The values of this expression can be found in Pearson's Tables of the incomplete β-function. The survival curves obtained from this formula are similar to those of Blau and Altenburger, although it is difficult to decide upon the values of n and of r from the experimental curve. Such an attempt has been made, for example, by determining the ratio of the doses required for 10% kill and for 90% kill.

If we put $n=1$ and $r=0$ in (1) or in (3), the survival curve is an exponential. For $n>1$ and $r=0$, an exponential curve is also obtained. This case is known as multitarget, not multihit. Finally, the case $r=n-1$, $n\geqq 2$ corresponds to clumping, and a sigmoid curve is obtained.

If we consider delayed division of the cell rather than lethal action, then r or r/n will vary with the stage of the cell (for example, prophase) and will therefore be a function of the time of irradiation: $r/n=F(t)$. Thus the hypothesis that has been advanced in this paper makes it easy to understand the concept of the cumulative dose as formulated by D. E. Lea.

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Comments and Communications

A Citizen's Duty

EVERYONE should vote in our national and local elections. The votes of the readers of this journal, who represent a group of the highest intelligence, are especially desirable. Yet those who are responsible for arranging national meetings of scientific, technical, and trade associations apparently have no regard whatever for election day. Last election day the country was flooded with technical meetings ranging from the National Academy of Sciences and American Petroleum Institute to countless trade organizations. In very few states is it possible to vote *in absentia* or by letter. Many technical people, therefore must choose between their duty at the polls and their presence at a society meeting. Why not recognize our obligations as citizens and, throughout the country, arrange all association meetings on dates that will not conflict with voting?

PAUL D. FOOTE

Gulf Research and Development Company
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Flash in Photomicrography[1]

A MAJOR problem in photomicrography is the elimination of vibration in the apparatus or in the building housing the apparatus. This problem becomes acute whenever long exposures or high magnifications are required. Photomicrography in this laboratory has been relatively difficult because the framework structure contains vacuum pumps and compressors, which may be in operation throughout the working day. Although several methods were used to eliminate vibration in the photomicrographic equipment, none was completely successful. The introduction of flash lighting eliminated the effects of vibration and yielded excellent photomicrographs (*1*).

A microscope lamp (Spencer #735A) with a 100-w coil filament, bayonet base projection bulb was aligned and adjusted to provide "Köhler illumination" (*2*). After the desired field had been selected and brought into critical focus, the projection bulb was replaced by either a Westinghouse speed midget (SM) or G-E #5 flash bulb. The SM flash bulb was ideal for photomicrography because of its speed and safety. It should be noted that the flash bulb must be fired with a d-c voltage of not more than 6 v. Illumination may be controlled by neutral density filters, crossed polaroid disks, or a ground-glass filter. Should the illumination prove insufficient, as could be the case with oil immersion objectives and long bellows extension, a faster film may be used.

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[1] This work was supported by a contract between the University of California and the Office of Naval Research.

[2] The opinions and assertions contained in this report are the private ones of the writers and are not to be construed as official or reflecting the views of the Navy Department or naval service at large (Art. 1252, *U. S. Navy Regulations* [1948]).

Reservist Reaction

THE comments by Charles G. Wilber, entitled "Mobilization of the Reserve," which appeared in SCIENCE, December 7, 1951, merit reply. . . . No mature reservist expects to avoid performance of duty very long merely on the basis of personal preference. Similarly, the scientist-reservist does not expect blanket deferment, hoping merely that when he is called to duty the position to be occupied will permit him to perform optimally in a professional capacity. Surely, and rightly so, the medical profession would

complain bitterly if a physician were ordered to any duty other than a medical assignment. It is this type of misassignment that has irritated the reservist.

To turn to the less lofty comments made by Mr. Wilber, the gravy apparently soaked up by members of the Reserve is very thin. Reserve status training may, in the very long run, permit promotion, but changes in grade are so slow that no officer expects to advance very far merely on the basis of inactive duty training. Of more concern to the reservist is the income loss generally accompanying recall to active duty. Complaint on this score would not be limited to reservists if other civilians were similarly demoted financially. Concerning payment for inactive duty training, most scientists are, or are being, organized into research and development units and thus do not draw training pay. Scientists in combat units—where they do not belong—may draw training pay, depending upon the type of unit. Should these men not accept this money as long as they feel they are misassigned?

Mr. Wilber labels as "pure fiction" the claim that a shortage of technically trained personnel exists, and insists that our military leaders should not pay undue heed to the demands made by some scientists. Fortunately, the highest military echelons include civilian advisers for precisely such problems, and numerous scientific societies are extending their services along these lines.

R. C. BARD

Department of Bacteriology
Indiana University

THE Reserve was formed to train men for active duty in case of general mobilization. As yet we have not come to this point. I have given my time to the Reserve to train men so that I would be doing my part both by being a scientist in industry and a member of the Armed Forces Reserve. True, we have collected pay for this, but we did give our time for the pay and owe the government nothing on that point. If teachers were hired to do this work, it would cost a great deal more than we are paid. It must be kept in mind that we are not at war and there is no general mobilization, in which case I would want to be the first to be called.

There are many men, trained and given a college education by the government, who have not served any active duty and are now free, and who could be called for a tour of duty, leaving the trained and experienced scientists to develop better means for the total defeat of Communism.

S. J. TASSINARI

Nesconset, Long Island, New York

CHARLES WILBER challenges a complaining reservist to prove his point *scientifically,* but he himself refrains from any such scientific method to support his subsequent assertion that the supply of technical men is adequate. So it was, before World War II. However, because of the decidedly scientific aspect of current wars, a shortage of technical men was experienced from 1943 to 1946. To fill the gap, the government recruited for training as technicians and "junior scientists" many thousands of male and female clerks and recent high school graduates, paying handsomely in salaries, in facilities, and in precious time. The government, however, failed to relieve from their military duties the vast numbers of personnel who were already in uniform, and who had paid, out of their own pockets and by virtue of their own desires, for a technical education. One detachment of draftees arrived at Edgewood Arsenal in the fall of 1940, over 200 strong, of which only a few did not possess a degree. These were mostly chemists, engineers, and the like. Several had Ph.D.s.

As to the statement that governmental scientific projects are adequately staffed, I should want to add that, if by adequate, Wilber means plentiful, he is correct. Nevertheless, the system being as it is, free competition based on initiative and merit is lacking in all but a few government technical installations.

The contents of the communication entitled "Scientific Manpower," which appeared in the July 27 (1951) issue of SCIENCE, should be given consideration by all. The outline therein presented recommends itself to any honest-thinking person, whether scientist or not.

Reservists may be classified in two very broad groups: those who are in the government service as civilian technical personnel, and those who are not. My guess is that the ratio of reservists recalled to active duty from the first group to the number of reservists recalled to active duty from the second group would be very significant, could it be known. Perhaps it would be *scientific* if the AAAS, the ACS, and other similar organizations conducted a survey along such lines. It would certainly be in the national interests if concrete reforms were brought about to insure us against the repetition of the worst of national wastes—that of a trained man.

ANTHONY O. MIRARCHI

Egypt, Massachusetts

DR. WILBER'S letter in SCIENCE rings bells with me. Please accept my congratulations on this letter, which is as *hard common sense* as I have seen in a long time.

S. W. GEISER

Department of Biology
Southern Methodist University

I DO not agree with Tassinari's comment that there is no general mobilization. If one were to talk to boys of high school and junior college age, it would be rather apparent that there is a widespread mobilization, including general drafting of young men. I agree with him that the many men who were educated by the government should be required to put in service. . . .

Concerning the letter by R. C. Bard, the original communication from the reservist to which I made an answer merely restated the old threadbare gripes of World War II concerning the misuse of scientific

personnel. I reassert that many members of the Reserve were glad to accept inactive duty pay as long as they could stay safely at home. Many of these same individuals did everything under the sun to get out of the Reserve and to obtain extensive delays in reporting for active duty during processing. I agree with Bard that recall to active duty does result in appreciable financial loss. I certainly agree that every effort should be made to place reservists who are scientifically trained in appropriate military positions. The individual reservists are, in many instances at fault for being misplaced. Many reserve scientists wanted to stay in combat units in order to collect inactive duty pay. At the same time, they could have been transferred to research and development units had they so requested. These latter units, however, had their inactive duty training without pay.

It should be pointed out to Anthony O. Mirarchi that most government laboratories seemed to have a rather adequate supply of scientific help. One would anticipate that a critical shortage of scientists would show itself in the service laboratories. By this I do not mean that we have a tremendous oversupply of scientists, but in any time of national mobilization, we do not have an oversupply of punch-press operators, iron, steel, and other resources.

The final paragraph in Mirarchi's letter suggests that a careful study or survey should be made, possibly by the AAAS or the American Chemical Society, to ascertain just what the facts are. On the basis of these facts, it would then be possible to avoid serious wastage and misassignment of trained men. With this latter point of view, there can be no argument, but until we have valid facts available for study, I still feel that the original criticism published in SCIENCE is unwarranted, and I base these conclusions on a rather good knowledge of the Reserve program as it involves the reserve scientist.

CHARLES G. WILBER

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A Simple Pipetting Device

THERE is a need in any laboratory working with radioisotopes for a simple, safe, versatile, and inexpensive device that will permit accurate delivery of solutions from a pipette. For the pipetting of solutions of soft β-emitters a device used in this laboratory meets these requirements, but it does not appear to be used elsewhere.

It consists of a three-way glass stopcock with an outlet through the bottom of the stopper. (Stopcock 7460 Catalog LP28 of the Corning Glass works. The smaller size is preferred.) The side arms are cut off, leaving convenient lengths. To one side arm a short length of thick-walled gum-rubber tubing is fitted for attachment to the pipette. To the outlet through the stopper a rubber bulb of convenient capacity is attached. It is expedient to provide a spring-clip or an elastic band to keep the stopper well-seated.

In use, a pipette is attached as indicated above. The stopper is turned so as to connect the rubber bulb with the pipette, and liquid is drawn up into the pipette. The tip of the index finger is applied to the end of the free side arm, and the stopper is turned to connect the two side arms of the stopcock. Delivery of the liquid is now controlled with the tip of the finger in the usual manner. The device may be used in the hand, or it may be held in a clamp that can be raised or lowered.

In the event that some liquid is inadvertently sucked into the rubber bulb, no harm is done to the operator or the apparatus. The latter may be easily decontaminated.

J. A. MCCARTER

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Distilled Water from Boiler Steam

ALTHOUGH distilled water is steam condensate, condensed boiler steam cannot ordinarily be considered distilled water, because boiler steam is usually a mixture of liquid and, frequently, solid base dispersed in small proportions in the vapor phase.

The availability of the "Liqui-jector," a device for trapping entrained liquid in compressed air lines, led me to investigate the possibility of stripping entrained boiler water and solid matter from process steam to improve the quality of the resulting condensate. A unit was very kindly supplied me by George W. Jordan, Jr., of the Selas Corp. of America, Philadelphia. This was connected to a steam line, and the steam passed through it. Condensing this steam provided water with a reading varying between 0.1 and 0.3 ppm on a Solu-Bridge conductivity meter. The water was pyrogen-free, showed a negligible residue on evaporation, and otherwise met the requirements of water for injection, USP. The steam line involved was from a vertical boiler operating on full load, in which the evaporating surface was very small for the quantity of water evaporated; and the steam carried much entrained feed water.

A full-scale condensing unit was assembled and has been in continuous operation since May 1950, providing Courtland Laboratories of Los Angeles with water for biological and pharmaceutical products, directly from boiler steam. Very little attention is required; care must be taken to prevent flooding the Liqui-jector with line condensate, and the water-repellent element in the Liqui-jector must be replaced from time to time.

E. T. MARGOLIS

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