Autophotography implies visible radiation and thus is not suitable for radioactive radiation. Because of the wide application of *autoradiography,* it will undoubtedly be necessary to qualify the term by the use of prefixes to distinguish its various phases—such as *micro-*, *macro-*, or *histo-autoradiography.* When necessary, this would seem to take advantage of the ability of Greek to lend itself to the logical classification of ideas.

The verb stem, *-graph,* is derived from *graphein* (to write or to draw). Thus by performing the technique, one autoradiographs. The result from this action—that is, the developed film or plate—is a *-gram.* This noun stem is derived from the Greek noun *gramma,* meaning something that has been written or drawn. *Autoradiogram* is correct, notwithstanding a photograph produced by photography. Etymologically, this result should be a *photogram* and the camera a *photograph.* Wide and consistent usage of this error has made these two terms acceptable. Not so for autoradiograph, since the usage has been neither so widely nor so consistently used. It does not seem appropriate that autoradiograph as a noun should be similarly perpetuated by scientists.

It might be argued that *graph* could be derived from the adjective *graphic* (pertaining to writing or drawing). To use *autoradiograph*—that is, self-ray-writing—is to employ it in its adjectival sense [*cf.* I sent the message by telegraph(ic) instrument] whereas a genuine noun use is desired. The *-gram* ending accurately provides this by its meaning, the result of an action. Another objection to *autoradiograph* as a noun form is the tendency to delete the *radio-*, producing *autograph,* which means a person's signature. However, *autogram* is a convenient nickname for autoradiogram and does not cause confusion. (Fischer (*5*), by the way, used *autophoto* as such a nickname.)

Therefore, we recommend the terms *autoradiography* to designate the technique, and *autoradiogram* to designate the result of the technique.

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5 February 1954.

A Concise Form for Scientific Literature Citations

A single issue of a modern scientific journal or book often contains thousands of literature citations. In view of the large total space thus consumed, it would appear worth while to adopt a more concise style for such citations than that now customary. Table 1 demonstrates a proposed new style, which would reduce the minimum linear space requirement for each citation by about one-half and would save time and labor for the authors, editors, and users of scientific literature. Although Table 1 is largely self-explanatory, certain features require comment.

Items regularly included. The minimum information necessary in principle to specify a certain article (or page of an article) consists of the page number, journal name, and year number. These items would be handled as follows:

The left-hand number in each new-style citation (Table 1) is the page number, consisting usually of one to four digits.

The set of capital letters in each citation is the code for the journal name. For the most important journals, these letters could be so chosen as to suggest the name, but this is not essential and would not be possible for all journals. With four letters, 26^4 or 456,976 different journal codes can be assigned. This number should be more than ample, not only for all scientific journals published in the world at present, but also

Table 1. Comparison of conventional and proposed concise form for some typical literature citations.

Ref. No.	Conventional form	Concise form
(1)	*Helv. Chim. Acta* 26, 2266 (1943)	2266-**HCAC**-43
(2)	*Ann.* 3, 132 (1832)	132-**DANN**-832.3
(3)	*J. Biol. Chem.* 188, 287 (1951)	287-**AJBC**-51.8
(4)	*Bull. Soc. Chim.* [4] 19, 327 (1916)	327-**FBSC**-16.9
(5)	*J. Am. Chem. Soc.* 72, 4077 (1950)	4077-**ACSJ**-50
(6)	*J. Chem. Educ.* 27, 654 (1950)	654-**AJCE**-50
(7)	*J. Org. Chem.* 13, 697 (1948)	697-**AJOC**-48
(8)	*Chem. Abs.* 40, 6512 (1946)	6512-**ACAB**-46
(9)	*Bull. Chem. Soc. Japan* 10, 424 (1935)	424-**KBCS**-35
(10)	*Science* 119, 135 (1954)	135-**ASCI**-54.9

Table 2. Suggested code letters for a few journals.

Code	Journal	Code	Journal
ACAB	*Chem. Abs.*	**BSOC**	*J. Chem. Soc.*
ACSJ	*Jour. Am. Chem. Soc.*	**DANN**	*Annalen (Liebig's)*
AIEC	*Ind. Eng. Chem.*	**DBER**	*Ber.*
AJBC	*Jour. Biol. Chem.*	**DMON**	*Monats.*
AJOC	*J. Org. Chem.*	**FBSC**	*Bull. Soc. Chim.*
ASCI	*Science*	**HCAC**	*Helv. Chim. Acta*
BBIO	*Bio. J.*	**RJPC**	*J. Phys. Chem. U.S.S.R.*

for journals which have been discontinued, or which may be started during the next century or two.

Each right-hand number (Table 1) is the year number, consisting usually of two digits—for example, –48 for 1948. For the unusual reference a century or more old at the time of citation, three digits would be needed—for example –832 for 1832. Note, however, that an 1886 reference cited in 1954 would read simply –86.

The separation of the two numbers of each citation by letters insures legibility with minimum punctuation. In printed material, the journal code letters should appear in boldface or italics.

Optional items. Although not essential, it would be convenient to let the first letter of each journal code designate the country of publication—for example the H in **HCAC** (Table 1) signifies Switzerland. Each of the eight or ten major scientific countries would receive an individual letter and where necessary additional alternate letters, and all remaining countries or territories would be covered by six continental code letters. If the first letter of every code were used to designate country, the remaining three letters would cover 17,576 journals for each country, thus only the two or three largest countries should require more than one letter (Tables 2 and 3). It would, of course, be possible to use journal codes containing a total of five letters, if four-letter codes should ever in the future become inadequate.

The proposed journal code system may be compared to the very successful international system of radio call letters, which for example assigns initial letters **W** and **K**, to United States broadcasting stations.

It might ultimately prove desirable to let the second letter of each journal code designate the field of science (for example, C for chemistry), but this problem need not now be considered in detail.

Items regularly omitted. The authors and title are unnecessary in a minimum citation but can, of course, be included as supplementary information whenever desired. Certain other items are, in principle, entirely unnecessary and could in time be abandoned if journal editors would arrange to do so.

The series number of any journal is fixed by its year number and thus can always be omitted; for example, any 1916 issue of the *Bull. Soc. Chim.* (**FBSC**) necessarily belongs to series 4.

Volume numbers are superfluous for any journal that has adopted the very sensible one-volume-per-year system. The *Journal of the Chemical Society* (**BSOC**), for example, has not used volume numbers since 1926. (In some other cases one-volume-per-year journals continue to use volume numbers merely from tradition.) Issue numbers have already been abandoned by most scientific journals, since pagination through a year (or volume) is now usually continuous.

Historical information regarding the number of preceding years, volumes, series, and so forth, could easily be given by each journal in its annual title page, thus eliminating the need to clutter up literature citations with such information.

Temporary procedure for multivolume journals. Since many journals still do have more than one volume per year, and in any event occasional references to back years of such journals will always be necessary, citations must sometimes specify both year and volume. The problem can be solved by appending the last digit (if necessary, last two digits) of the volume number to the year number. For example volume 119 can be distinguished from the other 1954 volume of *Science* by the modified year number –54.9 (see Table 1). An issue number could be specified by appending a second number, if it were necessary.

How the system could be put into effect. The new-style citations can be adopted immediately on an informal basis by any editor, author, literature searcher, or librarian who will compile his own list of perhaps 1 to 3 dozen journal codes. For the occasional uncoded journal, the conventional abbreviation can be sandwiched between the page and year numbers in place of the code letters. Individual scientists should find such citations handy for literature notes and bibliographies.

Ultimately a comprehensive journal code list sponsored by appropriate authorities would be desirable (*cf.* list in 1951 annual index of *Chemical Abstracts*).

Table 3. Suggested initial code letters designating country or continent of publication (remaining letters reserved for future allocation).

Continent or country	Code letters	
North America	**M**	
U.S.A.		**A, U**
South America	**W**	
Brazil		**Z**
Argentina		**V**
Europe	**E**	
Great Britain, Eire		**B**
Germany, Austria		**D**
France		**F**
Switzerland (Helvetia)		**H**
U.S.S.R.		**R**
Italy		**T**
Asia	**K**	
Africa	**Y**	
Australia	**S**	

However, it should be emphasized that the number of journals *frequently* consulted by an individual scientist is not likely to exceed 2 or 3 dozen. Most of the code letters for these journals would soon be memorized, so that it would seldom be necessary to consult a comprehensive list. Then, too, the use of code letters might in time be greatly facilitated if the official code for each journal were included on its pages and covers and if short tables of journal codes for each particular field were made available.

The new-style citations would be especially suitable for use with automatic sorting devices for punched cards and microcards. Microcard libraries might ultimately be mechanized so that "dialing" the citation symbols on a modified telephone dial would cause the desired page or pages to be projected on a screen.

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14 May 1954.

A Technique for Making Multiple-Bore Microelectrodes

In electrobiological work, it is often convenient to use two or more electrodes separated by a known, small distance. This communication describes a method of making what is in effect a glass pipette with multiple bores. With the several bores filled with a metallic or electrolytic conductor, the pipette becomes a relatively rugged electrode assembly. The number of bores in the pipette can be at least as many as seven, and the spacing between bores at the tip of the pipette can be made as small as 10 μ and probably less.

The method is that of Elson (*1*), who used it to produce multiple-bore capillary tubes. A number of Pyrex tubes about 20 cm in length are packed snugly inside a larger Pyrex tube of similar length. This bundle is then treated as a single tube; any technique that will produce a single-bore microelectrode will, with slight modification, yield a multiple-bore microelectrode. During the drawing, the individual bores (and interstices between tubes) remain open, although the relative proportion of walls and bores is somewhat altered.

The drawing technique used in this laboratory is perhaps worth brief description since it requires only simple apparatus and very little manipulative skill. The drawing is done in three steps, the glass being cooled between drawings. In the first step, the original bundle is heated by an oxygen and gas flame and drawn down to about 1 mm in diameter. The piece is then divided near the center of the reduced portion, and a small, solid knob is formed at the tip of each resulting piece; the knob is to facilitate attachment of the weights that are used in the last two stages of drawing.

For the second drawing, the tapered bundle from the first step is supported in a vertical position with the small part pointing downward. A coil of No. 24 Nichrome wire of inside diameter 3 mm and length 5 mm is slipped over the tip and raised until it surrounds the portion of the tapered, multiple-bore tube, which is 2 mm in diameter. A weight of about 25 g is attached to the tip of the piece by an alligator clip. The nichrome coil is heated by current supplied through a variac and a step-down transformer. The coil temperature is regulated so that the glass is slowly drawn out. When an elongation of about 6 mm has been produced, the current is turned off; the glass is not allowed to break. It is advisable to place a small shelf beneath the weight to stop the drawing when the desired elongation has been accomplished. The coil is then lowered 2 or 3 mm until it is centered on the necked-down portion of the glass.

For the third stage of drawing, a heavier weight is attached, the size of which determines the final tip diameter. The coil is heated to a dull red and the glass is allowed to break, after which the current is turned off. The piece that breaks off can be conveniently examined under the microscope.

Since the final tip diameter depends upon several variables, no precise statement can be made regarding the amount of weight to be used in the third stage. The usable range is about 50 to 900 g, corresponding very approximately to 10 and 150 μ, respectively. For a given set of conditions, the tip diameter is reproducible to about 10 percent.

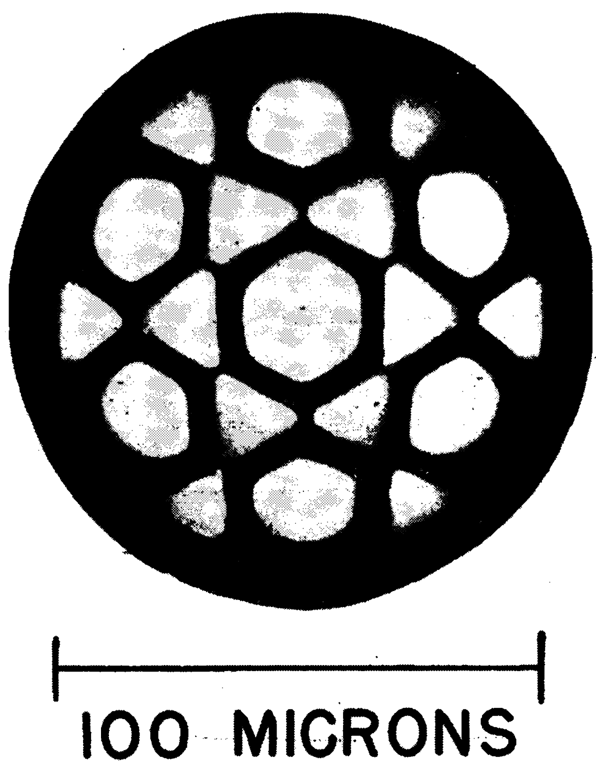

Fig. 1. Photomicrograph of the tip of a multiple-bore glass pipette having one central bore and six others arranged symmetrically around it.