paratively small floor area and, at the same time, of diffusing the floor load. Pamphlets, special bibliographies, tear sheets, etc., are kept in a vertical file, which consists of five four-drawer file cabinets.

The plan also includes an area (*WA*) for the assembling and distribution of classified documents produced by the organization served by the library. This fundamental publishing activity is fairly common among military research establishments, but it is not an intrinsic part of library activity and might well be made a function of another division of the organization, such as the mailing department.

The estimated initial costs of implementing a library of the size and scope projected are as follows: Books, bound periodicals, and current periodical subscriptions, $41,375; equipment, furniture, and supplies, $9,956; salaries, $27,550. After the first year, operating expenses would be: New books (500 at $5.00), $2,500; periodical subscriptions (250 at $7.50), $1,875; binding (300 volumes at $3.00), $900; supplies, $750; salaries, $23,550.

Staff requirements. Initially, the staff requirements of the combined library would be as follows:

1) A *chief librarian* to administer the whole operation, determine policy, select new acquisitions, and to initiate and supervise literature searches as they are required.
2) An *assistant chief librarian* to administer the business operations of the library, assist in the supervision of the library and its related document-assembling and distribution activity, and to perform literature searches.
3, 4) Two *cataloguer-abstracters.*
5) A *desk attendant* to supervise circulation of the classified and unclassified collections, maintain circulation records, and to answer simple reference questions.
6) A *clerk-typist* to assist the cataloguer-abstractors, and to order and type catalog cards and process books and reports.
7) A second *clerk-typist* to furnish general clerical and stenographic assistance to the professional staff of the library.
8, 9) Two *clerks* to assemble and distribute classified documents and to render general assistance.

At the end of the first year it would probably be possible to operate the library with one less cataloguer-abstracter and one less clerk. In a library operation of this size, interchangeability of personnel is a primary prerequisite. All must be adaptable and thoroughly familiar with the day-to-day activities of the group.

General considerations. In addition to the monetary considerations discussed above, there are two factors to be weighed in deciding on the advisability of a unified library as opposed to separate classified and unclassified libraries. Often, in searching the literature for technical information, it is difficult to predict whether this information will be classified or unclassified. The presence of both collections in a single area, manned by a single staff acquainted with both, makes for a much simpler and more efficient situation than exists where there are two libraries with two staffs in two different parts of the research establishment. On the other hand, in large organizations, where military research is but a minor part of the total activity, the two-library setup is definitely indicated, because only a part of the total staff will have the security clearance necessary to see and use the information contained in classified documents.

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Technical Papers

Technetium in the Sun[1]

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A sufficient quantity of element 43, technetium, has been isolated at Oak Ridge National Laboratory to permit the observation of the first and second spectra of this rare element. The description of these spectra has recently been published by Meggers and Scribner (*1*). It is therefore possible to remove this element from the category "Insufficient Laboratory Data" for identification in the sun (*2*), and to search for the leading lines in the solar spectrum.

In the Tc I spectrum there are three conspicuous low level lines that should be present if this element is represented in the solar spectrum. The *raie ultime* is masked, and the other two lines are absent. Because all strong lines of Tc are widened by hyperfine structure, concentrations less than 10^{-7} cannot be detected spectroscopically. The data for the leading lines are given in Table 1. The laboratory material is arranged in the form adopted by the writer in her *Multiplet Tables* (*3*). If Tc I is present, it is extremely faint—too weak to be detected spectroscopically in view of the unquestionable presence of Cr I at 4297.050 A, which masks the *raie ultime.*

By analogy with related elements in the periodic

[1] The inspiration for this note has come from W. F. Meggers, who generously furnished in advance of publication his manuscripts containing both the description and preliminary analyses of the Tc spectra. H. N. Russell has also taken a keen interest in this question, and estimated a reasonable value of the half-life of a long-lived isotope of Tc. The writer is greatly indebted to both for their very helpful suggestions and cordial collaboration.

TABLE 1

COMPARISON OF STRONG Tc I LINES WITH SOLAR LINES

Tc I I.P. 7.45									
Laboratory*					Sun†				
I A	Intensity arc	Low E P	J	Multiplet designation	I A	Intensity disk	Intensity spot	Δλ ⊙ − Lab	Solar identification
4297.06‡	500c‖	0.00	$2\frac{1}{2}-3\frac{1}{2}$	$a^6S-z^6P^\circ$	.045	1	2	−.01	Cr I
4262.26	400c	.00	$2\frac{1}{2}-2\frac{1}{2}$		Absent or masked§				
4238.19	300c	.00	$2\frac{1}{2}-1\frac{1}{2}$		" " " §				
4031.63	300c	.32	$4\frac{1}{2}-4\frac{1}{2}$	$a^6D-z^6D^\circ$	" " " §				
3636.10	400c	.32	$4\frac{1}{2}-5\frac{1}{2}$	$a^6D-z^6F^\circ$	" " " §				
3466.29	250c	0.32	$4\frac{1}{2}-3\frac{1}{2}$	$a^6D-z^6P^\circ$	.285	0		−.01	Fe I

* Analysis from material by W. F. Meggers, *J. Research Natl. Bur. Standards,* **47**, 7, RP 2221 (1951).

† For solar data, see C. E. St. John *et al., Carnegie Inst. Washington Pub. 396, Papers Mt. Wilson Observ.*, Vol. III (1928). The solar wavelengths have been corrected as indicated by H. D. Babcock, C. E. Moore, and M. F. Coffeen, *Astrophys. J.*, **107**, 287; *Contribs. Mt. Wilson Observ. No. 745* (1948).

‡ *Raie ultime* by analogy with Mn I.

§ H. D. Babcock (letter, December 1950) states that no line of the expected intensity is discernible on the solar atlas, because of the surroundings.

‖ In laboratory intensity column, *c* denotes that the line is complex. See K. G. Kessler and W. F. Meggers, *Phys. Rev.*, **80**, 905 L (1950).

table, technetium might be expected to appear in the singly ionized state. In the Tc II spectrum there are six outstanding low-level lines. The three strongest, each of which has an estimated spark intensity of 600 or more, lie at 2543 A, 2610 A, and 2647 A—a region where the solar spectrum is unknown, excepting rocket spectra of very low dispersion which do not permit a test, since all observed solar lines are badly blended. Of the remaining three, the one at 3212 A is masked by Fe I; and one at 3237 A, if present, is blended with Co I in the sun. The third, at 3195 A, agrees well with an unidentified solar line of intensity −1 on Rowland's scale of estimates. The data are given in Table 2, together with those for three fainter lines.

The Co I line at 3237.028 A is not sufficiently strong in the laboratory spectrum to account entirely for a solar line of intensity 1, but is doubtless one of the leading contributors. The Fe I line at 3211.989 A would have a solar intensity of at least 2, and must mask any other candidate. The evidence for the presence of Tc II in the sun rests chiefly, therefore, on the one unblended solar line at 3195.230 A, a line that has heretofore remained unidentified. A faint laboratory line of Mo II exists at 3195.233 A, but, by comparison with the solar intensities of the strong lines of Mo II, it may be ruled out as too faint to appear in the sun. Similarly, the weaker lines of Tc II given in Table 2 cannot be present unless the line at 3195.21 A is present.

For an element known to exist in nature in any appreciable amount, the above evidence would indicate the possibility of its presence in the sun, among the least abundant elements. The three leading lines of Tc II in the accessible region of the solar spectrum are all accounted for, none appearing to be definitely

TABLE 2

COMPARISON OF STRONG Tc II LINES WITH SOLAR LINES

Laboratory*						Sun†			
I A	Intensity Arc	Intensity Spark	Low E P	J	Multiplet designation	I A	Intensity disk	Δλ ⊙ − Lab	Solar identification
3237.02	200c§	400c§	1.0 ±	2 − 3	$a^5S-z^5P^\circ$	.037	1	+.02	Co I Tc II?
3212.01	80c	300c	1.0 ±	2 − 2		.005	2	.00	Fe I
3195.21	50c	200c	1.0 ±	2 − 1		.230	−1‡	+.02	Tc II?
3298.85	15	60				.868‡	−3	+.02	Tc II?
3266.92	15	80				.950	1	+.03	Fe II
2964.50	20	60				.52	0	+.02	−Zr II

* Analysis from material by W. F. Meggers, *J. Research Natl. Bur. Standards,* **47**, 7, RP 2221 (1951).

† For solar data, see C. E. St. John *et al. Carnegie Inst. Washington Pub. 396; Papers Mt. Wilson Observ.*, Vol. III (1928). The solar wavelengths have been corrected as indicated by H. D. Babcock, C. E. Moore, and M. F. Coffeen, *Astrophys. J.*, **107**, 287; *Contribs. Mt. Wilson Observ. No. 745* (1948).

‡ H. D. Babcock (letter, December 1950) reports that the line at 3195.230 A is stronger than −1 in intensity, and that 3298.868 A cannot be seen on superior Mount Wilson photographs of the solar spectrum.

§ In laboratory intensity column, *c* denotes that the line is complex. See K. G. Kessler and W. F. Meggers, *Phys. Rev.*, **80**, 905 L (1950).

absent. Accidental coincidences between laboratory and solar wavelengths can easily lead to spurious identifications, but if technetium exists in nature, the identifications tentatively suggested in Table 2 do not seem unreasonable.

The longest-lived Tc isotope known to date has a very short half-life, so far as elements found in the sun are concerned. The half-life of ^{99}Tc produced at Oak Ridge National Laboratory by irradiating Mo with neutrons is 9.4×10^5 years (*4*). A later determination from the Argonne National Laboratory is 2.12×10^5 years (*5*). If a longer-lived isotope having a half-life of the order of 4×10^8 years or more does not exist in nature, the suggested solar identifications are subject to serious doubt. The possibility that Mo can be transmuted into Tc in the sun is an interesting speculation. Lines of Mo I and Mo II are known to be present, although not conspicuous, in the solar spectrum. These considerations raise the interesting question as to whether Tc is as rare in the earth's crust as has been previously supposed. It appears that the possibility is not ruled out that the half-life of ^{97}Tc or ^{98}Tc may exceed 10^6 years (*6*).

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A Simple, Inexpensive Microhomogenizer

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Quantitative assays of enzyme activity in tissue homogenates require that the respective homogenates be uniform as to completeness of cell lysis. The ordinary Pyrex glass homogenizer, consisting of an outer tube and a fitted, motor-driven pestle, has proved unsatisfactory in this respect in microanalytical experiments involving many separate homogenizations. This is due primarily to the fact that the closely ground surfaces rapidly wear away, increasing the clearance and rendering the shearing action progressively less efficient. When one deals with minute amounts of tissue, these differences in the degree of cellular disintegration, however slight, may be quite significant, inasmuch as they are reflected as relatively large differences in enzyme activity, when the latter are projected against the small weights of the tissue assayed. The problem is more acute, of course, with tissues such as prostate, muscle, and

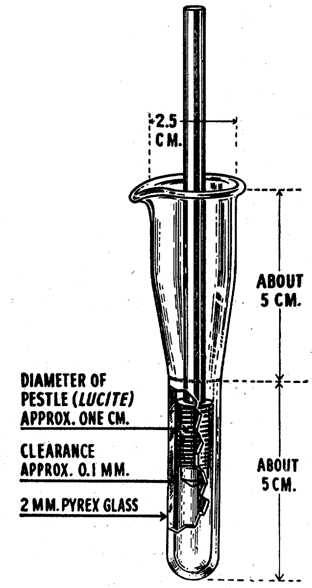

Fig. 1.

uterus than with more friable cellular tissues like liver, kidney, or spleen. Nevertheless, even in the latter variety, wear becomes an important factor when many homogenizations have to be done.

Early in 1948 efforts were made to develop a microhomogenizer, to be used primarily for enzyme studies on rodent prostate.[1] Several varieties of all-Pyrex apparatus were either purchased or constructed in the laboratory, but all proved unsatisfactory because of rapid wear of the shearing surfaces after 10–20 homogenizations. Also, as has been pointed out elsewhere (*1*), the presence of powdered glass in the homogenates prevented the use of dry weights for reference. A homogenizer was finally constructed of a glass homogenizing chamber and a Lucite pestle (Fig. 1).

A thick-walled (2-mm) Pyrex test tube is used, approximately 10 cm long, with an inside diameter of 1 cm. The upper 5 cm are cut away and replaced by a glass cup 5 cm in length, which is fashioned from a Pyrex test tube measuring 2.5 cm in diameter. The pestle is made from ½-in. Lucite stock. It is easily machined to fit snugly into the test tube and measures 4.5–5.0 cm in length. The upper end is threaded onto a 6-mm aluminum rod about 12 cm long. The pestle is then ground into its final form with fine carborundum powder, using a slow stirring motor. The grinding is judged satisfactory when the dry tube drops slowly off the stationary pestle, indicating a clearance of about 0.1 mm.

The original homogenizer has been in active use since its construction three years ago. There has been no apparent change in the amount of clearance between the shearing surfaces or in the efficiency of homogenization. This is in marked contrast to the

[1] The author wishes to express his thanks to Charles Tesar and A. G. Morrow, of the Johns Hopkins Hospital, for their help in this work.