with light sentences. The climax of the Health Fair held in the Reverend Billy Sunday's Tabernacle, when the eugenic family proves to be a gang of well-known crooks, and when the fireman sets the place on fire by dropping a lighted match into the Clean Up and Prevent Fires Exhibit . . . certainly this is a purple passage of burlesque. In spite of the intricate pattern of the plot, the rich variety of characters and the wide range of scene, the story has a smooth, unbroken rhythm that maintains its pace throughout. Lewis displays his craftsmanship when he assembles the materials, visits the scene, and then writes a description of a plague epidemic that could only have been written by an eye witness . . . or an artist.

Every intelligent medical man with a sense of humor will enjoy the book. Every medical student who feels vague rumblings of scientific curiosity or the urge for pure research, should read it. All embryo scientists, or even those nearing full term, may turn to it as a sanctuary, because, after all, the flame that burns in Arrowsmith, sometimes bright and sometimes flickering low; the moments of high egotism and the dark moments of doubt; the times of pride in the profession and the times of blushing shame; the bursts of frenzied work in the confidence of the outcome and the long spells of idleness shrouded in despair; the wavering allegiance between Truth and Mammon . . . these are common property. In Main Street, Lewis was the depicter of the American scene. In Babbitt, he was the pathologist at the necropsy table with Mr. Babbitt on the slab. In Arrowsmith, he is an artist.

THOMAS J. LEBLANC
MEDICAL COLLEGE,
UNIVERSITY OF CINCINNATI

SCIENTIFIC APPARATUS AND LABORATORY METHODS

HEAVY MINERAL OIL AS A PERMANENT NON-VOLATILE PRESERVATIVE FOR VALUABLE BIOLOGICAL MATERIAL

ANY one engaged in routine curatorial work has no doubt often found, in going over alcoholically preserved material, that the liquid had completely evaporated from defectively corked or infrequently inspected bottles, resulting either in the destruction or serious deterioration of much valuable material. One or two such accidents is all that is necessary to make an otherwise valuable specimen practically worthless. Where adequate curatorial assistance is not available, or where material of this sort is neglected for long periods of time, as is very often the case with small or inactive collections, the aggregate amount of destruction arising from this source alone is sometimes almost total.

Small vials, no matter how well they may appear to be stoppered, are never safe so long as alcohol is used as a preservative. Where type material is concerned this perpetual risk is doubly regrettable.

In consequence of these facts it would appear that a substitute preservative involving none of these objections would be a highly desirable acquisition.

Such a material has been found and tested out sufficiently to merit serious consideration in this connection. The process involved in its utilization is here given. The technique developed applies particularly to the smaller arachnids and insects, but could unquestionably be extended to many other groups.

The specimen is killed and dehydrated in the usual manner by means of 95 per cent. grain alcohol. The specimen should be transferred at least once to clean alcohol from that in which it was killed before taking the next step. After dehydration the specimen is transferred to carbol-xylene (25 per cent. carbolic acid crystals in 75 per cent. xylene). After a sufficient lapse of time, the material is transferred to pure xylene, in order to remove all traces of the carbolic acid which is immiscible in the oil. From this last reagent the specimens are transferred to any one of the highly refined, colorless and highly viscous mineral oils, of which Squibbs and Nujol are typical and well-known examples. In large quantities "Oronite Crystal Oil," as put out by the Standard Oil Company of California, is completely satisfactory for this work and very much cheaper than either of the two medicinal oils above mentioned. This material should cost somewhat less than alcohol, but, of course, the necessary stages requiring the use of xylol would make the total first cost somewhat higher. In the long run, however, the oil should be much more economical, since there would be practically no future necessity of replenishing that lost through evaporation as is always the case with alcohol. Carbol-xylene is used as an economical expedient to obviate the otherwise necessary step of passing material through absolute alcohol.

Specimens preserved in this type of oil retain their original colors much better than in alcohol; there is no danger of desiccation arising from the rapid evaporation of the preserving fluid; the specimens retain much of their original flexibility and consequently can be studied and handled with much less danger of breakage than is the case with alcohol preserved and hardened material; and finally the optical qualities of the oil are practically identical (the refractive index is higher: about 1.47) with those of alcohol, so that no disadvantage is experienced on this score. Specimens thus preserved are practically as free from possible injury or deterioration as balsam mounted, slide

material and infinitely more so than that which is pinned and dried. The only deterioration possible is that arising from breakage of the containing vessels.

There is one point of caution that should be borne in mind concerning these oils. They are absolutely neutral and non-toxic and it is not impossible that improperly treated material might ultimately develop decay. This could not occur, however, with specimens properly sterilized and completely dehydrated in the beginning, since no bacterial action can continue in the absence of both oxygen and water. It is also well to bear in mind that with all material, except that which is usually or just as easily studied while immersed in liquid, difficulty would be experienced in ridding the specimen of surplus oil. This could of course be easily accomplished by washing with xylene.

JOSEPH C. CHAMBERLIN
UNIVERSITY OF CALIFORNIA
CITRUS EXPERIMENT STATION,
RIVERSIDE, CALIFORNIA

SPECIAL ARTICLES

ARC SPECTRUM REGULARITIES FOR RUTHENIUM

THE arc spectrum of iron having been investigated by Walters[1] and by Laporte,[2] it appeared desirable to study the corresponding element, ruthenium, of the next period.

According to a plan of cooperation which was arrived at with the Institute for Theoretical Physics of the University of Munich, through the courtesy of Professor A. Sommerfeld, the elements Rh and Pd are being investigated for spectral structure by Drs. Catalán and Bechert, while the Ru analysis has been undertaken by ourselves. We are thankful to Dr. Bechert for his kindness in communicating to us some provisional results in Ru.

Although new wave length measurements[3] have been made by Meggers, no other experimental data (temperature classification and Zeeman effect[4]), which have been so important for the analysis of the iron spectrum, were available. As a substitute for absorption or furnace spectrograms we made photographs of the spectrum emitted by a condensed spark under water which showed 85 distinct absorption lines[5] between 2255 and 4709A. From these we recognize the lowest term of ruthenium as being a 5-fold term with the separations 392.2, 621.7, 900.9, 1190.8 cm^{-1}, and the inner quantum numbers 0, 1, 2, 3, 4, which in analogy with iron may be regarded as a quintet-D term. It must be pointed out that many separations which appear to be real (including three of the $\triangle$ D) were found by E. Paulson[6] ten years ago. The D term combines with 46 or more higher levels, thus accounting for the majority of strong lines in the ruthenium arc spectrum. The azimuthal quantum numbers of these levels are indicated by the fact that in general only the main lines and not the satellites of a combination appear in absorption. As an example of the combination of the low D term with a higher F term, we give the following multiplet to which we were guided by the strong occurrence of the main lines and the weak occurrence of the first satellites in absorption. The preliminary wave lengths and intensities here given were derived from an arc spectrogram made for this purpose, since

[1] Walters, Journ. Wash. Acad. Sci., 13, 243; 1923; J. O. S. A. & R. S. I., 8, 245; 1924.

[2] Laporte, Zs. f. Phys. 23, 135; 1924; *ibid.*, 26, 1; 1924.

[3] Meggers, Bur. Stand. Sci. Pap. 20, 20; 1925.

[4] The Zeeman data published by Purvis (Proc. Cambr. Phil. Soc. 13, 344; 1906) are found to be of very little value. New observations are being made in cooperation with Prof. B. E. Moore, of the University of Nebraska.

[5] A paper dealing with the under-water absorption spectra of the six platinum metals is in preparation.

[6] Paulson, Phys. Zs. 16, 81; 1915.

	$^5D_0$	392.2	$^5D_1$	621.7	$^5D_3$	899.6	$^5D_2$	1190.8	$^5D_4$
$^5F_1$	2392.42(15) 41785.9		2370.17(12) 42178.1		2335.74(5) 42799.8				
90.5									
$^5F_2$			2375.27(15) 42087.6		2340.69(15) 42709.3		2292.41(8) 43608.7		
193.1									
$^5F_3$					2351.34(20) 42516.0		2302.60(15) 43415.8		2241.10(10) 44607.0
286.0									
$^5F_4$							2317.85(25) 43130.2		2255.59(20) 44320.6
468.3									
$^5F_5$									2279.67(30) 43852.3