INHIBITION OF IMMEDIATE-TYPE HYPERSENSITIVITY RESPONSE BY DIRECT SUGGESTION UNDER HYPNOSIS*

BY

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The existence of psychological factors in the aetiology of many skin conditions has been recognized for over a century: even in 1856 Wilson considered "mental emotions particularly of the depressing kind" to be amongst the causes of eczema. Fifty years later von Pirquet (1906) coined the term "allergy" to describe for the first time "an acquired specific altered capacity to react" on the part of the tissues and established the existence of immunological mechanisms in the aetiology of the acquired hypersensitivity in tuberculosis, which he was able to demonstrate as a delayed skin reaction by injection of his "allergen" in the form of Koch's old tuberculin. That skin-sensitizing antibodies were present where an immediate hypersensitivity response could be elicited in many congenital as well as acquired conditions was then demonstrated by Prausnitz and Küstner (1921), while Coca and Grove (1925) later described this kind of hypersensitivity under the term "atopy."

Meanwhile, such atopic or allergic reactions of the tissues showing the immediate-type hypersensitivity response were recognized as the cause of many other conditions which were not necessarily dermatological, including asthma and hay-fever, and the treatment of this form of allergy in general by immunological techniques came to be widely investigated (Freeman, 1950). But continued clinical recognition of psychological factors associated with the allergic or atopic reaction led at the same time to the treatment of such allergy by psychiatric techniques and to a dichotomy of medical opinion concerning the best form of treatment which has largely contributed to the development of what is now described as psychosomatic medicine. That such a dichotomy of opinion derives from the seventeenth-century philosophical dualism of Descartes has already been pointed out by Cullen (1960).

It has been reported that skin-testing of a patient under treatment by direct suggestion under hypnosis for asthma and hay-fever showed a decreasing immediate-type hypersensitivity response to the known allergens in the course of treatment, but that when the patient's condition was relieved and skin sensitivity had apparently been eliminated by this means it was still possible to elicit the Prausnitz-Küstner reaction by intradermal injection of the patient's serum into a non-allergic subject (Mason and Black, 1958). In the present work, direct suggestion under hypnosis (D.S.U.H.) was employed as an experimental tool with which to investigate the psychological control of the immediate-type hypersensitivity response (I.T.H. response) under experimental conditions.

Methods and Materials

The I.T.H. response has the clinical appearance of an inflammatory process, and experimental assay was

*A further paper by Dr. Black, reporting the effect of direct suggestion under hypnosis on the dose-response curve of the Prausnitz-Küstner reaction, will be published next week.

therefore planned in terms of the cardinal signs of inflammation suited to objective measurement. The temperature change at the experimental site during the response was measured with thermocouples, the oedema present with skinfold-thickness callipers, and a record of the colour change was kept by colour photography. Such measurements were made of the normal response in the waking state on one arm and again on the other arm after D.S.U.H. not to react to the allergen.

The Subjects

Since these investigations concerned a psychophysiological phenomenon rather than a therapeutic technique, the subjects were selected from individuals thought likely to produce inhibition of an allergic response in this way—basing selection on the hypnotic trance depth and psychosomatic history of each individual concerned. They were thus highly selected: trained hypnotic subjects available for experimentation who showed an allergic response to one of the common allergen test preparations as supplied by Bencard Limited and who mostly gave histories of psychosomatic disorders, some of which were allergic. In a number of cases previous treatment for allergy had been given by psychotherapy, which in one case included D.S.U.H.

Forty-five hypnotic subjects were screened by skin-testing in the selection of a final group of 18. Seven of these were deep-trance subjects, amnesic of the period of the hypnotic trance and capable of psychological regression to childhood states, and 11 were medium-trance subjects responding to suggestions of anaesthesia, hand levitation, and mood changes.

Experiments and Controls

Inhibition of the I.T.H. response was attempted in 12 complete experiments on seven deep-trance subjects and five medium-trance subjects. Six control experiments were performed: the normal response on right and left, and left and right, arms was compared without D.S.U.H. on four medium-trance subjects and in one experiment on another medium-trance subject a comparison was made between the response to the single-prick-through-drop technique and the multiple-prick-through-drop technique. In a single experiment on a medium-trance subject an attempt was also made to inhibit the response to nettle-sting. Including controls, 18 complete experiments were performed.

Since all subjects had been screened initially, each subject had therefore been skin-tested prior to the experiment using the single-prick-through-drop technique with a variety of allergen extracts selected according to history. The mean number of such tests with different allergens on the 18 subjects was eight, but none of these preliminary tests was performed on the forearm. Subjects previously treated either by psychotherapy or by D.S.U.H. for allergic disorders were included in the series only with reference to an allergen concerning which no treatment had been given.

Technique and Apparatus

The subject lay on a couch in a temperature-controlled chamber maintained at 20° C. $\pm$ 0.5° C., although records showed the variation was usually $\pm$ 0.2° C. for the period of each experimental run. The difference in temperature between a distal control site on the forearm and a proximal experimental site was recorded, using

two piles of six copper-constantan thermocouples in series and a Honeywell-Brown potentiometer. In addition, at the centre of each pile a single thermocouple was available to record the actual temperatures at the sites using an ice reference. Owing to the natural temperature gradient down the arm, a positive reading of approximately 2° C. between the proximal and distal sites was obtained at the outset of each experimental run.

The thermocouple piles were set into "perspex" cylinders, 1.5 cm. diameter, suspended on a movable spring mounting which accommodated the apparatus to the shape of the subject's arm. Extension springs maintained the pressure on both cylinders throughout all experiments at 10 g. The apparatus was calibrated for both the piles and the central thermocouples over temperature ranges from 0 to 5° C., from 25 to 20° C., and from 37 to 32° C. Good agreement was found between all three sets of calibrations.

To record the erythematous flare, a Kodak "colour temperature" chart having been placed beside the arm, colour photographs were taken on "kodachrome" at a standard distance from the arm under standardized conditions of lighting by means of two flash bulbs.

To measure the oedema of the weal the skinfold thickness was determined with callipers measuring to the nearest 0.1 mm., according to the technique reported by Lewis *et al.* (1958).

Experimental Procedure

Alternate left or right arms were used for assay of the normal response in alternate subjects in the series. The veins on the flexor surface of the arm were marked out with a ball-point pen to avoid placing the thermocouples over a vein. Garments were removed to bare the arms from the shoulder, and after cooling the experimental arm for 30 minutes the thermocouples were applied and readings taken at five-minute intervals, until over 15 minutes three sets of readings indicated a steady state. The period of cooling required was found to vary from 45 to 90 minutes.

Once a steady state was obtained, the camera was set in focus over the arm and readings were taken every 15 seconds over a period of 15 minutes. The apparatus was then removed from the arm and the selected allergen to which the subject was known to be responsive was inoculated at the proximal site by the single-prick-through-drop technique and a stopwatch was started. A similar inoculation by prick-through-drop was also given immediately with normal saline at the distal site and one minute allowed before removal of both allergen and saline by wiping with absorbent cotton-wool. After replacement of the thermocouple piles, readings were taken every 15 seconds for 15-30 minutes, according to the response, and were recorded automatically in ink on paper by the Honeywell-Brown potentiometer.

The thermocouples were removed when the temperature difference had returned approximately to normal. The colour chart was then placed beside the arm and a colour photograph was taken prior to measurement with the skinfold-thickness callipers, since these themselves were found to cause an erythematous response.

Owing to this traumatic effect of skinfold-thickness measurement, it was not possible to record this parameter at the test site before as well as after the experiment. Furthermore, preliminary investigation of this

technique showed that the skinfold thickness itself varies down the arm. To measure the change in skinfold thickness, therefore, it was necessary to take all readings at the end of the experiment and to compare the thickness at both sites with the thickness of near-by sites, so that four skinfold-thickness readings were made at the end of each run—namely, two reference measurements near the sites and two measurements at the sites.

These experimental procedures were carried out on one arm, and the subject, without leaving the couch, was then hypnotized as deeply as possible by use of a code word established by previous post-hypnotic suggestion. The depth of trance was reinforced by count-down repetition of the code or by Mason and Black's modification of the Erickson-Wolberg hand-levitation technique involving split suggestions (Wolberg, 1948). To do this hand-levitation is produced by D.S.U.H. of lightness of the arm, and the subject is then warned that on the start of further count-down the arm will become very heavy. The subject is then told that by an act of volition contrary to the hypnotist's suggestions of increasing heaviness of the arm, he will nevertheless keep it up until the code is repeated at the end of count-down—and that when the admitted conflict thus created is so relieved he will take "a deep breath of relief" and on expiration will sink "deeper into sleep."

Over a period of five minutes D.S.U.H. was then given that there would be no reaction to the allergen. These suggestions were presented as forcefully as possible to the subject in a standardized form. This was as follows: "You will have the same injection again, but this time there will be no response—there will be no heat, no redness, no swelling, no itching, no reaction. Your arm will no longer respond to the fluid as it did before. It will be just as if water had been pricked in. There will be no response. Your arm feels different, your whole body feels different—you will not respond as before. You are different: you are no longer allergic to . . ." and the allergen to which the subject had previously responded was named.

The whole experimental procedure was then repeated as already described, allowing a preliminary period of 15 minutes before pricking in the allergen and normal saline at the proximal and distal sites respectively.

Results

Of the 12 subjects on whom inhibition of the I.T.H. response by D.S.U.H. was attempted eight showed evidence of varying degrees of inhibition, while four failed to show any such evidence. Of the eight subjects showing evidence of inhibition six were deep-trance subjects and two were medium-trance subjects, one of whom gave a history of successful treatment for hay-fever by D.S.U.H. Of the four subjects who failed to show evidence of inhibition three were medium-trance subjects and one was a deep-trance subject. None of these four subjects gave a history of the successful control of any kind of psychosomatic disorder by psychotherapy or D.S.U.H.

The average results with regard to temperature changes in the eight experiments indicating varying degrees of inhibition are shown in Fig. 1, in which the temperature differences in ° C. are plotted against time, both for the initial responses and the responses following D.S.U.H. not to react.

In one experiment the subject was tested again for evidence of inhibition at 54 days and an attempt to reverse the effect by further D.S.U.H. was made at 68 days. These results are shown in Fig. 2, where the initial response is given together with the response at 54 days, when evidence of inhibition was still present. Only a slight change in the temperature difference curve was then obtained by D.S.U.H. (direct suggestion under hypnosis) to react again when this was given at 68 days.

In one experiment with one subject out of the four who failed to inhibit, the effects of further repeated D.S.U.H. daily for 10 days were tested at 44 hours and at the end of the period. These results are shown in Fig. 3, where it can be seen that after repeated D.S.U.H. to inhibit there was a diminished response at 44 hours and that the shape of the curve indicated a further diminution after 10 days.

FIG. 1.—Temperature differences between arm sites. Mean of results of I.T.H. experiments in eight cases. Various allergens.

FIG. 2.—Subject 1. Result of I.T.H. experiment. Allergen: MI (Alternaria).

FIG. 3.—Subject 11. Result of I.T.H. experiment. Allergen: BI.

The average curves of the control series of four experiments in which comparison of the response on alternate arms was made on four subjects without D.S.U.H. are shown in Fig. 4. The individual results for these four subjects showed some scatter in the initial temperature gradient down the arm, but the individual responses once the allergen had been pricked in were very similar and no significant difference was observed in any of the four experiments between the response in one arm and in the other. The four sets of curves were very similar to the curves obtained from the temperature difference records in the four subjects who failed to give evidence of inhibition following D.S.U.H.

FIG. 4.—Mean of results of I.T.H. experiments in four cases. Response without D.S.U.H.

The results of the comparisons between inoculation techniques indicated that while the multiple-prick-through-drop technique tended to produce a steeper curve at the outset than the single-prick-through-drop technique, the maximum temperature difference was approximately the same and the shapes of the curves were otherwise very similar. Finally, in the single subject examined there was no evidence of inhibition of the response to nettle-sting following D.S.U.H. All these results with regard to temperature changes are summarized in Table I.

TABLE I.—Summary of Results in Terms of Temperature Changes

Subject	Trance State	Nature of Experiment	Conclusions from Results
1	Deep	D.S.U.H. not to react	Inhibition
2	"	" " " "	No inhibition
3	Medium	" " " "	Slight inhibition
4	Deep	" " " "	Inhibition
5	Medium	" " " "	"
6	"	" " " "	No inhibition
7	"	" " " "	"
8	Deep	" " " "	Slight inhibition
9	Medium	Comparison of techniques	Change in shape of curve only
10	"	Comparison of response: right and left arms	No significant variation
11	"	D.S.U.H. not to react	No inhibition immediately
12	Deep	" " " "	Inhibition in 44 hours
13	"	" " " "	"
14	"	" " " "	"
15	Medium	Comparison of response: right and left arms	No significant variation
16	"	" " " "	" " "
17	"	" " " "	" " "
18	"	D.S.U.H. not to react to nettle-sting	No change

When inhibition was obtained the results of skinfold-thickness measurement showed a close correlation with the temperature changes. The skinfold-thickness changes for the eight subjects showing evidence of inhibition in terms of temperature change are given in Table II, where the skinfold thickness at the near-by

TABLE II.—*Changes in Skinfold Thickness (mm.)*

Subject	First Arm : Normal I.T.H. Response						Second Arm : I.T.H. Response after D.S.U.H.					
	Distal : Reference Site			Proximal : Experimental Site			Distal : Reference Site			Proximal : Experimental Site		
	Near-by Site	Test Site	Diff. A	Near-by Site	Test Site	Diff. B	Near-by Site	Test Site	Diff. α	Near-by Site	Test Site	Diff. β
1	2.1	2.2	0.1	2.3	2.7	0.4	2.2	2.2	0	2.6	2.6	0
3	1.8	1.9	0.1	1.8	2.8	1.0	2.2	2.2	0	2.2	2.4	0.2
4	2.3	2.3	0	2.0	2.4	0.4	2.4	2.4	0	2.2	2.2	0
5	2.0	2.1	0.1	2.0	2.4	0.4	2.0	2.1	0.1	2.4	2.5	0.1
8	2.2	2.2	0	2.2	2.4	0.2	2.2	2.2	0	2.2	2.2	0
12	2.4	2.4	0	2.8	3.0	0.2	2.3	2.3	0	2.5	2.5	0
13	2.0	2.0	0	2.0	2.2	0.2	2.0	2.0	0	2.0	2.0	0
14	2.4	2.4	0	2.0	2.2	0.2	2.1	2.1	0	2.0	2.0	0

reference site and at the site are listed together with the difference between them for both sites on each arm, before and after D.S.U.H. not to react. The differences, which are a measure of the degree of oedema present, are in bold type.

In general the results of the colour photography supported the evidence of temperature changes and skinfold-thickness measurements. However, photography is not an entirely satisfactory means of measuring the colour change involved in an erythematous flare, since, though the lighting and exposure were identical throughout, the prints obtained show considerable variation in colour temperature according to the colour charts included beside the arm when each photograph was taken.

Discussion

What appears to be evidence of instant inhibition of the immediate-type hypersensitivity response, as measured by temperature change, was obtained in 6 out of 12 subjects to whom D.S.U.H. was made that they would not react to the allergen to which a previous reaction on the other arm had been demonstrated within periods which varied from one to one and a half hours. In two subjects there was evidence of a lesser degree of inhibition. Of the six subjects showing marked inhibition, five were deep-trance subjects and one a medium-trance subject giving a history of successful treatment of hay-fever by D.S.U.H. Only one deep-trance subject failed to exhibit some degree of inhibition, while the other three subjects who thus failed were all medium-trance subjects.

Analysis of the skinfold-thickness changes as measured shows that where the temperature change indicated inhibition oedema was also either totally or partially inhibited. A comparison between the evidence of inhibition in terms of temperature change and skinfold thickness is given in Table III. Here evidence of inhibition in terms of temperature change is listed against the reduction in skinfold thickness increase in millimetres. This was calculated by subtracting the difference of the differences for the second arm, from the difference of the differences for the first arm for each subject. Thus for Subject 1 in Table II the differ-

ence between the figures in columns B and A equals 0.3, and the difference between columns β and α equals 0, so that $(B - A) - (\beta - \alpha) = 0.3$.

The follow-up on Subject 1, who showed what appears to be evidence of instant inhibition following D.S.U.H., indicated that such inhibition had continued without further suggestion to 54 days and that an attempt to reverse this response at 68 days by further D.S.U.H. to react again to the allergen failed to produce a response similar to the initial reaction. This finding should be considered together with the follow-up on Subject 11, who failed to produce evidence of instant inhibition, but who was given the equivalent of repeated daily psychotherapy by D.S.U.H. over 10 days. At two days there was already evidence of inhibition, and this was found to be slightly increased by the end of the treatment period.

These results, however, could be due to hyposensitization by the experimental inoculations, although this is thought to be highly unlikely. If not due to hyposensitization they would appear to indicate that, whatever the mechanism involved, it is apparently enduring and that even if it does not occur instantly it can be made to occur by repetition of the stimulus—in this instance D.S.U.H. This is, of course, entirely in accordance with clinical findings that in the treatment of allergic psychosomatic illness by psychotherapy—or for that matter in the treatment of hysterical conversion symptoms—the results may be instant and dramatic and often reasonably enduring, or treatment may have to be continued over a long period before any results are obtained at all, whether enduring or not.

When studying prick tests we are dealing with a reaction between the allergen and the skin-sensitizing antibodies derived from the blood of the subject, as can be demonstrated by the Prausnitz-Küstner passive transfer reaction. The results of these experiments suggest, however, that, at least in certain individuals in whom an emotional or psychic experience of sufficient significance can be created—as in deep-trance subjects under hypnosis—a third factor must be taken into account—namely, control of skin reactivity by the psyche. That evidence for this psychic factor cannot always be elicited in psychotherapy or under experimental conditions need not necessarily refute the hypothesis of its existence. Without such an hypothesis it is difficult to explain the results of the experiments in which there was evidence of inhibition by six out of seven of the deep-trance subjects included in the series. The results of the four control experiments in which the temperature curves for each arm without D.S.U.H. were compared indicate that the variations obtained after D.S.U.H. were significant. Furthermore, the results of the comparison between the effects of the two inoculation techniques suggest that inadvertent variations in

TABLE III.—*Evidence of Inhibition: Temperature and Skinfold Thickness*

Subject	Evidence by Temperature Change	Reduction in Increase of Skinfold Thickness (mm.)
1	Inhibition	0.3
3	Slight inhibition	0.7
4	Inhibition	0.4
5	"	0.3
8	Slight inhibition	0.2
12	Inhibition	0.2
13	"	0.2
14	"	0.2

the pressure applied in the single-prick-through-drop technique used throughout the experimental series could not have been responsible for the results recorded following D.S.U.H.

Conclusions

It is concluded that instant inhibition of the I.T.H. response can occur in certain individuals by direct suggestion under hypnosis. One experiment indicated that inhibition of this response could eventually be produced in a larger proportion of individuals, if treatment were continued over a longer period by repeated suggestion in this way. Further work to investigate the significance of psychic factors in relation to the Prausnitz-Küstner reaction and the delayed-type hypersensitivity response has also been carried out and the results of these experiments will shortly be published.

Summary

Direct suggestion under hypnosis was employed as an experimental tool to investigate psychological control of the immediate-type hypersensitivity response in a series of experiments in which the normal allergic response was measured in the waking state on one arm, and again on the other arm, after giving direct suggestion under hypnosis that the subject would not react. The temperature change of the reaction was measured with thermocouples and the oedema with skinfold-thickness callipers, and a record of the colour change was kept by colour photography. The results showed evidence of very marked to moderate degrees of instant inhibition in 8 subjects out of 12. Deep-trance subjects had the greatest ability to inhibit the response in this way. It is concluded that instant inhibition of the immediate-type hypersensitivity response is possible in certain individuals by direct suggestion under hypnosis.

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The ideal operator for a certain lathe should be four and a half feet tall and have an arm span of eight feet. This example of one of the many problems facing machine designers is given in the first of a new series of booklets published by the Department of Scientific and Industrial Research on ergonomics for industry. *The Industrial Use of Ergonomics* is by W. T. Singleton, lecturer in ergonomics at the College of Aeronautics, Cranfield, who discusses why and how industry should use ergonomics. Among other titles to be published shortly in this series are *Instruments and People*, *The Design of Work for the Disabled*, and *Ergonomics v. Accidents*. (Available free from D.S.I.R., Warren Spring Laboratory, Stevenage, Herts.)

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MILK IN DIVERTICULA OF COLON

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This paper is based on 120 cases of diverticulitis treated as out-patients or admitted to a 40-bed unit during the years 1953-61. Twelve of the patients, aged 52 to 88, were suspected of having carcinoma of the left side of the colon because of pain and frequent loose stools containing mucus and occasionally blood; their symptoms were cured by cutting out completely or reducing the raw milk in their diet.

In cases of diverticulitis of the colon milk can cause morning diarrhoea with two or three small loose motions containing an excess of mucus, occurring soon after rising. In a more severe reaction blood as well as mucus may be passed, so mimicking absolutely a carcinoma of the left side of the colon. In a milder form only looseness and slight increase of frequency of the motion occurs. All types are liable to be associated with sigmoid colon pain, which is a recurrent colicky pain felt on either the left or the right of the hypogastrium, or occasionally on both sides.

Case Reports

Case 1.—March 25, 1952. Senior colleague, aged 66. For six years looseness and frequency of bowel action. For past six months soft formed stool on awakening and then small loose stool with lot of mucus before and after shaving and after breakfast. If he lit a cigarette a colicky pain occurred on the left side of the hypogastrium, lasting half a minute and recurring. Occult blood: large amount first specimen, moderate amounts next two. Barium enema (Dr. F. Kemp): multiple diverticula of sigmoid. Sigmoidoscopy to 9 in. (23 cm.): no growth. Two small piles capable of bleeding, injected. Subsequent occult bloods: one, traces only; two, negative. Two months later three occult bloods were all negative. He was assured it was not carcinoma of the left side of the colon, as all growths of the left side of the colon cause persistent occult blood, usually in large or moderate amounts, in two at least of the three specimens sent. Diverticula can bleed, but the bleeding stops. In a week or two the three occult bloods will become negative. The colicky sigmoid pain and morning diarrhoea continued. September, 1952: after an attack of pain he observed in a loose stool several small pellets about 4 mm. long, shaped like date-stones. Biochemical report of pellets was fat and protein. The patient had for many years drunk 1 to 2 pints (570 to 1,140 ml.) of Jersey milk every night, and stopping this was curative. He has remained well since.

Case 2.—September, 1952. A male personal friend aged 65. Two to four loose bowel actions with much mucus, chiefly before 10 a.m. Sigmoid colon pain. No occult blood in three specimens. X-ray examination revealed about 60 pea-sized diverticula, essentially in the sigmoid. Advised to stop all raw milk, including that put in tea, for a trial period of one week. Symptoms at once ceased and bowels became perfectly normal, acting once a day. He died of a coronary thrombosis in 1957. Moderate butter and fully cooked milk, such as baked custards, did not cause symptoms.

I have since always advised patients with diverticula with irritable sigmoid symptoms and no definite x-ray evidence of malignant disease, and especially no occult blood in three specimens, to have a trial period of one to two weeks without raw milk.

Seven other cases, in patients aged 59 to 76, were similar to the above two cases, with a history of hypo-