[4] Plaut, W., and Nash, D., in *The role of chromosomes in development*, 113, (Academic, New York, 1964).
[5] Plaut, W., Nash, D., and Fanning, T., *Molec. Biol.*, **16**, 85 (1966).
[6] Nash, D., and Bell, J., *Can. J. Genet. Cytol.*, **10**, 82 (1968).
[7] Lakhotia, S. C., and Mukherjee, A. S., *J. Cell Biol.*, **47**, 18 (1970).

[2] Winterberg, F., *Rev. scient. Instrum.*, **41**, 1756 (1970).
[3] Hirsch, E. H., *Rev. scient. Instrum.*, **42**, 1371 (1971).
[4] Winterberg, F., *Rev. scient. Instrum.*, **43**, 814 (1972).

Magnetic insulation

SIR,—The extravagant claims presented in a recent article by Winterberg[1], led me to look into the background of the idea of 'magnetic insulation'. The purpose of this letter is to point out that the scheme described in that article is unsound and will not work.

The basic idea in Winterberg's article is the prevention of electrical breakdown between conductors at different potentials using the interposition of a combination of a high vacuum and a high magnetic field parallel to the conductor faces. Electrons which could initiate the breakdown are supposed to be returned by the magnetic field to the electrode from which they were emitted. This, however, is essentially the configuration found in any number of magnetron devices. In forty years of experiments in this field it has been shown time and again that complete cutoff is not achieved for any magnetic field. The reason is that collective effects intervene; space charge instabilities always result in some current passing between the electrodes. Under these conditions simple orbit calculations no longer apply.

Winterberg's ideas were presented earlier in a longer article[2]. In that article he suggested that 'magnetic insulation' might make possible a transformer for 10^9 V. A year later the same objections that I have raised were published in some detail by Hirsch[3]. He concluded "The cutoff anomaly therefore renders 'magnetic insulation' impracticable . . . Clearly, the only way in which vacuum breakdown due to field emission from a given surface can be avoided is by reduction of the surface electric field." A reply by Winterberg[4] completely failed to answer Hirsch's objections.

Perhaps claimants for 'magnetic insulation' could be given the same requirement that is presented to inventors of perpetual motion machines. They are usually instructed to accompany their claims with a working model.

Yours faithfully,
JOHN P. BLEWETT

Brookhaven National Laboratory,
Upton, New York

[1] Winterberg, F., *Nature*, **246**, 299 (1973).

DR WINTERBERG REPLIES: Contrary to Blewett's belief, magnetic insulation has not only been experimentally confirmed[2] since I proposed it several years ago[1], but is already utilised in the coaxial transmission lines of relativistic electron beam generators (for example, the MJ Aurora machine). The magnetic field needed for the insulation effect in this case is generated by the strong azimuthal self-induced field of the current pulse passing through the transmission line. In the Aurora machine for example, the pulse length is 100 ns and the feasibility of magnetic insulation is therefore confirmed, at least for this time scale. The same should therefore be true for the magnetically insulated high voltage transformer[3], at least for an a.c. frequency of the order 10 MHz as it is realised in a Tesla transformer.

Blewett argues that experience with magnetron devices speaks against the feasibility of magnetic insulation and that the device described in my article falls into the same category. This, however, is not quite correct, because the magnetron device is an open ended system. It therefore has quite similar end losses and instabilities as an open ended plasma confinement device. This contrasts with a closed toroidal system, which is proposed in my article. In a magnetron the electrons can drift freely in the axial direction, causing breakdown at the ends, by contrast with the proposed closed toroidal system in which this free motion follows a closed loop parallel to the circular torus axis.

Both the magnetically insulated coaxial transmission line and the high voltage transformer are also open ended systems but with an azimuthal field, rather than an axial field as in the magnetron. The azimuthal field leads to a much smaller axial drift motion than in the magnetron device. Here again, the analogy with the *z* pinch (azimuthal field) and the θ pinch (axial field) can be drawn. Therefore, for both the magnetically insulated coaxial transmission line and the high voltage transformer, larger time scales than in the magnetron can be expected. This prevents breakdown. A closed toroidal system, as it is proposed in my article should, however, lead to substantially larger breakdown times, quite analogous to the much longer plasma confinement times for closed than for open ended systems. It is also known, from toroidal plasma confinement devices, that even higher stability can be achieved by strong shearing of the magnetic field lines and average minimum *B*, as in the Stellarator or Tokamak. The same principle could, of course, be used in the proposed machine, a big shear field being produced with the external field coil, with an induced circular current in the central conductor or with a combination of both. In a closed, magnetically insulated system the only important collective instability which then remains is the diocotron instability which is suppressed by making $\omega_p^2 \ll 2\omega_c^2$ where ω_p is the electron plasma frequency and ω_c the electron cyclotron frequency. This is one of the conditions for magnetic insulation.

F. WINTERBERG

Desert Research Institute,
University of Nevada System,
Reno, Nevada 89507

[1] Winterberg, F., *Phys. Rev.*, **174**, 212 (1968).
[2] Miller, R., Rostocker, N., and Nebenzahl, I., *Bull. Am. phys. Soc.*, **17**, 1007 (1972).
[3] Winterberg, F., *Rev. scient. Instrum.*, **41**, 1756 (1970).

Bovine thymin

SIR,—Recently, Goldstein[1] reported on the isolation of two polypeptide hormones from bovine thymus. He suggests and extensively uses the terms thymin I and thymin II to designate these hormones.

The choice of these names seems unfortunate because of a possible confusion with thymine (2,4-dihydroxy-5-methyl-pyrimidine), a component of some nucleic acids. In French and German, there would be only one way of writing both thymine and thymin, so that they could not be distinguished from each other. The numbers I and II should also be considered as provisional ones, as the structures of the hormones are still unknown and it could be that II is the precursor of I.

It is to be expected that any new important biochemical compound will ultimately have its name defined on an international basis by a nomenclature commission of such a body as the International Union of Biochemistry (IUB) or the International Union of Pure and Applied Chemistry (IUPAC). As this is likely to take some time, it would be worthwhile if Dr Goldstein could reconsider the question of the names to be used for the new hormones, to make them unambiguous and compatible with existing recommendations.

Yours faithfully,
M. ROTH

Central Laboratory,
Hôpital Cantonal,
Geneva, Switzerland

[1] Goldstein, G., *Nature*, **247**, 11 (1974).

DR GOLDSTEIN REPLIES: The points made by Dr Roth are well taken. The name thymin was originally assigned[1] to designate a hormone of the thymus