COMMENTS
by Readers

A note in this journal (*Science*, 1946, **104,** 426) cautions against use of sulfuric acid-dichromate mixtures in cleaning glassware for microbiological experiments because of the possible toxic action of the traces of dichromate that often remain on or in the glass, even after repeated rinses. Figures showing retarded growth of various microorganisms and inhibition of enzyme systems in the presence of extremely low concentrations of dichromate are cited. In view of this note and the relatively high degree of toxicity generally attributed to chromium and dichromates, the following observation is of special interest, since it shows that under certain conditions traces of dichromate might also distort experimental results, not by exerting an inhibitory action but by causing stimulation.

During the course of a study of biosynthesis of penicillin by *Penicillium chrysogenum* X-1612 in shake flasks, we attempted to formulate the simplest synthetic medium, composed exclusively of compounds readily available in industrial quantities, that is capable of yielding reasonable concentrations of penicillin. It was found that chromium, furnished as $K_2Cr_2O_7$, was beneficial in this solution (*Science*, 1945, **102,** 482). We were interested to observe the necessity of adding Cr, and probably Al, for biosynthesis of penicillin in the basal synthetic medium where penicillin had to be synthesized from minerals, and from carbon supplied in the form of lactose, starch, glucose, and acetic acid.

Later experiments showed that when the concentration of Cr (supplied as $K_2Cr_2O_7$) was raised from 1 γ/l. to 20 γ/l., the maximum titer of penicillin in the crude liquor was increased from 50 Oxford units/ml. to about 85. Solutions containing 7.5 and 10 γ Cr/l. produced titers of about 70 and 75 units/ml., respectively. Solutions containing 100 γ Cr/l. yielded 85 units/ml., and those with as much as 200 γ Cr/l. permitted good growth of the mold and produced about 55 units of penicillin/ml. In these experiments the concentration of Al (furnished as Al acetate) was 3.6 γ/l. Virtually no penicillin was produced in the basal medium prepared with distilled water when no $K_2Cr_2O_7$ was added. The penicillin potencies were determined by the standard cylinder-plate method using *Staphylococcus aureus* NRRL 313 as the test organism and a standard of calcium penicillin G.

Strictly speaking, Cr and Al should not be designated "essential," since it has not been determined that no other elements can substitute satisfactorily for them. However, in our experiments penicillin could not be detected in the solution in their absence, and no other elements tested (Mo, Ce, Co, Ni) replaced them satisfactorily. This suggests that perhaps Cr and Al may be effective in catalyzing cyclizations and condensations involved in the biosynthesis of penicillin as they are in chemical synthesis (*Ind. eng. Chem.* (Ind. ed.), 1945, **37,** 356, 1038). The biocatalytic activity of Cr may be exerted through a stimulating effect on enzyme systems such as has been reported previously (*J. biol. Chem.*, 1939, **128,** 251). (ROBERTSON PRATT and JEAN DUFRENOY, *University of California College of Pharmacy, San Francisco.*)

Devotion of a rather large amount of space (*Science*, 1946, **104,** 373–374) to the description of what today may be fairly termed a relatively crude device suggests quite strongly that enough of our scientific colleagues bedeviled by the problems of circuit control are not fully oriented with modern resources.

Before the advent of modern relays I made many enforced practical studies on their lack of function, especially troublesome with heater circuits where thermostatic failure adds its contribution. Certain practical points garnered from years of experience may therefore be worthy of record for the benefit of those less interested in such matters. The key to accurate thermostatic control is a sensitive thermostat. This is almost inevitably associated with an inability to handle heavy currents, or sparking occurs at the contacts, leading to eventual failure. The natural corollary is that the associated relay must operate from small currents. In practice this should be less than 10 Ma. As a-c relays are now available, it is generally better to use them, since the sparking at contacts is less than an equivalent d-c load and consequently corrosion and sticking are minimized. Of the many and varied attempts to eliminate sparking at contacts, none has been entirely successful from a practical standpoint, in which expense is one real factor. Unless care is taken to match the circuit load correctly with the appropriate size of condenser, the use of these alone to suppress sparking may be quite unsatisfactory. In actual practice the condenser large enough to suppress nearly all visible sparking is too large, for its own charge, when released by contact closure, may be, and indeed often is, heavy enough to fuse the points and cause troublesome sticking.

For heavy loads such as heater circuits, I have found the use of a simple high-resistance bridge to be as effective and easier than the use of condensers. This is a small lamp that also has signal value. Where condensers are used, it is still advisable to use such a bridge so that they may be slowly discharged. This saves a good deal of contact "make" sticking. For a-c circuits a choke coil could be used. As the modern "wipe" silver contacts work well with heavy loads—5–10 amp. or more—the advantages of the more expensive, clumsy but sealed in, mercury contacts, except in very dusty or humid environments (stoker furnace controls) is now less apparent. Moreover, they will operate only at slow speeds, due to the internal sloshing of the mercury that may eventually set up a continuous arc. Their use inevitably leads to a bulkier apparatus. The mercury contacts are being replaced for many purposes by the remarkable little 4-ounce pressure switch, a highly sensitive switch operating off a slight pressure and short throw. These are admirably incorporated into relay controls and are also sealed in. They may be found operating the cheap but serviceable "brooder" thermostatic controls, as well as the more expensive room thermostats. The standard ones available