year, to experiment with other animal membranes. As a result I found that the method outlined below proved uniformly satisfactory.

The skin of a freshly killed or of a preserved frog was cut at the junction of leg and trunk. This cut, entirely encircling the leg, permitted the skin of the leg to be peeled off precisely as a glove is removed from the hand. At the knee joint it was necessary to proceed carefully to avoid tearing the skin. Having pulled the skin off as far as the foot, the bones and sinews were cut. The result was a leg-shaped sac, open at the top, containing the bones of the foot at its lower end, and entirely free from perforations. The sac was pulled over the end of a glass tube about twelve inches long, and securely fastened by several turns of strong thread. A strong solution of dextrose was poured into the open end of the tube, and the tube shaken until the liquid passed, drop by drop, down into the sac. This process was continued until the liquid stood about an inch high in the tube. The apparatus was supported in such a way that the sac of skin was completely immersed in a tumbler of water. The level of the liquid was recorded by putting a small label on the tube, and the apparatus was ready for demonstration.

The apparatus and procedure described above have the following advantages over any other method that I have seen:

1. *Simplicity.*—Parts are to be found in any biological laboratory. Entire apparatus can be set up in fifteen minutes.

2. *Reliability.*—It is a very simple matter to secure a water-tight junction of the sac and tube by taking several turns of thread and tying the sac tightly to the tube.

3. *Rapidity of Action.*—Since there is a large surface exposed to osmotic action, the rise of the liquid in the tube is rapid. It is not uncommon to note a rise of one centimeter in twenty minutes. This is a valuable point, for it makes possible the recording of data and results in the same laboratory period. A narrow label may be fastened to the tube to mark the level of the liquid at the beginning of the hour. The data are given the pupil, a sketch of the apparatus is made, and by that time the liquid has risen enough to make possible the recording of the new level and the drawing of conclusions. After the contents of the tumbler have been tested with Fehling's solution, pure water may be substituted, and the experiment repeated.

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WHY NOT GOVERNMENT-MAINTAINED FELLOWSHIPS?

IN recent number of SCIENCE,[1] Mr. E. W. Nelson has called attention to the many opportunities that exist in Washington for research in connection with the various government bureaus. To the end that these opportunities may be more widely appreciated he suggests a closer cooperation between the universities and these bureaus and he suggests that universities might find it possible to maintain fellowships which would permit their holders to work at Washington.

That such opportunities exist is undeniable and there are doubtless a very large number of workers who would be extremely glad to take advantage of them, but that any university will be able to establish even a single fellowship of this type is almost too much to hope for. The number of fellowships of even the ordinary character is still far too few. However, there is another angle from which the matter may be approached.

Why should not the federal government itself maintain a group of such fellowships? The presence in Washington of the Congressional Library, the National Museum and the various government bureaus has at times been used as an argument in favor of the establishment there of a National University. Whether such a university should be established is perhaps debatable and whether if it were established it could effectively utilize these special opportunities is more so. In fact it probably could not. But in the absence of such an institution, or perhaps even in addition to it,

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[1] Nelson, E. W., "Cooperation between Zoological Laboratories and the Government Bureaus," SCIENCE, XLIX., 409, 1919.

these splendid opportunities might well be made available for the holders of such fellowships as I have suggested.

These fellowships should not be restricted to the purely scientific branches. What better place than Washington for historical research? Where else than in the Department of Labor with such a division as the Children's Bureau could certain social problems be studied to better advantage? Yet it is probable that the majority of such fellowships would be in connection with the scientific activities of the government. For that reason it is from our national scientific societies that the initial impulse for a movement leading to the establishment of such an institution must come.

G. F. Ferris

SPECIAL ARTICLES

THE TERM "INVERSION"

The diversity among the phenomena which are referred to by the term "inversion" is so great that at present the word has lost any precise meaning which it may have had in the past. The organic chemist uses it when discussing the behavior of the allotropic forms of a substance and also when alluding to that well-known single-phase phenomenon, the inversion of cane sugar; while the inorganic chemist generously uses it to denote, in addition to the meanings already referred to, such a phenomenon as an incongruent melting. The writer is not an organic chemist and therefore does not wish to criticize the terminology used by the organic chemists, but feels in duty bound to protest against the present use of the term "inversion" by most inorganic chemists.

When an inorganic chemist hears the term "inversion" used, he invariably associates it with phenomena like the change of rhombic to monoclinic sulfur[1] or phenomena like the thermal dehydration of sodium sulfate decahydrate.[2] The first use of the term is, I think, a very satisfactory one, but for the second type of phenomena a different term should be employed, since otherwise there can not but result an overlooking of the important temperature interval which characterizes this type of "inversion" in systems of three or more components. The term "transition," now used synonymously with "inversion," could well be confined to phenomena of the second class mentioned above.

The distinctive feature about an inversion such as that of rhombic to monoclinic sulfur is the fact that the inversion temperature is a fixed point[3] at constant pressure regardless of the complexity of the system, provided no solid solutions are formed, whereas in the case of the transition of sodium sulfate decahydrate to the anhydrous salt the transition temperature is dependent, in addition, upon the composition of the whole system. Thus both hydrated and anhydrous salt can coexist in the presence of suitable liquids over a wide range of temperatures. The change of transition temperature by the addition of a third component is not an isolated phenomenon but rather an example of one of the types met with most frequently in phase rule studies of complex systems.

On the theoretical side Bancroft[4] has pointed out as a corollary of the theorem of Van Alkemade[5] that in ternary systems at constant pressure involving no solid solution the temperatures at which two solid phases can coexist in the presence of a suitable liquid will rise as the composition of the liquid approaches the side line, *i. e.*, will be a maximum in the binary system. In other words, in a system such as sodium sulfate: water: sulfuric acid, the temperatures at which the solid phases, sodium sulfate and sodium sulfate decahydrate, can coexist will rise as the liquid becomes less acid and be a maximum when the solution contains no free acid.

With this corollary in mind, the effect of

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[1] Findlay, "Phase Rule," page 34 (1908).

[2] *Ibid.*, p. 138.

[3] The variable inversion temperature of cristobalite (SiO_2) found by C. N. Fenner, *Am. J. Sci.*, 36, 331 (1913), is a phenomenon of unstable equilibrium and is hence excluded from this discussion. discussion.

[4] "The Phase Rule," W. D. Bancroft, p. 149 (1897).

[5] *Z. physik. Chem.*, 12, 371 (1893).