

James How and Co.

operated by **George John Smith, 1835 – 1905**

successor to

James How

operated by **James How, 1821 – 1872**

successor to

George Knight and Co.

operated by **George Knight, Jr., 1812 – 1862**

successor to

George Knight and Sons

operated by **George Knight, Sr., 1775 – 1845**

George Knight, Jr., 1812 – 1862

Richard Knight, 1813 – 1878

All known microscope slides labeled "*James How and Co.*" are of mineralogical specimens (Figure 1). That company was operated not by James How, but by George Smith, a man who probably had worked for How and who purchased the business in approximately 1873. Smith frequently exhibited mineralogical slides to his colleagues at the Royal Microscopical Society and the Quekett Microscopical Club, and extensively advertised such specimens. Judging from Smith's great interest in mineralogy, but without apparent excitement for other types of specimens, it is not unreasonable to suggest that Smith probably made at least some of these slides himself.

Smith's predecessor, James How, made and sold a variety of optical instruments and supplies, including microscopes and slides. However, I am not aware of any extant microscope slides marked as having been sold by James How.

James How had acquired his business from his former master, George Knight, Junior. Advertisements published in 1863, when How was beginning his independent business, stated that he had worked for Knight "*upwards of twenty years*" (Figure 8).

Following is a history of the Knight and How businesses, and biographies of the men who operated them.



Figure 1. The company name and addresses indicate that these microscope slides were sold by George J. Smith, who operated James How and Co. from 5 Bride Street between 1876 and 1879, and from 73 Farringdon Street between 1879 and approximately 1891.

George Knight, Jr., was born February 19, 1812 in Islington, London, the second child and eldest son of George and Eliza Knight. George the father was an ironmonger, a trade to which the junior George also applied himself. At some point prior to 1841, young George and his brother, Richard, joined their father's business, which became known as George Knight and Sons. By that time, the partnership was both an iron dealer and a manufacturer of chemical and photographic apparatus. Father George died in 1845, whereupon the business continued under the same name and operated as a partnership between his sons, George and Richard.

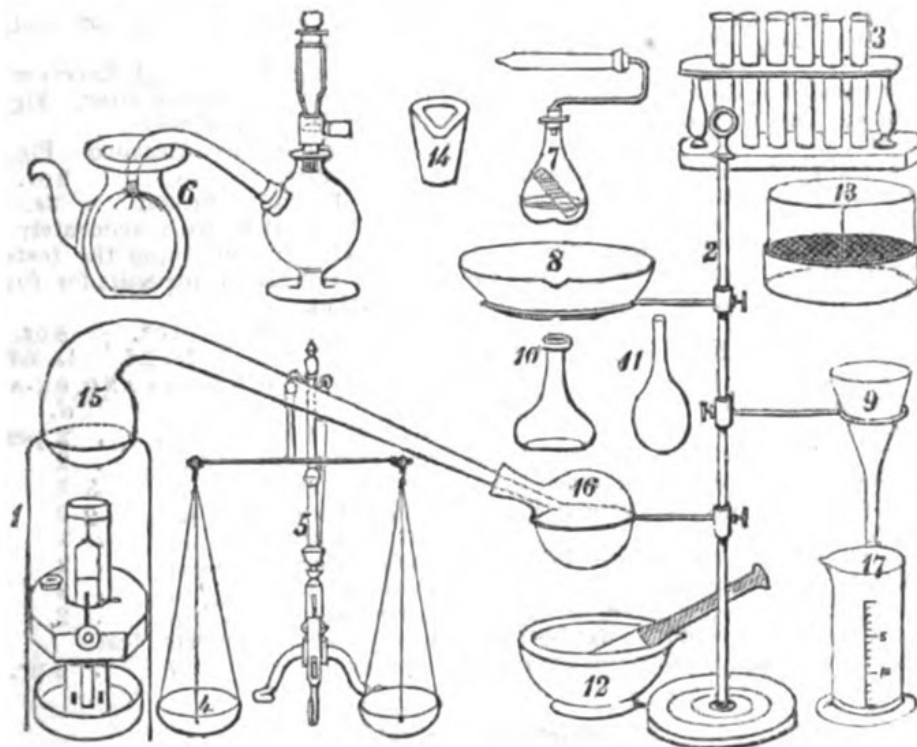
The 1846 *Post Office Directory* for London recorded George Knight and Sons as “*scientific instrument makers*” at 2 Foster Lane, and “*ironmongers*” at 41 Foster Lane. Examples of instruments and supplies produced by Knight (and Sons) are illustrated in Figures 2 and 3. A Culpepper-style microscope attributed to Knight is described, but not illustrated, at http://www.christies.com/lotFinder/lot_details.aspx?intObjectID=946660.



Figure 2. Optical and scientific instruments produced by George Knight and Sons. (A)

Ivory/bone label from Knight, Foster Street, London. (B) Transitional daguerreotype/plate camera. (C) Stereoscope, at the Science Museum, London. (D) Rain gauge, at the Science Museum, London. Photo credits are listed in below, in the Resources section. Images used for non-profit, educational purposes according to Creative Commons understandings.

CHEMISTRY APPLIED TO AGRICULTURE.



GEORGE KNIGHT AND SONS,

MANUFACTURERS OF CHEMICAL AND PHILOSOPHICAL APPARATUS,
IRONMONGERS, &c. &c.,

41, FOSTER LANE, LONDON.

Be to draw the attention of Farmers, Agriculturists, and others, to the annexed list of Apparatus, Instruments, and Tests, which they are now prepared to supply at a small cost, and which comprises all that is required for the examination into the chemical constitution of soils, so that their comparative value and fitness for the production of grain and other produce may be most readily ascertained, and the proper

manures suited to different lands by which considerable and unnecessary outlay may frequently be saved.

The different instruments and tests are supplied separately at the prices named, or complete sets may be had fitted into a small portable chest, according to the plans suggested by Davy, Henry, Rham, Ure, and others. Price, from 5*l*. 5*s*. to 10*l*. 10*s*.

APPARATUS.

Argand Oil Lamp, with wire frame for heating retort, flask, or evaporating dish.

Fig. 1. Price 3*s*. 6*d*. to 9*s*. 6*d*.

Stand with 3 various sized rings for the

support of retort, receiver, funnel, flask, or evaporating dish. Fig. 2. Price 6s. 6d. to 9s. 6d.

Set of Test Tubes in Rack, for testing by means of the re-agents substances held in solution. Fig. 3. Price 3s. 6d. to 6s. 6d.

Scales for weighing different portions of soil, and ascertaining by means of the bottle and weight, the specific gravity. Fig. 4. Price 8s. to 17s. 6d.

Set of Brass Weights from $\frac{1}{4}$ oz. to $\frac{1}{2}$ lb. Price 1s. 9d. to 5s. 6d.

Box of Decimal Grain Weights from 1-10 gr. to 1000 grains. Price 15s.

Knight's Specific Gravity Apparatus, consisting of bottle and weight with full directions for use. Price 15s.

Rev. Mr. Rham's Specific Gravity bottle and weight, for taking the specific gravity of soils, sands, &c. Price 5s. 6d.

Specific Gravity Bottles, containing exactly 100, 250, 500, or 1000 grains. Price 5s.

Brass stand for the more conveniently supporting the scales. Fig. 5. Price 10s. to 42s.

Sir H. Davy's Apparatus for the Analysis of Calcareous Earths. Fig. 6. Price 30s.

Parnel's Apparatus for the analysis of calcareous earths. This very pretty instrument supersedes by means of the balance, Davy's more expensive one. Fig. 7. Price 5s. 6d.

Ure's double bottle for the same purpose. Price 2s. 6d.

Pepy's Bottle with Spiral Tube for the same purpose. Price 4s.

Berlin, or Wedgewood Ware Evaporating Dishes for washing portions of soil and many other useful processes. Fig. 8. 6d. to 2s. 6d.

Glass or Wedgewood Ware Filtering Funnel. Fig. 9. 6d. to 1s.

Filtering Paper 2s. per quire.

Glass Flasks with round or flat bottoms for making or heating solutions over the

argand lamp. Figs. 10 and 11. 6d. to 1s. 6d.

Wedgewood or Berlin Ware, Pestle and Mortar, for reducing to coarse powder portions of soil. Fig. 12. 1s. 6d. to 4s.

Small Sieves for separating the stones and coarser portions from the finer. Fig. 13. 2s. to 4s.

Rham's Improved Arrangement. Price 5s. 6d. to 10s.

Crucible and Cover for ascertaining the quantity of silicious sand, as well as the combustible matter present; it may be heated in a common fire. Fig. 14. 3d. to 6d.

Glass Tubes, mounted according to the plan suggested by the Rev. W. L. Rham, for ascertaining roughly the composition of a soil when time will not permit of a more minute examination. Price 2s. 6d. to 7s. 6d.

Glass Rod for stirring solutions and dropping small portions of acid. Price 3d. to 6d.

Small Glass Retort and Receiver for the distillation of volatile matter. Figs 15 and 16. Price 2s. to 5s. 6d.

Graduated Glass Measure. Fig. 17.

2 oz.	4 oz.	8 oz.
1s. 6d.	2s. 3d.	3s.

Glass Bottles, with accurately ground stoppers, for containing the tests, acids, &c., or for preserving soils for future examination.

1 oz.	2 oz.	4 oz.	8 oz.
9d.	10d.	1s. 2d.	1s. 6d. each.

THE ESSENTIAL TESTS AND RE-AGENTS.

Muriatic acid	Sol.	. 2	per ounce.
Sulphuric acid	"	. 2	"
Pure ammonia	"	. 3	"
Muriate ammonia	"	. 2	"
Nitrate ammonia	"	. 2	"
Carbonate ammonia	"	. 2	"
Prussiate potash	"	. 2	"
Carbonate potash	"	. 2	"
Litmus and turmeric test paper	"	. 3	pr. packet.

Shortly will be published.

A NEW AND ENLARGED EDITION

OF

KNIGHT'S PRICED CATALOGUE OF GENERAL, CHEMICAL, AND PHILOSOPHICAL APPARATUS AND INSTRUMENTS.

Figure 3. 1844 advertisement for Knight and Sons, from the 'Farmer's Almanac and Calendar'.

George Knight and Sons earned a Prize Medal at the 1854 London International Exhibition at the Crystal Palace (Figure 4).

**CHEMICAL AND PHILOSOPHICAL
APPARATUS.**
THE PRIZE MEDAL was awarded to **GEORGE KNIGHT & SONS** for the **CHEMICAL APPARATUS** exhibited by them at the "Great Exhibition of All Nations," and they respectfully invite experimentalists of all classes, to inspect their establishment, 2 Foster-lane, Cheapside, comprising one of the most extensive assortments of Philosophical Instruments on sale in London. Photographic Apparatus of every description.
G. K. & SON'S are the appointed sole Agents for Voigtlander & Son's celebrated "Lenses" for Portraits and Views.
**GEORGE KNIGHT & SONS, 2,
Foster-lane, Cheapside.**

Figure 4. Advertisement from 'The Guide to the Crystal Palace and Park'.

In addition to their manufacturing businesses, Knight and Sons published books. Notably, they put out an English language version of Gustave le Gray's *Waxed Paper Process*, translated and modified by their assistant, James How (Figure 5). How also wrote an article "On the Production of Waxed Paper Negatives" for the magazine *The Chemist* in 1854, and the book *On the Production of Positive Proofs, from Waxed paper, Collodion and Other Negatives*, published by Knight and Sons in 1855. How was described in 1855 by *The Chemist* as one who "has long paid considerable attention to the art of photography, and is well known as an excellent and reliable authority".

Just published, Second Edition, price 1s. : by post, 1s. 6d.
THE COLLODION PROCESS.
By T. H. HENNAH.
Also, price 1s. : by post, 1s. 6d.
The WAXED PAPER PROCESS of **GUSTAVE LE GRAY**. Translated from the French. To this has been added, A New Modification of the Process, by which the time of exposure in the Camera is reduced to one fourth, by **JAMES HOW**, Assistant in the Philosophical Establishment of the Publishers.
George Knight & Sons, Foster-lane, London.

Figure 5. An 1854 advertisement for books published by George Knight and Sons.

Brothers George and Richard dissolved their partnership in July, 1855. *The London Gazette* announced, "Notice is hereby given, that the Partnership lately subsisting between us the undersigned, George Knight, and Richard Knight, carrying on the trade or business of Philosophical Instrument Makers, at No. 2, Foster lane, Cheapside, in the city of London, and of Ironmongers, at Nos. 40 and 41, Foster-lane aforesaid, under the style or firm of George Knight and Sons, and carrying on the trade or business of Cochineal Merchants at No. 6, Mincing-lane, Fenchurch-street, and at No. 2, Martin-lane, Cannon-street, in the said city of London, under the style or firm of Richard Knight and Company, has been dissolved by mutual consent – Dated this 7th day of July, 1855. George Knight Richard Knight".

As a point of clarification, sources such as www.earlyphotography.co.uk confused George's brother Richard with George's second son, also named Richard, and have reported that "The

partnership between George Knight and his son Richard was dissolved in 1855". George's son was born on June 23, 1842, and so was only 13 years old when his father's company was dissolved. The use of the name George for two generations of the family further confused matters.

George Knight, junior, described himself as an "ironmonger" on his children's christening records up through 1845. The 1841 census listed both father and sons as being ironmongers, indicating that dealings in iron were the major part of their business during those times. As a probable reflection of his financial success, the younger George listed himself as a "gentleman" on the baptisms of son Edward in 1849 and daughter Ada in 1854. For the 1851 census, the younger George described himself as a "manufacturer of philosophical instruments", employing 15 men. In 1861, he reported to be a "philosophical instrument maker employing 8 men". This business was obviously good for the Knights, with both the 1851 and 1861 censuses recording multiple live-in servants. George, his wife Louisa, and their children lived at 46 Regent's Square, London, from 1842 until his death.

After 1855, the scientific instrument business was operated by George. Advertisements indicate that the business was renamed "George Knight and Co." (Figure 6), although other people's references to the shop generally used the old "and Sons" name. George's business appears to have been centered on the 2 Foster Lane shop. There, he made and sold all manners of equipment and supplies for photography and chemistry. Knight also published scientific books, which included further editions of T.H. Hennah's *Collodion Process* in 1856 (Figure 5), and, in 1857, *The Chemical Atlas* by A. Normandy and *A Manual of Electricity* by H.M. Noad.

**Just published, price 1s. Fourth Edition of the
COLLODION PROCESS, by
T. H. HENNAH.
GEORGE KNIGHT & CO., Foster Lane,
London.**

**GEORGE KNIGHT & CO.,
2, FOSTER LANE, CHEAPSIDE,
LONDON, Manufacturers of Chemical Appa-
ratus and Philosophical Instruments of every
Description.**

**The PHOTOGRAPHIC DEPARTMENT
comprises Voigtlander's celebrated Lenses for
Portraits and Views, for which MESSRS.
KNIGHT are the sole Agents.**

**CAMERAS on the most Improved Construc-
tion. Stands; Plain, Waxed, and Iodized
Papers of English and Foreign Makers; Col-
lodion of Superior Quality, and every other
requisite for practising the Art with success.**

**KNIGHT'S REGISTERED COSMO-
RAMA STEREOSCOPE. affording greater
facility for viewing as one the double Pictures.**

**Practical Works on the Talbotype, Waxed
Paper, and Collodion Processes, 1s. each.**

Figure 6. 1856 advertisements from 'Notes and Queries'. This was shortly after George Knight dissolved the partnership with his brother, and re-styled the business as George Knight and Company. The business at 2 Foster Lane produced and sold cameras, photographic supplies and a variety of chemicals and apparatus. Knight also published books on photography and chemistry.

George Knight and Co. survived until 1862 (Figure 7). George evidently got heavily into debt, and was forced to sign the business over to his creditors in June, 1862. It is possible that ill health played a role in ending George's company: he died August 6 of the same year. As further

evidence of legal and financial difficulties, George Knight's will did not clear probate until 1867, and his estate was valued at "under £100".

NOTICE is hereby given, that by an indenture, dated the 26th day of June, 1862, and made between George Knight, of Foster-lane, Cheapside, in the city of London, Chemical Apparatus Manufacturer, of the first part; Robert Westwood, of Newgate-street, in the said city of London, Wholesale Chemist, and Alfred White, of Castle-street, Saffron-hill, Manufacturing Chemist, of the second part; and the several persons, creditors of the said George Knight, who shall execute the said indenture, of the third part; the said George Knight did convey and assign all his real and personal estate unto the said parties of the second part, upon certain trusts, for the equal benefit of themselves and the several persons parties thereto of the third part, respectively, being creditors of the said George Knight, and that the said indenture was executed by the said George Knight on the 26th day of June, and by the said Robert Westwood and Alfred White on the 27th day of June, 1862, in the presence of, and the execution thereof was attested by, Richard Cumming of No. 13, King-street, Cheapside aforesaid, Solicitor, and that the said indenture lies at the offices of the undersigned for inspection and execution by the creditors of the said George Knight.—
Dated this 30th day of June, 1862.

VAN SANDAU and CUMMING, Solicitors for
the Trustees, No. 13, King-street, Cheapside.

Figure 7. Notice of George Knight's bankruptcy, from 'The London Gazette'.

Shortly after Knight's foreclosure, the business reopened under the ownership of James How, a former employee. By early 1863, How was advertising a catalog of his products, including "microscopes, microscopic apparatus and objects" (Figure 8). Figure 9 illustrates a microscope and a microscope lamp made by James How. One of his slide cabinets is shown in Figure 10. As noted above, no slides have been identified that can be conclusively shown to have been sold by How, suggesting he may simply have sold unattributed slides from outside sources. The shop at 2 Foster Lane was described by earlyphotography.co.uk as "a large, wide fronted, premises with a photographers glasshouse at the top .. on the eastern corner of Foster lane and Cheapside".

MICROSCOPES, ETC.

JAMES HOW,

Upwards of Twenty Years with and Successor to GEORGE KNIGHT & SONS,
Philosophical Instrument Makers,

2, FOSTER LANE, LONDON.

NOW READY, free by post on receipt of Four Stamps, a CATALOGUE OF SCIENTIFIC INSTRUMENTS. PART I., containing MICROSCOPES, Microscopic Apparatus and Objects, TELESCOPES, and other Optical Instruments. PART II., containing PHOTOGRAPHIC APPARATUS and CHEMICALS, is in preparation, and will shortly be published. A List of ENTOMOLOGICAL and NATURAL HISTORY APPARATUS may be had on application.

Agent for JONES'S PHOTOGRAPHIC CARTOONS for the MAGIC LANTERN.

G. KNIGHT & SONS, 2, FOSTER LANE, LONDON.

Figure 8. The earliest identified advertisement for James How's new business, from the March, 1863 issue of 'The Intellectual Observer'. Apparently, How had not yet changed the name of the

business (or not yet changed the sign on his shop).



Figure 9. A microscope and a microscope lamp produced by James How. In that they bear his name, they date between 1862 and 1872. The same model of lamp was sold by How's successor, James How and Co., until at least the end of the 1880s.



Figure 10. A large microscope slide cabinet sold by James How, successor to George Knight. Produced between 1862 and 1872. No microscope slides have been identified that can be attributed to the periods when James How or George Knight operated the optical shop at 2

Foster Lane.

James How was born March 8, 1821, in Greenwich, Kent, to William and Susannah Coleman How. James' father was a carpenter. The 1841 census recorded the twenty year-old James as working as a butcher.

His 1863 advertisements described James How as having worked with George Knight for approximately 20 years (Figure 8), indicating a career change and move to London around 1843. How's obituary described him as having been Knight's "*manager*". The 1848 christening record of his eldest daughter stated that James then worked as a "*chemist*", and the 1861 census described him as a "*chemist warehouseman*", suggestive of a primary occupation with the Knight photography business. Judging from How's production of microscopes and other optical instruments, it is reasonable to assume he also received training in lens grinding and other skills of the optician trades. He described himself as an "*optician*" for the 1871 census.

James and his wife, Emily, raised six children. The family was relatively well-off by 1871. They did not live at the shop, but instead lived at 42 Gresham Road, Brixton, Surrey. James evidently commuted to work. They employed a domestic servant, another sign of modest luxury.

Although microscope slides sold by How have not been identified, photographs in magic lantern slides are known (Figure 11). James How produced a large series of photomicrographs (small objects enlarged by photography through a microscope) taken by Richard Maddox. The 1867 *Catalogue of the Educational Division of the South Kensington Museum* described a "*Series of Enlarged Photographs of Microscopic Objects; the Negatives by Dr. Maddox, printed by J. How. These are also mounted as Slides for the Magic Lantern, price 6d. each (in frame, glazed). Also 6 Specimens mounted on Card*".



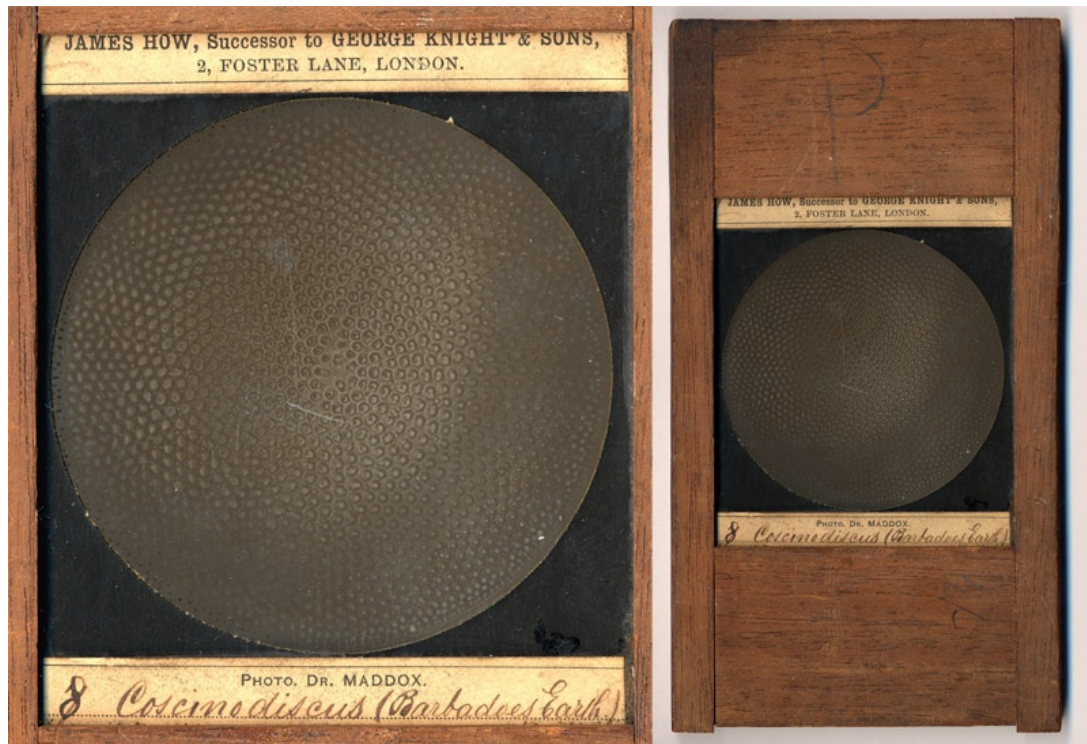


Figure 11. Two lantern slides of diatoms, produced by Richard Maddox and sold by James How. The slides measure 3 x 3 inches (75mm x 75 mm), with original mahogany wood frames that are 3 ¾ x 7 inches (95 x 175 mm). Close-ups of the photos appear to the left, and full views of the wooden-framed slides are shown to the right. Both of these subjects were exhibited in 1864 by James How to the Photographic Society of London.

At the November 15 and December 15, 1864 meetings of the Photographic Society of London, James How “exhibited, on a disk of about 7 feet diameter, by means of the oxyhydrogen lantern, a series of beautiful microscopic photographs taken by Dr. Maddox, some of them with the highest-power object-glasses. These marvelous productions excited universal admiration . . . The following are among those which were most admired: Vegetable. - Seed of *Eccremocarpus*. Diatomaceae. - *Actinosphenia splendens*; *Aulaeodiscus formosus*; *Auliscus moronensis*; *Coccinodiscus (Barbadoes earth)*; *Liemophora flabellata*; *Navicula didyma*. Echinodermata. - *Echinus*, section of spine, tr.; *Synapta digitata* (spicules and plates from skin). Crustacea. - *Canthocamptus furcatus*; Cyclops. Insecta and Arachnida. - Parasite of Beetle Parasite of Field-Mouse; Parasite of Mole Parasite of Sparrow, female; *Acarus* of Fig; Itch-insect; Flea of Mole, male; Flea of Mole, female; Flea of Pigeon, male; Eye of Beetle; Foot of Fly; Gizzard of Cricket; *Hygrotus elegans (Water-Beetle)*; Leaf-insect; Scale of Hawk Moth; Spiracle of Cockchafer; Tongue of Drone Fly; Tongue of Rhingia; Tongue of Hornet. Vertebrata. - Blood-corpuscles, Human. The Chairman said that he regarded it as a great achievement in photography to render, with such perfection as they had seen on the screen, objects so small in size that four millions of them would be required to cover one square inch. Those Members who wished to see more of them might do so at Mr. How's place, in Foster Lane. There were a hundred of them, and only twenty had been shown”.

“The Chairman called attention to a series of photographs of microscopic objects by Dr. Maddox, which were exhibited by Mr. How. They were, he thought, the best photographs of the kind he had ever seen. Photographs of microscopic objects had hitherto generally been failures; but these struck him as being really the finest in the world ... He would recommend any Member who happened to have a lens with him to examine the prints carefully, as they would well repay such an examination”

How displayed his products at the 1867 Paris Universal Exhibition. According to the catalogue,

these included “*photographs*”, a “*photography tent*” (portable dark room) and a “*field box*” (probably a portable, light-tight box that one could reach inside to manipulate photographic plates, protected from daylight).

As did his former master, James How also published scientific books. These included *Urinary Analysis*, by Robert Venables, in 1868.

James was elected a Fellow of the Royal Microscopical Society on February 10, 1864. He also joined the Quekett Microscopical Club on March 27, 1868, shortly after it was formed. At the 1866 Annual Soiree of the Royal Microscopical Society, “*Mr. James How had some beautiful examples of Zoophytes with expanded tentacles, Halodactylus, Sertularia, &c.; the larvae of the shore crab, circulation of the blood in the frog, specimens of Trichina spiralis in human muscle, &c. Mr. How also exhibited, in one of the rooms upstairs, by means of the oxyhydrogen light, a selection of photo-micrographs by Dr. Maddox, consisting of vegetable structures, diatoms, parasites, parts of insects (some of these exhibited for the first time), such as preparations of the head and wings of the male and female gnat, and larvae and pupa state of the same, and a fine photograph of the tongue of the house-cricket*”. Clearly a good salesman, How did not waste opportunities to display his products to potential customers. He was also recorded as displaying microscopes and lamps at RMS and QMC meetings.

**HOW'S
MICROSCOPE LAMP.**
Price 10s. 6d.

EXHIBITED at the Islington Literary and Scientific Institution, April 27; the Royal Microscopical Society's "Scientific Evening," May 10 (see 'Monthly Microscopical Journal,' No. 30, p. 281); the South London Microscopical and Natural History Club, May 16th, 1871.

Description on receipt of One Stamp.

HOW'S STUDENT'S MICROSCOPE,
£5. 5s.

Catalogue of Microscopes on receipt of Three Stamps.

HOW'S NEW COLLECTING CASES.
See How's Catalogue of Apparatus, &c., for Collecting and Preserving Objects of Natural History; by post, Three Stamps.

JAMES HOW
(SUCCESSOR TO GEORGE KNIGHT AND SONS,)
Chemical and Philosophical Instrument
Manufacturers,
2, FOSTER LANE, LONDON.

Figure 12. 1871 advertisement from the cover of ‘The Monthly Microscopical Journal’.

In early 1873, the *Monthly Microscopical Journal* reported, “*Mr. James How, the well-known philosophical instrument maker of Foster Lane, recently complained of a small tumour that had appeared behind one of his ears, which, on the following day, became so painful as to compel him to leave his business. The tumour rapidly developed into a carbuncle, and erysipelas supervening, he died on Sunday, the 8th of December, 1872, at the comparatively early age of fifty-two. Mr. How was for many years manager of the business of the late firm of George Knight and Son, Foster Lane, whom he afterwards succeeded. He was intimately conversant with the*

practical details of photography in its numerous ramifications, and several years since published his method of producing negatives by the waxed-paper process, a process which he simplified to a very great extent, and by which he produced many fine photographs. He was elected a Fellow of the Royal Microscopical Society on the 10th of February, 1864. Mr. How introduced a cheap students' microscope, which was admitted to be one of the best instruments of its class, and his skill in exhibiting microscopic photographs and similar objects was widely known and appreciated". His will left "under £3,000" to his widow, Emily.

The business continued under other ownership for at least two more decades, using the name "James How and Company". The similarity in names has led many historians to assume that How was still alive and operating the company for all that time.

To the best of my knowledge, George John Smith bought James How's shortly after How's death. Smith joined the Quekett Microscopical Club on June 27, 1873, an indication of his ascendancy into the world of well-connected microscopists. He was elected Fellow of the Royal Microscopical Society in 1881. Smith was described in the 1881 census as being an "*optician master*", implying that he was skilled in lens grinding and other optical-related skills. His election to the RMS and QMC also suggest microscopical artistry. Those skills would have required an apprenticeship. Smith may have apprenticed with How, or, alternatively with Smith's father-in-law, Joseph Bloomfield. The parish record of Smith's 1861 marriage to Caroline Bloomfield noted that her father was an "*optician*". The 1861 census described George Smith as a "*practical chemist*", a further suggestion that he worked for James How and George Knight before taking over the business.

George John Smith was born ca. April, 1835, to Thomas and Jane Smith. He was christened May 3, 1835 at Spitalfields Christ Church with St Mary and St Stephen, (now within London). George's father, Thomas, was a butcher.

Presumably, Smith retained the How name for his company in order to take advantage of How's good reputation. Smith appears to have sold the same models of microscopes and lamps as did How. The name of the new business seems to have confused even members of the Quekett Microscopical Club, to whom both How and Smith should have been known: the *Journal of the Quekett Microscopical Club* report of the 1875 Annual Soiree stated, "*Mr. G.J. Smith, for Mr. How - Large Binocular Microscope; Students' and popular Binocular Microscopes; transparent Anatomical preparations, &c.*"

The above-mentioned report implies that How and Co. sold slides of anatomical sections. No microscope slides are known that are labeled with the Foster Street address, suggesting that they may have been produced by an outside source(s) without labels that identify How & Co.

During the autumn of 1876, Smith moved the James How and Co. shop from Foster Street to 5 Saint Bride Street (Figures 13 and 14).

NOTICE OF REMOVAL.
JAMES HOW AND CO.,
SUCCESSORS TO GEO. KNIGHT & SONS
Chemical, Optical, and General Scientific Instrument
Manufacturers,
2, FOSTER LANE, LONDON,
HAVE REMOVED to more convenient and accessible Premises,
5, ST. BRIDE STREET, FLEET STREET,
Three Doors north of Ludgate Circus, and within Seven Minutes' Walk of
their Old Establishment.

Figure 13. Smith moved his business to 5 St. Bride Street during the autumn of 1876. Advertisement from the November 2, 1876 issue of 'Nature'.



Figure 14. A How and Co. microscope slide, sold from their location at 5 St. Bride Street.

Like his predecessors, Smith displayed his microscopes, magic lantern slides and other products at meetings. These were often among the displays of commercial suppliers, enhancing their function as advertisements to his fellow society members and visitors. For example, the report of the 1877 Annual Conversazione of the Quekett Microscopical Club read, “By permission of the Council of University College, a Conversazione was held in the Museum, and the East and South Libraries, on Friday, the 13th of April. About 1,050 ladies and gentlemen were present. 120 microscopes were brought by the members of the Club, and 60 by members of the South London, the Croydon, the Sydenham, the Greenwich, and the New Cross Societies. The leading London Opticians also kindly lent their assistance, as on former occasions...Among the large number of excellent professional exhibits, the following were particularly noticed: Messrs. Jas. How and Co. (by Mr. G.J. Smith). - Popular Binocular and Students' Microscopes. Sections of Rocks - Igneous, Sedimentary and Metamorphic, &c.” and “Mr. G. J. Smith (James How & Co.) exhibited at intervals, during the evening, by means of the oxy-hydrogen apparatus, in one of the dark rooms, Views of Scottish Scenery, Statuary, Photomicrography, Experiments with Polarized Light, &c.”

A report of the 1881 conference of the British Association (a preeminent general science organization) stated, “Further on were to be seen a collection of mineral and rock sections, exhibited by Messrs. James How & Co., of London; this firm also exhibiting a beautiful collection of lantern transparencies, chiefly geological and physiological, for the illustration of scientific lectures by means of the lantern.”

George Smith appears to have been particularly interested in studies of rocks and minerals. All known instances of Smith exhibiting microscope slides to his RMS and QMC colleagues involved sectioned mineral specimens. As examples, during 1878, he displayed to the QMC “Graphic Granite from Scotland” and “Ptychodus tooth from chalk” on March 8, and “Sherzolite from the Pyrenees, &c.” on May 18. To the RMS, he exhibited “Sections of dolerite with unaltered olivine and syenite, from Peru” on April 20, 1881, “Limestone with shells, from Headon Beds, Christchurch Bay, Hants. Quartz Diabase from Freiburg, with polarized light” and “Augite, Syenite, Propylite, &c, with polarized light” on November 26, 1884, and, on November 28, 1888, “(1) Olivine Dolerite, Glacial Drift, Finchley. (2) Basalt (columnar) with Olivine, Erpel, Linz, Rhine. (3) Micropegmatite. (4) Pikrite, Tringenstein. (5) The Fayette Meteorite, Bluff

Settlement, Colorado River, Bluff Co., Texas. (6) Ejected blocks of Trachytic Lava from the Tuff of the Lacher See, Eifel, Prussia". Print advertisements also emphasized mineral sections (e.g. Figure 15). His great interest suggests that Smith would have produced at least some thin-sectioned mineral slides. However, it is not known whether he produced the slides sold by How and Co., or if they were brought in from outside sources. Those slides sold for between 1 ½ and 2 shilling each in the mid-1880s, and so could have been a fairly profitable commodity.

The How and Co. business moved a second, time, in mid-1879, to 73 Farringdon Street (Figure 15). It remained at that location until Smith ceased business, which was in the early 1890s.

JAMES HOW & CO.,
 SUCCESSORS TO GEO. KNIGHT & SONS,
73, FARRINGDON STREET, LONDON,
 LATE OF 2, FOSTER LANE, AND 5, ST. BRIDE STREET,
CHEMICAL, PHYSICAL, AND GENERAL SCIENTIFIC INSTRUMENT MAKERS.
 HOW and CO.'S series of Geological Illustrations for the Lantern are indispensable to Lecturers upon Geology. Lists of application.
ROCK SECTIONS, IGNEOUS, METAMORPHIC, AND SEDIMENTARY, FOR MICROSCOPICAL INVESTIGATION.—A large assortment kept in stock, consisting of Granites, Syenites, Porphyries, Trachytes, Andesites, Rhyolites, Diorites, Gabbros, Dolerites, Basalts, Pitchstones, Obsidians, Schists, Serpentine, Limestones, &c.
HOW'S MICROSCOPE, ADAPTED FOR THE INVESTIGATION OF ROCK STRUCTURES, with Concentric Rotating Stage Polariscope Condenser, ½-inch, 1-inch and 2-inch Object Glasses in Case, £10 10s.
HOW'S STUDENT'S MICROSCOPE, £5 5s.
HOW'S MICROSCOPE LAMP. THE MINIATURE MICROSCOPE LAMP.

Figure 15. Smith moved the business again, during the summer of 1879, to 73 Farringdon Street. Advertisement from the August 21, 1879 issue of 'Nature'.



Figure 16. A How and Co. microscope slide, with the address cut from the label. Based on comparisons with other How and Co. slide labels (Figure 1), this was probably stock on hand when Smith moved the business from Saint Bride Street to Farringdon Street (1879), the address being removed to avoid confusion with customers.

The 1881 census recorded George J. Smith as being an “*optician master employing 3 men, 1 boy*”. His son, 18 year-old George Bloomfield Smith, was an “*optical turner*”, presumably working for his father as a lens grinder. Both father and son were listed as “*scientific instrument maker*” on the 1891 census.

James How and Co. came out with a compact, portable microscope lamp in the mid-1880s. An

advertisement from *Hardwicke's Science-Gossip* described the "Pocket Microscope Lamp" as "very convenient and portable, gives ample illumination, has all necessary adjustments, is provided with a Cylindrical Case, and can be conveniently carried in the breast coat pocket; when charged with sufficient Oil to burn for above 3 1/2 hours, weighs under 12 oz. Price 8s. 6d. Microscopists who are in the habit of exhibiting at the Meetings of their respective Societies and elsewhere, should provide themselves with this little Lamp. Micro-Petrology, Typical Rock Sections, 1/6 AND 2/- each. JAMES HOW & Co., 73, FARRINGDON STREET, LONDON."

earlyphotography.co.uk notes that their last record of James How and Co. was from 1891. I did not find any references to the business after that point, although he was still actively exhibiting mineralogical microscope slides in 1894. Thus the Knight-How-Smith chain of optical businesses likely ended in the early- to mid-1890s.

George Smith's wife, Caroline, preceded him in death, passing away in early 1887. Smith's son, George, and youngest daughter, Mabel, were living with their father in 1891. By the time of the 1901 census, George J. Smith was a pensioner at Sutton's Hospital, Charterhouse, London. He died there, on May 5, 1905.

This and other illustrated biographies of early microscopists can be read at the author's web site, <http://microscopist.net>

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How microscope: <https://www.bonhams.com/auctions/19035/lot/195/>

How microscope lamp: <https://www.mhs.ox.ac.uk/collections/search/displayrecord/?mode=displaymixed&module=ecatalogue&invnumber=47451&query=>

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Knight trade label: <http://www.earlyphotography.co.uk/site/companies1.html>

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