

in May. Thus the oestrogen levels in both sexes seem very likely to be at their lowest (so that dopamine will be at its highest) at precisely the times when suicides are commonest in the respective sexes.

Incidentally the idea that depression is caused by high levels of dopamine resulting from low levels of oestrogen would explain the type of depression which follows gonadectomy, contraceptive pill-withdrawal and the menopause. It might even explain puerperal depression because during pregnancy both oestrogen and prolactin are at astronomical levels while at parturition oestrogen falls almost to zero.

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#### SCHIZOPHRENIA: BEHAVIORAL VARIABILITY AND EVOLUTIONARY PERSISTENCE

DEAR SIR,

Schizophrenia has probably existed as a disease entity for at least 3,000 years and possibly has afflicted mankind since his origins (Lewis, 1966). A number of hypotheses have been advanced to account for the persistence of a schizophrenia gene or genes positing both physiological (e.g. Huxley *et al*, 1964) and behavioral (e.g. Hammer and Zubin, 1968; Jarvik and Chadwick, 1974; Kuttner *et al*, 1967) advantages for nonpsychotic relatives. Among these hypotheses is the proposal that creativity and schizophrenia might be genetically linked, and that creativity exhibited by nonpsychotic carriers of the genes provides an adaptive advantage (e.g. Claridge, 1972; Hammer and Zubin, 1968; Heston, 1966; Karlsson, 1968). However, the process underlying the similarity between creativity and schizophrenic thought has yet to be conclusively demonstrated, and a specific hypothesis of the adaptive advantage of this process is lacking.

Sengel and Lovallo (1980) have recently proposed that extreme variability in memory retrieval processes is the functional deficit which underlies thought disorder in non-paranoid schizophrenia. Further, it is postulated that variability of memory retrieval increases along a continuum from normal behavior to creativity to schizophrenia. The characteristic most frequently seen to demonstrate the similarity between creative and schizophrenic thinking is the tendency to emit unusual associations (Hasenpus and Magaro, 1976). With the Sengel and Lovallo (1980) model, the concept of variable memory retrieval provides a process that accounts for the associative substitutions and intrusions that characterize creative and schizophrenic thinking. Moreover, this model leads to a hypothesis of the adaptive advantage of the schizophrenia-creativity polymorphism.

An analogy can be drawn between genetic variability, adaptation, and fitness, on the one hand, and behavioural variability, adaptation, and fitness on the other hand. The postulated increased variability of retrieval enhances the potential for adaptive responses to changing environmental contingencies. Thus, this greater variability provides a large 'pool' for selection. In other words, the creative individual generates more low probability responses, among which may be the adaptive solution to a new evolutionary problem (e.g. Campbell, 1974). Variable memory retrieval can be seen as producing the novelty selection operates on. At its most extreme, this variability manifests itself as psychosis, and the psychotic carrier of the schizophrenia-creativity polymorphism loses his adaptive advantage because he lacks the structure to integrate feedback and preserve, or retain, a successful behavior. The selection of successful variations will lead to a favourable fitness differential, ensuring preservation of the schizophrenia-creativity polymorphism and the concomitant risk of schizophrenia.

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#### BIOFEEDBACK AND RELAXATION IN ANXIETY

DEAR SIR,

Drs Leboeuf and Lodge reported in the September issue of the *Journal* that frontalis EMG biofeedback and progressive relaxation while equally effective in reducing levels of anxiety were clinically unimpressive as anti-anxiety measures (*Journal*, 1980, **137**, 279-84). They also noted that reduction in muscle tension did not correlate with the associated anxiety relief.

A mental device to dwell upon, a passive attitude, comfortable position and a quiet atmosphere have been listed as the main ingredients of all relaxation therapies (Benson, 1974). The only difference between EMG biofeedback and progressive relaxation would seem to be in the mental device used to minimize distraction. The feedback signal of the biofeedback machine and the subjective feeling of muscle tension in progressive relaxation are more likely to serve as devices to dwell upon rather than as specific aids to lower anxiety. Several other investigators have also reported absent correlations between reductions in muscle tension and anxiety (Surwit and Keefe, 1978; Raskin *et al.*, 1980). Furthermore, the concept that relaxation of the frontal muscle will readily generalize to the rest of the body is not supported by scientific evidence (Surwit and Keefe, 1978). In a similar research project carried out in our laboratory, in addition to the findings reported by Leboeuf and

Lodge, we found a significant correlation between Stanford Hypnotic Susceptibility Score and Anxiety Reduction ( $r = .44$ ,  $P < .05$ ). Highly hypnotisable individuals are thought to excel in their ability to concentrate (Karlin, 1979). This adds further support to the notion that the feedback signal of the biofeedback machine serves as an emotionally neutral signal for the patient to focus on while relaxing.

It is unclear at the moment, how relaxation therapies compare with the alternative pharmacological treatments. It should be noted that the relaxation therapies are free of problems of drug toxicity and dependence. A recent study which compared biofeedback treatment to diazepam on forty anxious subjects found both forms of treatments to be equally effective at the end of treatment and biofeedback to be more effective at the three month and six month follow-up evaluations (Lavallee *et al.*, 1977). More information is needed before any firm conclusions can be drawn in this regard.

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#### AN EARLY CASE OF BATTLE HYSTERIA

DEAR SIR,

With reference to Dr M. A. Patton's letter, (*Journal*, February 1981, **138**, 182-83), about an 'Early Case of Battle Hysteria', I would like to mention that a typical case of combat hysteria, perhaps the earliest, is masterfully described by Herodotus whom I quote below:

"... In this fight of Marathon there were slain of the foreigners about six thousand four hundred men, and of the Athenians a hundred ninety-two. These are the numbers of them that fell on both sides. And it fell out that a marvellous thing happened: a