectrum, through a space nearly equal to that which is occupied by the violet. In order to complete the comparison of their properties with those of visible light, I was desirous of examining the effect of their reflexion from a thin plate of air capable of producing the well-known rings of colours. For this purpose I formed an image of the rings, by means of the solar microscope, with the apparatus which I have described in the Journals of the Royal Institution, and I threw this image on paper dipped in a solution of nitrate of silver, placed at a distance of about nine inches from the microscope. In the course of an hour, portions of three dark rings were very distinctly visible, much smaller than the brightest rings of the coloured image, and coinciding very nearly in their dimensions with the rings of violet light that appeared upon the interposition of violet glass. I thought the dark rings were a little smaller than the violet rings, but the difference was not sufficiently great to be accurately ascertained; it might be as much as 1/30th or 1/40th of the diameters, but not greater. It is the less surprising that the difference should be so small, as the dimensions of the coloured rings do not by any means vary at the violet end of the spectrum so rapidly as at tbe red end. For performing this experiment with very great accuracy a heliostate would be necessary, since the motion of the sun causes a slight change in the place of tbe image, and *leather impregnated with the muriate of silver* would indicate the effect with greater delicacy. The experiment, however, in its present state is sufficient to complete the analogy of the invisible with the visible rays, and to show that they are equally liable to the general law (of interference), which is tbe principal subject of this paper." [5]

It detracts nothing from the greatness of Dr. Young to say, that although the philosophy of this experiment is permanent truth, yet the spectral image of it soon faded away. Photography was not then, at the beginning of the century, an art as permanent as it is elegant and useful. Little was wanted to make it so, but it hung fire for nearly fifty years, till Talbot supplied that little.

I have just learnt from Admiral Smyth, that his friend Dr. Peacock, the Dean of Ely, has for the last seven years been engaged on a *Life of Dr. Young*; and when the work appears, [6] we shall have a more accurate knowledge of the man who was unquestionably the Newton of his day. Like his illustrious predecessor, he was a pioneer in the philosophy of light; and, as we have seen, by a single photographic experiment, overlooked hitherto by us all, has shown a perfect analogy between the undulations of the visible and invisible rays. Had he happened to head his chapter, as Wedgwood [7] does, "On a method of taking Pictures by the agency of Light on Nitrate of Silver," his name and place would have been duly marked; but because theory, and not experiment, was the great point before him, the philosophical photographer is overlooked by the practical one.[8] , [9]

Dr. Young's propositions are, that radiant light consists in undulations of the luminiferous æther, that light differs from heat only in the frequency of its undulations, that undulations less frequent than those of light produce heat, and that undulations more frequent than those of light produce chemical and photographic action, — all proved by experiments.

You close your own “Researches on Light” by proposing the following questions as of the greatest importance for future investigation:- “Is *energia* absorbed by material bodies? Does it influence their internal constitution? Is it radiated from bodies in the dark, or at all concerned in the production of any of those changes which have been attributed to *dark rays*?”

Dr. Young's hypothesis seems to anticipate your questions, and almost to answer them in their order. He says, “All material bodies have an attraction for the *ætherial medium*, — by means of which it is accumulated within their substance, — and for a small space around them - in a state of greater density, but not of greater elasticity.” (Bakerian Lecture, 1801.[10]) Hence he considers material bodies to have within them latent light, latent heat, and latent chemical force, or “energia” (which is, in his opinion, a particular condition of the ætherial medium); that the luminous, calorific, and chemical phænomena are exhibited under two modifications, — the vibratory or permanent, and the undulatory or transient state; and that the forces which produce these several effects differ from each other only in the frequency of their undulations or vibrations.

Such are the conclusions at which the all-inquiring Dr. Young arrived in 1801 [11], on a subject which in 1850 is proposed for our investigation. Well may Admiral Smyth say, “How strange it is that we are still but half-acquainted with the results of his powerful mind !”

Of course I shall not quarrel with you if you do not accept his conclusions, *totidem verbis*, because, as I am aware, you see reasons for believing that light, or that agent which affects the organs of sight, is broadly distinguished from those rays which bring heat from its solar source, and both of these classes form those which produce, in the constitution of bodies, those singular changes which are more particularly the objects of your study. But Sir John Herschel has shown that, by certain artifices, even the extreme rays may be rendered visible; and Dr. Young, by an experiment most ingenious, and to his own mind, at least, most, conclusive, has demonstrated the analogy of the invisible with the visible rays. I feel sure, therefore, that while adducing and discussing the proofs of your own theory, you will be glad to take the opportunity afforded by your second edition of placing Dr. Young's name in the niche which Fame has left empty.

Believe me to be, my dear Sir,

Very truly yours,

J. B. READE.

To Robert Hunt, Esq.

Footnotes.

By R. Derek Wood © Midley History of Photography

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There are authoritative short biographies in the *Oxford Dictionary of National Biography*, Oxford University Press 2004, of persons mentioned on this page: ‘Brayley, Edward William (1801/2-1870), writer and lecturer on science’ by J. N. Hays; ‘Brewster, Sir David (1781–1868), natural philosopher and academic administrator’, by A. D. Morrison-Low; ‘Hunt, Robert (1807-1887) chemist and photographer’, by Alan Pearson; ‘Peacock, George (1791–1858), mathematician and university reformer’ by Harvey W. Becher; ‘Reade, Joseph Bancroft (1801–1870), microscopist and experimenter in photography’ by R. D. Wood; ‘Wedgwood, Thomas (1771-1805), chemist’ by Trevor H. Levere; ‘Wollaston, William Hyde (1766–1828), chemist, physicist, and physiologist’ by Trevor I. Williams; ‘Young, Thomas (1773–1829), physician and natural philosopher’, by Geoffrey Cantor.

1. Robert Hunt's *Researches on Light*, 2nd edition London 1854, appendix 2 on pp. 371-5.
Also published as Rev. J. B. Reade, M.A., F.R.S., ‘On Some Early Experiments in Photography, being the substance of a letter addressed to Robert Hunt, Esq.’, *Philosophical Magazine* (4th Series), May 1854, Vol. 7 (46), pp. 326-31. Reade had offprints from the *Phil.Mag*, for example sending one to Richard Owen at the Natural History Museum in London. One of those *Phil. Mag.* offprints also survived in the library of the Royal Photographic Society (being catalogued at 04 - 'History of Photography').
After its appearance in the *Phil.Mag* the letter was immediately reprinted under a heading of ‘Photographic Correspondence’ in *Notes & Queries*, 3 June 1854, Vol 9, pp. 524-5 but omitting the second half concerning Thomas Young's spectrum

experiments using silver salts in 1803. In its turn "(from Notes & Queries)" was reprinted in America in *Humphrey's Journal of the Daguerreotype and Photographic Arts* (New York), August 15, 1854, Vol. 6, pp. 129-130.

2. This mistake of "March" (it had earlier appeared in *North British Review* in 1847) misled historians of the beginnings of photography. The situation created by this mistaken date was not fully resolved until 1972 - see 'J. B. Reade's Early Photographic Experiments: further evidence', by R. Derek Wood, *British Journal of Photography*, 28 July 1972, Volume 119, No. 5845, pp. 644–646, 643, (and on-line at Midley History of early Photography)

3. Rev. J. B. Reade. Communicated by J. G. Children, Esq., Sec. R. S. 'Observations and Experiments on the Solar Rays that occasion Heat; with the application of a remarkable property of these rays to the construction of the Solar and Oxy–hydrogen Gas Microscopes', read at Royal Society meeting 22 December 1836, *Proceedings of the Royal Society*, Vol. 3 (1830–1837), No. 28 (8 December 1836 – 16 March 1837), p. 457. Also published in *Philosophical Magazine* (3rd Series), March 1837, Vol. 10 (No. 60), pp. 219–20.
Reade uses a term "Abstracts" for this publication, being a fairly common colloquial usage of the 1830s, for the *Proceedings of The Royal Society* as it was the continuation of a series (vol. 1-2) covering the years 1800 to 1830 originally called the *Abstracts*. A change of title to *Proceedings* had taken place on 18 November 1830 being the first issue part number of vol. 3. Through the 1830s each issue covered from between four to six weekly meetings of the Royal Society.
This paper concerned only Reade's optical arrangements for illuminating the microscopic specimens, but being cited by him in the present context of Young's use of silver salts may have lead unwary readers to suppose it provided support for an idea that Reade had himself used silver salts in this paper of 1836.

4. Thomas Young's third Bakerian lecture, ‘The Bakerian lecture. Experiments and Calculations relating to physical Optics’, was read at Royal Society on 24 November 1803 and published in *Philosophical Transactions of the Royal Society of London for the year MDCCCIV*, (1804), pp. 1-16

5. Reade correctly quotes this long passage from Young's third Bakerian lecture, although the italics of “*leather impregnated with the muriate of silver*” were emphasis by Reade not Young. Also Reade has “placed at a distance” although in the *Phil. Trans*. original it is “placed at the distance”. Young's final sentence - a remark about the present impractical use of thermometers to reveal the infrared heat end of the spectrum - was omitted.
The passage was Experiment 6 - ‘Experiment on the Dark Rays's of Ritter’ of Young's lecture of 24 November 1803, being on pp. 15-16 of the Royal Society's *Philosophical Transactions*., 1804.

6. George Peacock, *Life of Thomas Young*, London: John Murray 1855.
When this book appeared in 1855, the year following Reade's letter to Hunt, Peacock added the following comment to his brief paragraph on his p. 173 about Young's demonstration using silver salts to show the position of the invisible rays beyond the violet end of the spectrum: “This experiment was of great interest, not merely as establishing the close analogy which exists between the visible and invisible rays, but also as one of the first attempts to form a real photographic picture, though without any anticipation of the very important uses to which the principle involved in it was afterwards to be applied.” Peacock's concise footnote reference for that last sentence about photography was “See Philosophical Magazine for May, 1854”. The citation, without being extended to include the name of author or title, is indeed referring the reader to Reade's letter to Robert Hunt. Reade was pleased that

he had been instrumental in Peacock picking up his own point about Young's experiment (J. B. Reade to Robert Owen, autograph letter dated 14 November 1856, in Owen Correspondence, Vol. XXII, ff. 184-5, Library of the Natural History Museum, London).

7. Thomas Wedgwood's article (with Faraday's notes) appeared in 1802:
'An account of a method of copying Paintings upon Glass, and of making Profiles, by the agency of Light upon Nitrate of Silver, Invented by T. Wedgwood, Esq. with Observations by H. Davy,' *Journal of the Royal Institution*, 1802, Vol. 1, pp. 170–174.

8. Wedgwood's account of producing images by the effect of light on silver nitrate was published one and a half years before Young read his third Bakerian lecture at the Royal Society. Young was clearly in a position to be well acquainted with Wedgwood's experiments, for in July 1801 Young had been appointed Professor of Natural Philosophy at the Royal Institution and edited that first volume of the Institution's *Journal* in which Wedgwood's work was published. For brief information of Young at Royal Institution see 'Memoir of the life of Thomas Young', anon [Howard Gurney]. pp. 20, 53 (London 1831), and 'Life of Thomas Young', by George Peacock, pp. 134-5, 188 (London 1855)

9. Reade's enthusiasm for Young might seem at first reading to be suggesting that Young's spectrum experiments have an equal rating to the actual copying of images by Wedgwood. However, it is worth noting that Reade is pointing out that Young's name and place in the history of the use of silver salts should be "duly marked". And, as we have seen in the above three footnotes No.s 6-8, Wedgwood's use of silver salts was published before Young's third Bakerian lecture. Reade's letter to Hunt did indeed have the effect of placing Young into the history. The historiographic line can be traced from Hunt's

book to other influential publications such as the long essay on ‘Researches on Light’ in *North British Review*, August - November 1858 (p. 202); ‘Photography and the Stereoscope’ in *Stories of Inventors and Discoveries* London 1860, by John Timbs (pp. 313-4).
But was this attention on Young started by Reade altogether good for subsequent writings on the prehistory of Photography? Reade links Young's name with Wedgwood, and it is true that Young's position at the Royal Institution makes it likely he would have been influenced by Wedgwood in using silver salts - But equally, indeed more so in that their work also related to the study of the spectrum, Young was influenced by the recently published work of Ritter and W. H. Wollaston. Indeed it is Wollaston (‘A method of examining refractive and dispersive Powers, by prismatic Reflection’, *Phil.Trans*, 1802, pp. 365-380) who was neglected, with regard to the use of silver salts, by 19th century writers on the history of photography. However, justice was done to Wollaston at the beginning of the 20th century when James Waterhouse in 1903 read at the Royal Photographic Society in London his fine paper on ‘The Beginnings of Photography - a chapter in the history of the development of photography with salts of silver’, published in *The Photographic Journal* June 1903, Vol 43 (new series Vol. 27), pp. 159-178.

10. Reade is not referring here to the same lecture in which Young reports his use of silver salts, but to Young's previous second Bakerian lecture, 'On the theory of light and colours', read at Royal Society on 12 November 1801, published in *Phil. Trans*., 1802, pp. 12-48.

11. Thomas Young's second Bakerian lecture of 1801, was his most influential work 'On the [wave] theory of light and colours', see above note 10.

[Other appearance of J. B. Reade in Hunt's book]

Robert Hunt, *Researches on Light*, 2nd edition 1854,

Introduction, p.xv
Reasoning upon these facts, and some others of a still more striking character, mentioned under their proper divisions, it appeared to M. Berard that “solar Light consisted of three substances” to which severally belonged “the colorific, calorific, and chemical phenomena.” This hypothesis did not however receive any support from the philosophers of his time, and the weight of several eminent names was brought in support of the opposite view. In the Historical Section I have directed attention to an experiment by the eminent Dr. Young, and I have printed in the Appendix a letter from the Rev. J. B. Reade, who strongly supports Dr. Young's position.
p.xvi
An attentive consideration of Dr. Young's experiment, as there described, proves no more than this,— that, as in the ordinary refracted spectrum the chemical action is found at its maximum about the region of the violet rays; so in the interference spectrum, the chemical change is confined to the violet rings.

Robert Hunt, *Researches on Light*, 2nd edition 1854, pp. 84-86
The discovery of the extraordinary property of the gallic acid, in increasing the sensibility of the iodide of silver, is amongst the numerous claims which Mr. Talbot has made to discoveries in the photographic art. It must however be remembered that Sir J. Herschel used gallic acid, but not successfully, and that previously the infusion of galls had been employed by the Rev. Mr. Read [sic. - Read not Reade] with success.
The calotype process, as described and practised by Mr. Fox Talbot, yields pictures of exquisite beauty, which preserve, with the utmost fidelity, not only the bold outline of the object, but its minute and delicate details. The charm of colour alone is wanting, and this is compensated by the harmony of the whole. The gradation of shadow is often given in a really wonderful manner, the lights of the picture decaying in soft and almost invisible tints into the deepest shades; the middle lights being preserved in a manner, which renders these pictures the most truthful studies for the artist who desires to fix the charms of Nature on his canvass, rather than those, so called, artistic effects, which are the bane of modern art and destructive alike to truth and good taste.*

* [Footnote on p. 85 and continued bottom of page 86]
Mr. Fox Talbot has, in his patent, claimed the use of gallic acid as being his own discovery, and he has enforced his claim by legal proceedings in several cases. Now, Mr. Talbot's patent was sealed on the 8th February, 1841. On the 10th of April, 1839,— that is, nearly two years previously to the date of this patent,— Mr. E. W. Brayley exhibited and explained at one of the soirees of the London Institution pictures obtained by the Rev. J. B. Reade, F. R. S., prepared by the following process, as described by Mr. Reade on the 9th March {sic], 1839, in a letter to Mr. Brayley.
“The more important process, and one probably different from any hitherto employed, consists in washing good writing paper with a strong solution of nitrate of silver, containing not less than 8 grains to every drachm of distilled water. The paper thus prepared is placed in the dark, and allowed to dry gradually. When perfectly dry, and just before it is used, I wash it with an infusion of galls, prepared according to the Pharmacopeia, and immediately, even while it is yet wet, throw upon it the image of microscopic objects by means of the solar microscope. It will be unnecessary for me to describe the effect, as I am able to illustrate it by drawings thus produced. I will only add, with respect to the time, that the drawing of the flea was perfected in less than five minutes, and the section of cane, and the spiral vessels of the stalk of common rhubarb, in about eight or ten minutes. These drawings are fixed by hyposulphite of soda. They may also be fixed by immersing them for a few minutes in weak salt and water, and then, for the same time, in a weak solution of hydriodate of potash. The drawing of the Trientalis Europea was fixed by the latter method : it was procured in half a minute, and the difference in the colour of the ground is due to this rapid and powerful action of the solar rays. This paper may be successfully used in the camera obscura. Farther experiments must determine the nature of this very sensitive argentine preparation. I presume that it is a gallate or tannate of
[p85] silver, and, if so, it will be interesting to you to know that what has hitherto been looked upon as a common chemical compound is produced or suspended at pleasure by our command over the rays of light.”