

An Improved Pneumatic Syringe for Self-Administration of Drugs by Rats

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WEEKS, J. R. *An improved pneumatic syringe for self-administration of drugs by rats.* PHARMAC. BIOCHEM. BEHAV. 14(4) 573-574, 1981.—A pneumatic cylinder operates the plunger of a microliter syringe and a three-way valve switches the syringe between a solution reservoir and the animal. The major improvement is the substitution of an electrically operated subminiature solenoid valve for a mechanical valve. Redesign eliminated several components, thereby making the device more compact and easier to use

Apparatus Self-administration Syringe Behavior

SELF-ADMINISTRATION of drugs by animals serves as a laboratory model for experimental addiction and for study of the reinforcing properties of drugs [1]. About 3 years ago, I described a device wherein a pneumatic cylinder drove the plunger of a Microliter syringe [2]. In the original device a mechanical valve switched the syringe between the solution reservoir and the animal. Now a subminiature 3-way electronic valve, modified for mounting directly on the syringe, is used. This substitution and several other design changes allowed elimination of over 20 parts. The new device is cheaper, more compact, easier to use, and more reliable. It has been in continuous use here for about one year.

The syringe and function of its components is described in Fig. 1. The syringe is shown mounted on a chemical stand. It could also be mounted on the vertical support rod of the

inexpensive cage rack designed for continuous intravenous infusion of unrestrained rats [3]. The flow-through swivel, rat saddle, lever switch and electrical interface (to which the control unit, valves, and lever switch are connected) are not shown. For these components, see the figure in the original publication [2]. Details on the use of the syringe and of the function and programming capabilities of the control unit are also in the original publication.

A detailed instruction manual for the assembly, operation and maintenance of the syringe and control unit is available from the author on request. Completely assembled pneumatic syringes, as well as the electronic control unit and interface, are now commercially available (see instruction manual for details).

REFERENCES

- 1 Schuster, C. R. and T. Thompson. Self-administration of and behavioral dependence on drugs *A Rev Pharmac.* 9: 583-602, 1969.
- 2 Weeks, J. R. The pneumatic syringe. A simple apparatus for self-administration of drugs by rats *Pharmac Biochem. Behav.* 7: 559-562, 1977
- 3 Weeks, J. R. A method for administration of prolonged intravenous infusion of prostacyclin (PGI₂) to unanesthetized rats. *Prostaglandins* 17: 495-499, 1979.

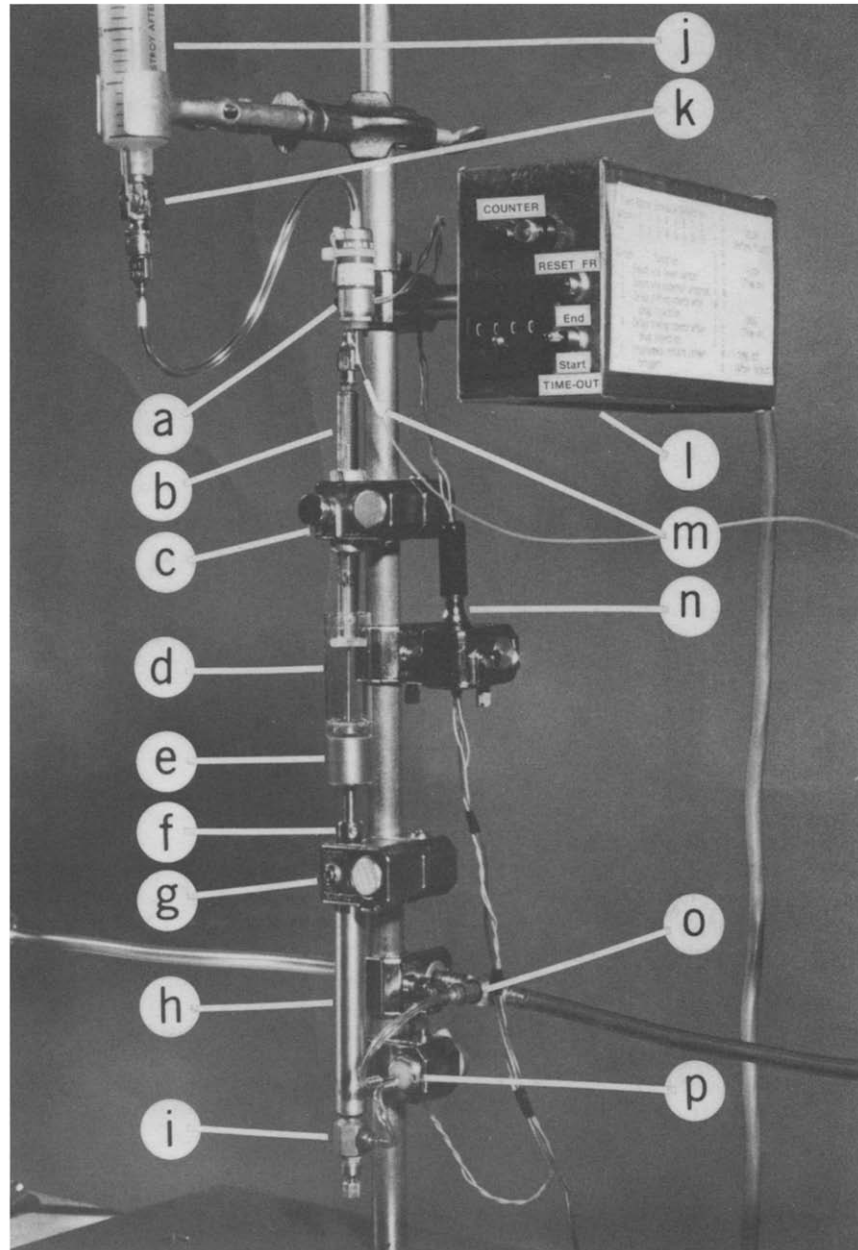


FIG 1 Pneumatic syringe mounted on a chemical stand. (a) Angar Scientific 336-3-24 solenoid valve, equipped with a hypodermic needle hub on the common port and 21 ga hypodermic needle tubing on the normally closed port (special part 336091). The normally open port on the top connects to the drug reservoir. (b) Hamilton Microliter syringe (100 μ l illustrated) (c) Microliter syringe support block (d) Glass cup (shell vial) for propylene glycol to rinse and lubricate syringe plunger (e) Short piece of aluminum rod, which serves as a spacer and weight to assure refilling of the syringe. It is epoxied to the syringe plunger (f) Set-screw collar on the plunger of the pneumatic cylinder which limits the plunger return and thereby determines the injection volume. A loose-fitting O-ring around the plunger serves as a shock absorber. (g) Pneumatic cylinder support block (h) Pneumatic cylinder. The cylinder is thread mounted in a piece of aluminum rod (i) Needle valve controls the rate of plunger travel and creates a delay to assure that the syringe valve operates before the plunger moves. (j) Drug solution reservoir (20 ml syringe barrel illustrated) (k) Stopcock (optional) (l) Electronic control box (m) Tubing from valve to flow-through swivel. (n) Miniature phone plug and mating jack for syringe valve (o) X-fitting in the compressed air supply line (p) Angar Scientific 336-3-24 solenoid valve, equipped with Clippard Instrument Laboratory hose barbs (special part 336092)