of the milieu intérieure." He used the term in a couple of his books but always made it masculine; had it been feminine it would have been fickle, not fixed.

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Beta-blockers and the peripheral circulation

SIR,—The recent report of Drs P D McSorley and D J Warren (9 December, p 1598) raises an important question that has received too little investigation—namely, what is the role of the adrenergic beta-receptors in the peripheral circulation? The authors imply that the cardioselective beta-blocking drugs are preferable to the non-selective ones because they produce less vasoconstriction as a result of their lack of effect on peripheral vascular beta-receptors, and that this is undesirable in patients with peripheral vascular disease.

I would like to propose some qualifications to their suggestions. One of the main reasons for thinking that beta-receptors are tonically active in man is the well-known observation that propranolol produces an increase in total peripheral resistance, for which the traditional explanation has been blockade of the beta-adrenergic vasodilator effect. An objection to this interpretation, however, is the finding that the majority of reports on the acute haemodynamic effects of beta-blockers indicate that both selective and non-selective blockers share this property. Only during exercise is there a clear difference between the effects of the two types of beta-blockers on peripheral resistance. An alternative explanation for the vasoconstriction is that it is mediated reflexly by the alpha-adrenergic system; that sympathetic discharge is increased by acute beta-blockade is suggested by the finding that plasma norepinephrine rises.¹ Other lines of evidence pointing to a relatively minor role for the peripheral vascular beta-receptors are, firstly, that direct intra-arterial infusion of propranolol has little effect on blood flow²; and, secondly, that non-selective and selective beta-blockers are equally good antihypertensive agents—if beta-adrenergic tone was of consequence one would expect that the cardio-selective blockers would be more effective.

The next question is the role of vascular beta-receptors in peripheral vascular disease. In this context we are dealing with a fixed stenosis that produces a diminution of flow distally, resulting in ischaemia, particularly during exercise. Most of the available evidence indicates that maximal vasodilatation during exercise will occur regardless of the level of sympathetic stimulation,³ and that local metabolic changes are of paramount importance. Reactive hyperaemia in skin and muscle is largely independent of sympathetic tone.⁴ Thus sympathectomy and alpha-adrenergic blockers have been found to be of little benefit in patients with intermittent claudication,⁵ and there is no reason to suppose that beta-adrenergic tone is more important than alpha-adrenergic tone in this regard. Furthermore, both selective and non-selective blockers appear to be equally effective in the treatment of angina⁶; only in some patients with Prinzmetal's angina does propranolol have an adverse effect as a result of its effect on vascular beta-receptors.⁷

If it is accepted that autoregulation is of greater importance than neural regulation of

vascular tone in most ischaemic tissues, the adverse effects of beta-blockers in patients with peripheral vascular disease may be not so much because of their effect on vascular beta-receptors as their effect on cardiac output. If flow is already limited vasodilatation of ischaemic tissue is less likely to help.

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¹ Morganti, A, et al, *American Heart Journal*, in press.
² Brick, I, et al, *American Journal of Cardiology*, 1966, 18, 329.

³ Skinner, N S, in *The Peripheral Circulations*, ed R Zelis, p 57. New York, Grune and Stratton, 1975.

⁴ Shepherd, J T, *Circulation Research*, 1964, 14-15, suppl 1-76.

⁵ Coffman, J D, in *The Peripheral Circulations*, ed R Zelis, p 237. New York, Grune and Stratton, 1975.

⁶ Jackson, G, Atkinson, L, and Oram, L, *British Medical Journal*, 1975, 1, 708.

⁷ Hillis, L D, and Braunwald, E, *New England Journal of Medicine*, 1978, 299, 695.

Cardiac resuscitation with electricity

SIR,—Dr E Perman's interesting article "Successful cardiac resuscitation with electricity in the 18th century?" (23-30 December, p 1770) recalls a report¹ of what was probably the first use in an experimental study of DC shock applied to the chest for resuscitation. The object of the investigation was to find out the mode of death of people killed by lightning. Abildgaard produced unconsciousness in a hen by applying one shock from a Leyden jar to its head. The animal could not be resuscitated by any stimulus or repeated shocks to the head. When, however, he applied an electric shock through the sternum to the dorsal spine, the animal got up and walked away. These results were reproducible. Without the second shock to the sternum the animals died. It seems likely that the unconsciousness was due to ventricular fibrillation and resuscitation to defibrillation by DC shock.

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¹ Abildgaard, C P, *Societatis Medicae Havniensis Collectanea*, 1775, 2, 157.

² Scherf, D, and Schott, A, *Extrasystoles and Allied Arrhythmias*, 2nd ed, p 898. London, Heinemann Medical Books, 1973.

SIR,—The historical annotation by Dr E Perman on Mr Squires's communication in 1774, on how "Electricity restored vitality" to an apparently dead child (23-30 December, p 1770), prompts the following comments: (1) This report has been alluded to previously, in particular by Glenn.¹ (2) Experiments on electricity were popular in the latter half of the eighteenth century and shocks were used in the treatment of varied disorders—for example, by Benjamin Franklin² in paralytics and by the Reverend John Wesley in non-defined conditions.

Wesley, in a letter³ written in London in 1760, stated "one [remedy], I must aver, from personal knowledge, grounded on a thousand experiments, to be far superior to all the other medicines I have known, I mean electricity. . . . Certainly it comes the nearest an universal medicine, of any yet known in the world." It is worth noting that Franklin was resident in London in 1774 and active in the scientific community at the time of the report by Squires, but I have been unable to find any evidence of their knowing one another. In this period, Franklin had become a well-known personality

in England, Scotland, and France. At this time also, a Danish physician and veterinarian, Peter Abildgaard, had been pursuing electrical experiments in animals⁴ and had pointed out the resuscitation could be effected by shocks across the chest of an animal. A later essay in this period, discussing successful resuscitation by electric shocks, was published by Charles Kite.⁵ That the procedure had become known at the turn of the century is supported by the statement of Allan Burns in his 1809 text.⁶ "Where however, the cessation of vital action is very complete and continues long, we ought to inflate the lungs and pass electric currents through the chest: the practitioner ought never, if the death has been sudden, and the person not very advanced in life, to despair of success. . . ."

Apparently desultory interest continued through the nineteenth century—witness the remarks by Walshe,⁷ in which he recommended galvanic shocks in severe syncope.

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¹ Glenn, W, *Annals of the New York Academy of Science*, 1964, 3, 815.

² Franklin, B, *Papers of Benjamin Franklin*, ed L W Larabee, p 298. New Haven, Yale University Press, 1963.

³ Wesley, J, *Primitive Physic*, p 34. Epworth Press, 1960.

⁴ Driscoll, T E, et al, *Annals of Internal Medicine*, 1975, 83, 878.

⁵ Kite, C, *An Essay on the Recovery of the Apparently Dead*, London, 1788. (Collection of the Medtronic Corporation.)

⁶ Burns, A, *Observations on Some of the Most Frequent and Important Diseases of the Heart*, p 148. New York, Hafner, 1809, reprinted 1964.

⁷ Walshe, W H, *A Practical Treatise of the Heart and Great Vessels*, p 194. London, Smith Elder and Company, 1873.

"Safety of Medical Electrical Equipment"

SIR,—The correspondence in your journal by Professor J M A Lenihan (30 September, p 948) and Mr D E Oliver (6 January, p 57) underlines the general ignorance among medical and other members of the hospital team regarding the purposes of safety testing of electromedical equipment.

Design requirements and "type testing," which are the main concern of IEC publication 601-1 are not intended to be applied to each and every piece of electromedical equipment purchased by a hospital. The object is to achieve an international standard and congruity of design of equipment, one or two items of each model being provided by the manufacturers for extensive, and often destructive, testing in a central laboratory. The international application of standards is a great advantage to manufacturers, who can therefore develop equipment for use in all parts of the world. Hitherto many items have had to be modified before being delivered from one country to another, because although perfectly satisfactory in their country of origin they did not comply with the electrical safety regulations of the country of the purchaser. Hospital Technical Memorandum 8 has served us well, but we must now see the matter on an international basis. This will be of great benefit to our manufacturers. A very large contribution to publication 601-1 was made by British engineers.

I must, however, take issue with Mr Oliver when he suggests that it is unnecessary to "monitor each individual item." All patient-