and so far, apart from the patient who stopped all treatment, no relapses have been observed.

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LACTATE-INDUCED ANXIETY: THERAPEUTIC APPLICATION

DEAR SIR,

We read with interest the paper on 'Anxiety and the Effects of Sodium Lactate Assessed Clinically and Physiologically' by Desmond Kelly, Nita Mitchell-Heggs and Daniel Sherman, published in the *Journal* for August 1971 (7). We should like to take the opportunity of answering some of the questions raised by the authors, and also to record that we have developed a new method of treatment.

For the past three years, following the report of Pitts and McClure (9), we have undertaken an ongoing study of intravenous lactate infusion and anxiety. This has so far involved the infusion of 66 subjects with sodium lactate. Thirty-three subjects (24 patients and 9 normal volunteers) took part in a study designed to test the reliability of panic reproduction as described by Pitts and McClure, with physiological, biochemical and endocrinological measurements simultaneously recorded. The effect of medication (propranolol) on psychological state as well as on physiological measurements during lactate infusion has also been assessed (1). Arising from our results a new method of treatment for long-standing intractable, non-situational anxiety was devized and applied to a further series of 33 patients.

Our research method differed somewhat from those reported. We found it impossible to administer the calculated dose of 10 ml./kilogram of ½-molar sodium lactate within 20 minutes while maintaining a constant drip-rate; accordingly we switched to the use of 5 ml./kilogram of 1-molar lactate. As a control procedure with each subject a preliminary experimental session was held in which a volume of normal saline was infused equivalent to that required for the body-weight-related infusion of sodium lactate. The two infusions were separated by exactly one week and given at the same time of day under identical conditions and using the same psychological and physiological measurements. Care was taken to avoid the pre-menstrual week in women. Heart-rate, respiration-rate, electrical skin resistance, skin temperature over both α- and β-adrenergic receptor areas and muscle tremor (by surface electromyography) were monitored continuously. In some of the subjects, reaction-time, plasma lactate, phosphate, bicarbonate, calcium, cortisol and growth hormone were estimated at known intervals.

There were no significant symptoms with the saline infusions. With the infusion of lactate the manifestations of symptoms in our patients were more similar to those observed by Kelly *et al.* than to those reported by Pitts and McClure, and included paraesthesiae, tremor, a sense of vibration, palpitation and dysphoria. The time after beginning lactate infusion at which our patients experienced symptoms (mean 14 minutes) was also closer to Kelly's observation. It would appear that the strict attention paid to a constant drip-rate throughout the 20 minutes (not stressed by Pitts and McClure) may account for this.

Mean scores on the Middlesex Hospital Questionnaire (4) are comparable:

	Free-floating anxiety	Phobic	Obsessional	Somatic	Depressive	Hysteric
Kelly *et al.*	12·4	9·4	10·8	10·4	8·3	6·6
Bonn *et al.*	13·2	10·0	11·3	11·2	7·5	5·7

We also devized a special self-rating scale for anxiety (Normal < 10), and the mean scores were:

Pre-NaCl	30·6	Post-NaCl	30·0
Pre-Lactate	29·1	Post-Lactate	55·2

However, in some important respects our findings differed from those of Kelly and of Pitts and McClure. For example, none of our patients reported an exact reproduction of their 'natural' anxiety attacks in association with lactate infusion. Using Pitts and

McClure's Anxiety Neurosis Criteria, of our first 20 patients 4 experienced overt panic, 12 'would have panicked but for your presence, doctor', 3 experienced 'prelude' to panic, and 1 experienced no mood change. During the control infusion none of this group experienced panic, and the tendency was for symptoms present at the beginning of the infusion to improve or disappear towards the end of the 20 minutes. All the subjects completed the full infusion schedule, and after lactate infusion 3 of the most acutely anxious gained relief in association with taking diazepam 10 mg. orally.

We have already reported the results of studies which provide answers to some of the questions raised by Kelly. With regard to whether a β-adrenergic blocker, such as propranolol, can modify the symptoms produced by the infusion of sodium lactate, our published findings indicate that this is not so (1).

Kelly speculated about the nature of metabolic changes resulting from sodium lactate infusion, and also referred to the possible correlation of blood lactate levels and onset of symptoms. We are able to provide evidence which helps to elucidate these matters. Some of our results comparing lactate with saline infusions were as follows:

Blood values	Difference in mean change	S.E. of diff.	t	d.f.	P
Phosphate (mg/100 ml.) ..	−0·628	0·104	6·04	6	<0·001
HCO_3 (mM./litre)	−5·0	0·80	6·25	4	<0·01
Calcium (mg./100 ml.) ..	−0·76	0·24	3·17	4	<0·05

The strikingly significant hypophosphataemia associated with lactate infusion is not mediated by sympathetico-adrenomedullary activity, as it still occurs after adrenergic blockade (2).

Our findings with regard to blood lactate levels were as follows:

Mean blood lactate levels (mM./litre)	
Before infusion	0·85
At first reported symptoms ..	2·98
At end of infusion	4·26
1 hour later	1·17

Pitts and McClure calculated that the amounts infused would produce a blood lactate level of 12–15 mEq./litre, but we feel that this must be a misprint for mg./100 ml. However, the levels reached in our series are consistent with the findings of Edwards and Clode (5) who reported an overall mean value in subjects after 6 minutes exercise of 3·96 mM./litre; their highest level was 5·96 mM. as compared with our highest of 5·37 mM. It would appear that our infusions produced lactate levels within physiological limits. Furthermore, Edwards and Clode were able to conclude from their results that 'the increase in blood lactate attributable to hyperventilation is comparatively small in exercise tests involving short periods of moderately severe exertion'. Their findings, together with our experience that lactate infusion is not associated with hyperventilation, have been important to us in embarking on our trial of treatment, for hyperventilation during the anxiety of lactate infusion could cause a respiratory alkalosis which in combination with the metabolic alkalosis produced by the lactate itself could be potentially serious (6).

We now wish to refer to the new method of treatment which arose out of the above research and which will be reported in detail at the Fifth World Congress of Psychiatry. It is generally agreed that one explanation for the persistence of conditioned avoidance response is that avoidance occurs before fear can be fully aroused, thus protecting the fear from extinction by preventing pairing of fear with neutral stimuli. The question was thus prompted whether 'free-floating' anxiety and anxiety attacks in non-situational anxiety states might be maintained by inadequate severity and quantity of fear attacks in neutral situations. On the basis of these considerations one of us (J.A.B.) decided to use infusions of sodium lactate to induce maximal anxiety reaction for therapeutic purposes. The method is as follows. For three weeks twice-weekly 'flooding' with lactate was undertaken in 33 patients suffering from intractable anxiety states without marked specific phobia. These patients had all had much previous treatment, including psychotherapy, drug treatment with major and minor tranquillizers, trials of antidepressives, and in two cases there had been serious consideration of leucotomy. Illness duration was between 8 months and 28 years (mean 11·5 years); because of this it was felt justified to regard these patients as their own controls.

Results are promising, and can be summarized in the scores obtained using the newly constructed and validated self-rating Morbid Anxiety Inventory (M.A.I.) of Salkind. The M.A.I. correlation coefficient with the Hamilton Anxiety Scale is +0·74, and in a recent between-patient drug trial the Spearman rank correlation coefficients between M.A.I. and clinical assessment was +0·73 ($P<0·001$) Eysenck Personality Inventory was +0·40 ($P<0·025$), and for the Institute for Personality and Ability Test Scale was +0·48 ($P<0·005$) (3).

Two months before beginning treatment the mean M.A.I. score was 32·7, and immediately before treatment began it was 32·5 (no significant difference).

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Three weeks after the course of treatment it had fallen very significantly to 18·3 (Mean diff. 14·2: S.E. of diff. 2·24: t 6·34: P<0·0005). Six weeks after treatment it had risen slightly to 20·5, but this value is still very significantly lower than the pre-treatment mean score (Mean diff. 12·0: S.E. of diff. 2·55: t 4·71: P<0·0005).

No previous reference has been found to the use of a behavioural treatment method in the management of 'free-floating', non-situational, non-phobic anxiety. Marks (8) has pointed out that desensitizing procedures in patients with severe agoraphobia are significantly more successful if free-floating anxiety can be relieved beforehand. We were impressed by the observation that the phobophobic element, which was so frequently seen in our patients, was substantially reduced after treatment, leading to interruption of a pathogenic somato-psychic sequence which had helped to maintain the anxiety neurosis.

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GRID TEST OF THOUGHT DISORDER

Dear Sir,

Permit me to comment on the paper by Williams, 'The Effect of Varying the Elements in the Bannister-Fransella Grid Test of Thought Disorder' (August *Journal*, 1971, **119**, 207–12).

Williams, in varying the elements of grids, is actually varying the constructs, since even though the same verbal label is retained a construct exists only in a *context*. Thus there is no reason to expect '(looks) kind', applied to photographs, and '(behaves in a) kind (way)' applied to known people, to have the same strength of implication in relation to other constructs. His experiment extends part of my 1962 experiment and his conclusions seem broadly the same, though I think mine the more succinctly put—'within one person's construing system different subsystems may have varying structural qualities'. He claims that 'it is not immediately clear whether personal construct theory would predict this effect'. Perhaps it might become slowly clear to him if he pondered the range and fragmentation corollaries and the concept of subsystem, in the theory, which directly imply such effects. He cavils at the use of photographs as elements in grid work on thought disorder while not denying that *either* photographs *or* people elements (Bannister 1960) broadly identify thought disorder.

However, my main concern is with the *ad hoc*, tautologous and impoverished nature of concepts such as 'cue insensitivity' and their relationship to the logical requirements of research into schizophrenia (Bannister, 1968). The point of developing research into thought disorder in terms of personal construct theory is that it is an extensive and integrated framework and language for dealing overall with human psychological processes. From it have been derived arguments as to the origins of thought disorder (Bannister, 1965), the precise source of its various clinical manifestations, its relationship to other forms of disturbed construing such as paranoid thinking (Bannister, Fransella and Agnew, 1971) and its relationship to the total life of the person. 'Cue insensitivity' is *not* a theory, it is a notion, half-linked to a disparate bundle of other notions. It is acceptable to common sense, amenable to some *ad hoc* operational definitions, productive of a handful of experiments and destined for relegation to the mounting scrapheap of like bits of intellectual ironmongery ('distractability', 'slowness of processing', 'arousal', 'regression', 'perseveration', 'concreteness', 'difficulty in establishing set', 'proprioceptive diathesis', 'rigidity', 'overinclusion' and all the as yet unnamed mini-theorems which will be called up for duty for the duration of the journal paper).