

A few simple rules may be given here. Assume that $F = S.f/s$.

For the disk patterns:

(1) Sf/s flashes per second produce a pattern of f spots, independently of the value of s .

(2) If s is even, the crosses coincide with the circles.

(3) If s is odd, the crosses alternate with the circles.

For the two-field string patterns:

(1) The number of lines seen in either field is equal to f ; when two lines merge into one, that line must be counted twice.

(2) If s is even, the two fields are identical, and appear as a single field.

(3) If s is odd, the two fields are similar but not identical.

It is rarely the case that f/s is a simple ratio. Then, as in Lissajou curves, one sees changing patterns. These can be worked out by shifting the initial position of the disk in the construction shown above. It is just this fact that makes the two-field method so convenient. Assume that a string has been tuned to the frequency F , for which we obtain just one line in either field. If the string starts to resonate to some source, one can usually observe two lines moving in opposite directions. The writer has used a $\times 25$ microscope to observe such resonances.

The changing patterns just mentioned can be worked out by a slow rotation of the disk patterns, as stated. From this it will be understood that a complete cycle of change means that the disk has moved by an angle equal to the angle between two spots of the same set. Or in the two-field patterns, we have made a complete cycle of changes when we return to some pattern in the same way. Then, if the pattern corresponds to a ratio f/s , and there are R complete repetitions per second,

$$\frac{F}{f} - \frac{S}{s} = \frac{\pm R}{fs}$$

Although, for simplicity, we have spoken of strings,

the two-field method is adaptable in many ways to the observation of other bodies, *e.g.*, the writer used a Neon bulb in the selection of steel springs which were to vibrate at a frequency of 240.

PAUL F. GAHR

WELLS COLLEGE

REGULATING THE AIR SUPPLY OF MICRO BURNERS

Most of the micro burners obtainable from supply houses have an inflexible and very often an inefficient adjustment of the gas-air mixture. The usual practise with laboratory workers has been to test a number of burners and then select the best of the lot, without attempting adjustment. Obviously, this is an awkward and somewhat unsatisfactory solution of the problem.

A method, almost as convenient as that used for the Bunsen burner, has been found for regulating the air supply of micro burners. The small burner is connected to the gas line and lit. While the flame is burning, twist with a pair of pliers the metal gas connection which projects from the base, loosening or tightening until the proper type of flame is obtained.

Occasionally a burner will be found which requires further treatment. In these cases the gas connection is unscrewed and, using a small three-cornered file, two flat channels about 5 mm wide and 6 or 8 mm long are filed on each side of the tube. These shallow channels start from the middle of the tube and slant upward, meeting at the pin hole gas outlet on top. The connection is replaced frequently while filing and the gas-air mixture tested as described above, in order to prevent spoiling the burner by too much filing. If necessary, the small gas outlet can be made larger by reaming with a pin. However, it is usually found that the opening is already too large. This can be remedied by filing the sides of the hole rather thin and then pressing the edges inward until the desired opening is obtained.

CORNELIUS A. DALY

MEDICAL DEPARTMENT, UNION UNIVERSITY
ALBANY MEDICAL COLLEGE

SPECIAL ARTICLES

ACCELERATED, EXPERIMENTAL POLIOMYELITIS IN NASALLY INSTILLED MONKEYS

IN a previous communication,¹ attention was directed to the accelerating effect of a second virus injection, after an interval of from 7 to 10 days, in provoking experimental poliomyelitis in *Macacus rhesus*. The earlier report dealt with the phenomenon from

¹ S. Flexner, "Accelerated Infection in Experimental Poliomyelitis," *SCIENCE*, 1931: 74, 520.

the point of view of establishing human strains of virus in monkeys. Since that report was made, additional studies of the subject of accelerated infection have been undertaken.

The first test, made by injecting the human virus intracerebrally and intraperitoneally, were soon followed by the injection of sub-infective doses of monkey virus intracerebrally alone. The results showed that acceleration does not depend on the

presence of foreign (human) nervous tissues along with the virus, and probably is not simply a summation effect of the two virus injections.

The events following the second or accelerating injection of virus are characterized by an abrupt rise in temperature (105° to 106° + F.) and the onset of paralysis, often rapid, which may progress quickly to prostration and death. The accelerating action has now been shown to apply also to monkeys receiving the virus by instillation into the nasal cavities. Since the natural infection in man takes place through these cavities, this observation may prove to have practical import. The virus, in suspension, is dropped into the nares on two successive days; and if infection does not manifest itself in from 7 to 10 days, the instillations are repeated. After one or two such instillations, symptoms, consisting of fever and paralysis, may manifest themselves promptly, as in the instances of intracerebral inoculation.

The sudden onset of severe symptoms following the second nasal instillations has suggested not only relationship with the phenomenon in children described by Draper² under the term "dromedary" type of poliomyelitis, but has also supplied a possible explanation of its nature. According to this provisional explanation, the "dromedary" effect is a result of reinfection, arising either from the patient himself (autochthonous infection) or from a new exposure to the virus.

The path of the virus introduced into the nares—ascending by way of olfactory nerve cells in the mucous membrane to the olfactory lobes of the brain, and then to other parts of the nervous system in regular sequence—has become more firmly established as the experimental study of poliomyelitis has progressed.³ The part taken by the meningeal choroid plexus complex in the extension of the virus has been little studied.⁴ Upon examining, on successive days, the cerebrospinal fluid withdrawn by lumbar puncture after the first and second sets of nasal instillations of virus, it was found that the number of mononuclear cells in the fluid increases considerably, even before the appearance of any symptoms of infection, except sometimes fever (105° F.), and that the occurrence of fever, increased cells and the presence of globulin in the fluid may be the only detectable

pathological effects of the instillations. However, the second instillations are succeeded, but not invariably, by a further rise in cells and by the appearance of paralysis, which may extend rapidly, leading to death; or the paralysis may be partial, become arrested and terminate in recovery. It remains to be determined whether monkeys which develop the cerebrospinal fluid changes only, exhibit later a heightened resistance (immunity) to the virus injected intracerebrally, and whether the blood serum has acquired antiviral properties. The occurrence of these mild effects from the instillations may profitably be compared to the alterations in the cerebrospinal fluid observed during epidemics of poliomyelitis in certain children who develop no detectable paralytic symptoms whatever.

The acceleration procedure has been employed advantageously in still other ways: (1) To determine the neutralizing action of blood sera in respect to strains of virus differing qualitatively and quantitatively from one another; and (2) to throw light on the degree and duration of active immunity in monkeys that have recovered from an acute attack of experimental poliomyelitis, or have been rendered immune by the intradermal injection of virus. In the first instance, intracerebral, and in the second, intranasal inoculation is performed. A greater degree of regularity and accuracy has been introduced into these difficult tests by the use of the acceleration method in the experimental study of poliomyelitis.

SIMON FLEXNER

LABORATORIES, THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH, NEW YORK

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