prematurely endorsed it are reluctant to believe that their judgment may have been wrong.

Many wild theories have been put forward with the object of explaining the observed phenomena in accordance with the wishes of those who propound them, and objective data on the subject are extremely restricted in their scope. The following facts appear, however, to be established :—

(1) It is possible to produce, by passing a suitable electric current through the brain, a nightmare state in which the subject retains his senses, but appears to an external observer to be completely unconscious, the pupil reflex being absent. The conditions under which this state can be produced have not been satisfactorily delimited, but they appear to approach those employed in the slaughter-house. The requisite range of conditions, whatever it may be, is one which sometimes although very rarely occurs in electrical accidents.

(2) A weak interrupted direct current produces the same objective phenomena as sinusoidal (electrolethaller) current twenty times stronger as read with an ammeter. Thus it is found that to get the desired objective effects on pigs in the slaughter-house the sinusoidal electrolethaller current must lie roughly between half an ampere and one ampere, while Regensburger gets similar results with 10-per-cent-interrupted direct current of from 31 to 53 milliamperes.

(3) Controlled experiments on human beings have not been carried quite up to the point where the subject fails to recover his mobility immediately on the cessation of the current. In slaughter-house practice the current-strength lies just above this point, and it must have done so in the case of those rare electrical accidents in which the nightmare state persisted after the accident.

(4) Leduc submitted himself to interrupted direct current up to 4 milliamperes but failed to reach unconsciousness, although his assistants supposed him to be completely unconscious for twenty minutes. He felt sure, however, that if the current had been raised a very little higher unconsciousness would have ensued. Dr. J. Hertz, in Paris, therefore repeated the experiment on incurable invalids with currents up to 25 milliamperes (or 18 milliamperes where the on period was 10 per cent) but Leduc's prediction was not fulfilled. The subjects failed to pass beyond the nightmare state. They exhibited permanent dilation of pupils and were unable to respond to stimuli, but they retained their sensibility.

(5) Breathing was sometimes inhibited during the nightmare state in Hertz's subjects, and in some victims of electrical accidents. Zimmern in particular refers to an accident in which the victim knew that he could not breathe voluntarily and dreaded that artificial respiration might be abandoned prematurely.

(6) The muscles in Hertz's subjects were sometimes contracted and sometimes relaxed. The absence of squealing in electrolethalled pigs is not therefore necessarily due either to muscular contraction or to unconsciousness. It may, for all we know, be due simply to the nightmare state.

(7) Whether the pigs, if conscious, suffer pain from the current must depend on whether their muscles are relaxed or violently contracted. Both conditions may occur in practice.

I intend to publish before long a more detailed statement of the above points ; the purpose of the present letter is to urge that every effort should be made to encourage inquiry into an unsettled question, with regard to which we require new data based on research and not dogmatic assertions based on the will to believe.

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Magnetism of Tin

S. Ramachandra Rao has reported[1] that, on testing colloidal powders of white tin magnetically, its paramagnetic susceptibility becomes diamagnetic as the particle size decreases, this diamagnetism increasing as the particle size decreases. A few years ago we often observed the same phenomenon in the investigation of the effect of cold-working on the susceptibility of white tin. In our case we found that the paramagnetic susceptibility of white tin changes its sign as the internal stress caused by cold-working increases, this value of diamagnetism increasing in proportion to internal stress. This change of susceptibility has been explained by a slight expansion of tin by cold-working[2].

Thus the interesting phenomenon observed by S. R. Rao may be explained as follows. As a theoretical calculation shows, the lattice constant of a metal is somewhat larger in the surface layer than in the interior, the constant attaining gradually its normal value at some hundred layers below the surface. Hence it is to be expected that, as the particle size of tin diminishes, its mean lattice constant increases ; the result of colloidalisation is therefore the same as that of cold-working. Hence we may assume that through the volume expansion due to colloidalisation of tin, its magnetic susceptibility is affected in two different ways :

(1) The decrease of paramagnetic susceptibility due to the diminution of free electrons caused by the expansion.

(2) The increase of diamagnetic susceptibility due to the increase of bound electrons caused by the expansion.

In the case of cold-working of white tin, its susceptibility is observed to change, for example, from $0{\cdot}027 \times 10^{-6}$ to $-\ 0{\cdot}0049 \times 10^{-6}$, corresponding to a change of density by cold-working from 7·291 to 7·280. The calculated value of the susceptibility corresponding to this change of density is from $0{\cdot}0270 \times 10^{-6}$ to $-\ 0{\cdot}0051 \times 10^{-6}$; the agreement between the observed and theoretical values is satisfactory. It may, therefore, be concluded that the curious change of susceptibility from a positive to a negative value in the case of colloidalisation is due to the increase of the mean lattice constant due to refining of tin particles ; but a quantitative comparison between the theoretical and observed values cannot be made, as the change of density caused by colloidalisation has not yet been measured.

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[1] Nature, **134**, 288, Aug. 25, 1934.
[2] K. Honda and Y. Shimizu, Nature, **132**, 565 ; 1933. Y. Shimizu, *Sci. Rep.*, **22**, 915 ; 1933.