

New Inventions

A ONE-WAY VALVE FOR MULTIPLE INJECTIONS FROM ONE SYRINGE

THE danger of using one syringe to give multiple injections is well known. Hughes¹ and Evans and Spooner² have shown that contamination of the syringe may be due to the negative pressure induced in the syringe when the needle is detached. The presence of this negative pressure is easily shown by the fact that a drop of fluid hanging from the point of the needle is sucked in at the moment of removal. Reflux of fluid to the syringe at some stage of the injection—e.g., during the withdrawal of the needle from the skin—is another cause of contamination, which can be shown by injections into fluids under a known pressure ("artificial mouse").

Up to now the only safe method of preventing such contamination has been the sterilisation of needle and syringe after each inoculation. Changing the needle after each inoculation, according to the recommendations of the Medical Research Council seven years ago,³ appears to be a sure method of transferring infection. The advice of Fleming and Ogilvie⁴ to dip the needle, without detaching it from the syringe, in a hot oil bath (liquid paraffin at 130°C) for 10 seconds, applies only to contamination of the needle and not to that of the syringe.

But, as is shown in the following experiment, even the needle cannot be sterilised in this way, if it has been contaminated with a virus beforehand.

A sterile syringe was filled with sterile broth. The needle (size 12) was infected by dipping half the shaft in a 5% emulsion of a vaccinia egg-culture. The infected part or more of the needle was dipped in a hot oil bath (130°C) for 10 seconds. Then one drop of the broth was pressed through the needle and inoculated on to the chorio-allantoic membrane of each of four duck's eggs. All of them showed vaccinia infection after 3 days. The experiment was repeated on three occasions; on each occasion vaccinia infection of the membrane resulted.

The only way to avoid the necessity of sterilising both needle and syringe after each injection is to prevent reflux of fluid on to the nozzle of the syringe *in all circumstances*, so that the nozzle and the syringe contents are protected from contamination. A simple device which achieves this object is described here.*

THE APPARATUS

A one-way valve between the needle and the syringe allows the fluid to pass only from syringe to needle.

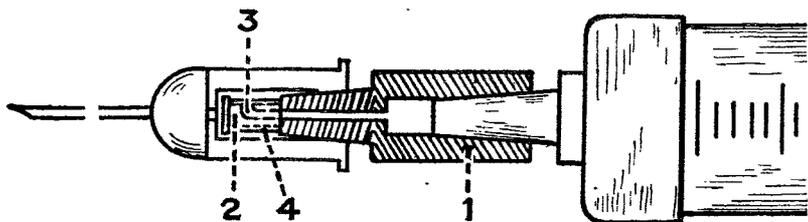


Fig. 1—Construction of one-way valve: 1, brass tube; 2, tapered end; 3, aperture; 4, rubber collar.

The valve (see figs. 1 and 2) is a tapering nickel-plated brass tube, with two lateral apertures closed by a rubber collar. The fluid forced by the piston from the syringe through the tube passes through the lateral openings, displacing the rubber collar, into the needle. Back pressure from the needle to the syringe merely closes the valve, preventing reflux of fluid and protecting the syringe against contamination. After every inoculation the needle and valve must be changed, but there is no need to sterilise the syringe.

1. Hughes, R. R. *Brit. med. J.* 1946, ii, 685.
2. Evans, R. J., Spooner, E. T. C. *Ibid.* 1950, ii, 185.
3. Medical Research Council War Memorandum no. 15. H.M. Stationery Office, 1945.
4. Fleming, A., Ogilvie, A. C. *Brit. med. J.* 1951, i, 543.
* Those interested in the manufacture may apply to Rijks Instituut voor de Volksgezondheid (general director: Dr. J. Spaander), Sterrenbos 1, Utrecht, for further particulars. Patents applied for.

EXPERIMENTS ON ANIMALS

The efficacy of the valve is easily demonstrated in the laboratory by the mouse-inoculation method.

Mice were infected intraperitoneally with a highly virulent strain of streptococcus (Aronson), which in very small doses kills mice within twenty-four hours. After eighteen hours an infected dead mouse was injected intraperitoneally with 0.5 ml. of sterile broth from a 'Record' syringe containing

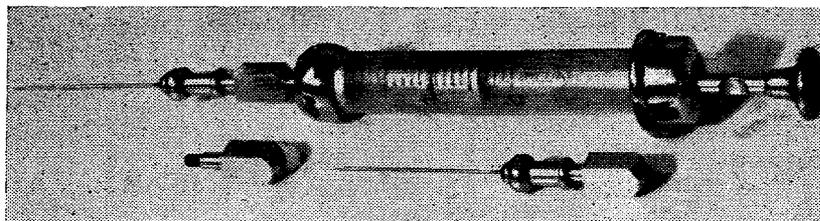


Fig. 2—The valve, the valve fitted to the needle, and the valve and needle fitted to the syringe.

2 ml. The needle was left in the abdominal cavity for ten seconds; it was then withdrawn, care being taken not to move the plunger. Another sterile needle was then substituted for the first, and 0.25 ml. of broth from the same syringe was injected intraperitoneally into a normal mouse. Three separate series of such experiments were made, using 5, 6, and 10 normal mice. All the mice died within twenty-four hours (see table).

Simultaneously, three similar series of experiments were made with the needle and one-way valve described above, no care being taken to avoid movement of the plunger during withdrawal of the needle from the abdominal cavity of the infected mice; the set was changed after each injection into an infected mouse; and series of 9, 8, and 8 normal mice were treated. None of these 25 mice showed symptoms

NORMAL MICE INJECTED INTRAPERITONEALLY WITH 0.25 ML. BROTH FROM A SYRINGE PREVIOUSLY USED FOR THE INJECTION OF 0.5 ML. BROTH INTO THE PERITONEAL CAVITY OF A MOUSE THAT HAD DIED FROM STREPTOCOCCAL INFECTION

Test	Without valve. Changing the needle between the inoculations into the infected and normal mouse		With valve. Changing the valve-needle set between the inocula- tions into the infected and normal mouse	
	No. of mice inoculated	No. of deaths within 24 hours	No. of mice inoculated	No. of deaths or diseased mice
I	5	5	9	0
II	6	6	8	0
III	10	10	8	0
Total	21	21	25	0

of infection during the observation period of two weeks (see table).

These experiments show that the valve affords full protection against transmission of streptococci. Since this effect does not depend on the properties of the infecting agent, similar protection can be expected against transmission of any virus. The valve is now being used at our institute for the purpose of preventing serum-hepatitis arising from mass inoculations.

DIRECTIONS FOR USE

The one-way valve should be used when a single sterile syringe has to serve for multiple injections without being sterilised between injections. The valve cannot be used for withdrawing fluids. The working of the valve is tested by feeling resistance when the plunger is pulled. (It has to be remembered, however, that old syringes may be leaky, leading to underestimation of the tightness of the valve.) The injection is given in the usual way. The rubber collar offers some resistance to the fluid, but this can easily be overcome. It is essential that the valve-needle set should fit the nozzle of the syringe firmly so that it is not blown off. In giving intravenous injections, to check the position of the needle in the vein, the syringe and valve together can be disconnected from the needle to allow the blood to

flow out for a moment. After each injection the valve and needle must be exchanged for a fresh sterile set.

Cleaning and Sterilisation

A little water is syringed through the valve to remove remnants of injection fluid. The valves can be sterilised by boiling or by autoclaving. In the latter instance it is convenient to assemble the needles and valves before sterilisation. Disinfection in alcohol is unreliable and damages the rubber collar.

Testing Valves

The valve is fitted to a needle and syringe. The needle is dipped in water, and the plunger is pulled for ten seconds; no water should enter the syringe. The test is best done with a tuberculin syringe (1 ml.) immediately before sterilising valves and needles.

Repair

The rubber collar withstands numerous injections and sterilisations. Condemned valves can be repaired by renewing the rubber collar.

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Reviews of Books

Commentary on Age

KENNETH WALKER, F.R.C.S. London: Jonathan Cape. 1952. Pp. 192. 12s. 6d.

Mr. Walker has found "old age to be far less disconcerting at close quarters than it appeared at a distance"; and that is, in brief, the lesson he tries to teach. (He admits, however, that he is really only now approaching the fringes of old age.) It is slowly being realised that many unpleasant things once thought to be the necessary concomitants of old age can be prevented—not by a regimen, in youth, of deadening austerity, but by an awareness that changes will become necessary, and that the transition from middle to old age can be painless.

Mr. Walker gives a clear account of the ageing process, both anatomically and physiologically, and follows this by a sensible summing up of the various controversies on rejuvenation. He emphasises how important is the psychological aspect of any rejuvenation operation, but warns that "ageing is a highly complex process and if it is ever to be arrested or reversed it will be by means of remedies so difficult to apply that our patients may well prefer to keep to the customary road and to grow old in accordance with the dictates of Nature." But the prospect is not all pleasing: the waning of the influence of the Church has left a void in many a person's emotional life, and unless that can be filled "the last stages of the journey through life become a journey of weariness and despair." On the whole, however, this is a useful and encouraging book by one who has developed a realistic and helpful philosophy.

Understanding Natural Childbirth.

HERBERT J. THOMS, M.D., in collaboration with LAURENCE G. ROTH, M.D.; Picture Story by DAVID LINTON. New York and London: Staples Press. 1952. Pp. 112. 17s. 6d.

THIS book is designed to prepare the pregnant mother for the bodily changes of pregnancy and to help her to cooperate fully during her labour and delivery. There have been books similar in aim, of the "natural childbirth" school, but they have lacked the dramatic serial photographs of the process by David Linton, some of which were published in *Time* and *Life* and *Picture Post* while others are seen here for the first time. These are very well done, presenting beautifully the familiar emotional landmarks of labour. Some previous books in this category have been either over-emotional or over-technical. This one presents complex facts in a simple and detached manner, the message of each section being summed up in chapter headings quoted from such English authorities as Prof. W. C. W. Nixon, Dr. Grantly Dick Read, Dr. Janet Vaughan, and the late Mrs. Helen Heardman, as well as from American sources. The text shows well how a maternity hospital can be run on a basis of mutual understanding between all its participants, and reminds readers that if the father is allowed to help, a woman need never be left alone during labour;

that the baby who is put to the breast immediately after birth acquires the sucking habit easily, giving the mother confidence in suckling, and aiding involution; and finally that group discussion is a good way to allay fear.

Urine and the Urinary Sediment

A practical manual and atlas. RICHARD W. LIPPMAN, M.D., research associate, Institute for Medical Research, Cedars of Lebanon Hospital, Los Angeles. Springfield, Ill.: Charles C. Thomas. Oxford: Blackwell Scientific Publications. 1952. Pp. 124. 55s.

A COLLEAGUE of the late Dr. Thomas Addis, Dr. Lippman has long been a keen and careful observer of the urinary sediment in disease; and the main feature of his book is a series of beautiful colour photographs of casts, cells, and crystals, as they occur in the urine in various diseases. These pictures are splendid and the methods and findings well described. Here, perhaps, is the last word on the urinary sediment. The price is high, but many hospital laboratories will want to possess this book, both as a work of reference and for the instruction of medical students and technicians.

Biological Antioxidants

Transactions of the Fifth Conference Nov. 30–Dec. 1, 1950. Editor: COSMO G. MACKENZIE, department of biochemistry, University of Colorado. New York: Josiah Macy, Jr., Foundation. 1952. Pp. 229. \$3.75.

THE discussions at this conference were primarily about the chemical effects, particularly the oxidative effects, of radiation on biological systems—from that of the whole mouse (A. M. Brues) to that of the humblest bacterium (O. Wyss).

Discussions on the physicochemical effects of radiation on solutions in vitro (R. S. Livingston), and the effects of sulphhydryl systems, chiefly enzymes, also in vitro (E. S. Guzman Barron) are reported fully. These communications deal primarily with oxidation and to a much smaller and more variable extent with antioxidants; however, Free Radicals, Peroxides, and Antioxidants in Some Biological Processes, by E. V. Jensen, is packed with good meat on antioxidants.

While the report will be of interest to radiobiologists and others with previous experience in the field, it is doubtful if it will be intelligible to the newcomer or the general reader. The proceedings have been reported verbatim and interjections seem to have been encouraged. Many of these result in remote deviations from the theme, so that continuity of argument is lost. If the tea-table conversation of a rather large and progressive laboratory were reported it would perhaps read like this report.

Essentials of Anæsthesia (5th ed. Oxford: Blackwell Scientific Publications. 1952. Pp. 378. 40s.).—The fifth edition of this useful general work by Prof. R. R. Macintosh and Dr. Freda Bannister includes a chapter on curare and other muscle relaxants introduced during the last few years. The impact of these drugs on anæsthesia has, indeed, made additions and modifications necessary throughout the book, but otherwise it is much the same. Dr. Bannister has been entirely responsible for the latest revision.

Clark's Applied Pharmacology (8th ed. London: J. & A. Churchill. 1952. Pp. 691. 37s. 6d.).—For a long time to come the doctor's knowledge of pharmacology is likely to be composite—derived in part from experimental work in the pharmacological and physiological laboratories, in part from the mass of empirical therapeutics which he learned as a student in the wards, and in part from the announcements of the manufacturing pharmacists. The textbook which deals adequately with both experimental and empirical pharmacology has still to be written, but "Clark" has always been deservedly popular with senior students and practitioners because it shows some awareness of the pharmacological problems of medical practice. In their revision Prof. Andrew Wilson and Dr. H. O. Schild have maintained this tradition, but their wish to be comprehensive has involved compensatory sacrifices, and some sections of the book seem unnecessarily meagre—to physiologist and clinician alike. They are to be congratulated on bringing the text up to date without impairing the structure of the original, but there are perhaps more misprints and minor errors than there should be. Some of the lighter touches are of a kind which will not be well received by all readers, and the need for plain words is apparent here and there.