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Bernard Grad

The influence of certain, apparently especially gifted, persons on the health and growth of other persons, animals and plants has long been a subject of speculation. Dr. Grad's experiments, dealing with technique and first results, approach certain phenomena in plant growth from a laboratory-controlled and quantitative viewpoint. (See also "Medical Aspects of Mental Healing," pp. 135 to 165.)

■ ATTEMPTS TO INVESTIGATE whether there exists a telekinetic effect on plant growth are not recent. For example, more than three-quarters of a century ago, Lafontaine mentioned such an effect on fruit and flowers(1), and about 40 years later Montandon discussed similar studies(2). Still more recently, Dr. and Madame P. Vasse introduced the use of seedlings in these studies, thus leading to a simplification of the measurement techniques(3). At about the same time, exploratory studies were being conducted at Duke University by Dr. J. B. Rhine and his students, and several important innovations were introduced in regard to experimental design, especially as concerned statistical theory and the double blind technique. A detailed description of the method developed in Rhine's laboratory is given in an article by Vasse(4). Still more recently, Loehr published a book describing the apparent power of prayer on plants(5). In it he described two experiments in which kernels of corn and lima beans and sweet pea seeds were watered with water that had been prayed over.

With this as background, our own studies on plant growth were undertaken. They formed part of a continuing series of experiments designed to investigate under controlled experimental conditions a man, O.E., who claimed to mediate a healing power which influences plants and animals. A study recently conducted with the same man revealed that wounds artificially produced on the back skin of mice healed at a significantly faster rate when treated by him than when treated by other persons not making such a claim or when left untreated(6). When the plant studies were first undertaken, our aim was to learn what the optimum conditions for these studies would be, and for this, numerous preliminary experiments were conducted. As these preliminary studies were not conducted under double blind conditions, their results will not be described in detail but will nevertheless be outlined so as to provide an understanding of the development of the technique finally decided upon at the time of writing this paper. Utilizing this technique, double blind experiments were conducted and both techniques and double blind experiments will be reported in this paper in detail. Also, this method is the basis for studies currently in progress and an understanding of how it was arrived at should prevent needless repetition by others.

When experiments with plants were first undertaken, it was decided that treatment by O.E. would involve treating the barley seeds or plants directly by holding them in his hands for 15-20 minutes daily, five days a week and by watering them with water treated by Mr. E. in the same way. In our first studies, an attempt was made to observe whether significant differences could be obtained in the germination count between seeds treated by Mr. E. and control untreated seeds. When these experiments failed to produce significant differences, studies were begun with seeds buried in soil, and it was here that the first significant differences between control and treated plants were observed with the former growing significantly faster. Subsequent experimentation demonstrated that of the several different types of pots used, those made of peat were preferable to those made of clay or plastic.

Still another factor that became apparent upon further study was the fact that the best results were obtained under conditions of an inhibition of the normal growth of the seeds. That is, the soil was allowed to become quite dry, and when the seeds or plants were in

marked need of water, it was given, but only enough to permit an amount of growth less than the optimal. For this, the amount of water to be added to a given amount of dry soil in a peat pot of given dimensions and housed under given conditions had to be worked out. Also, while it was undesirable to add too much water, it was nevertheless necessary to add enough so that the experiments would not be unduly prolonged, while still not yielding more marked differences between control and treated groups. The data to be provided below, under "Materials and Results," gave significant results.

Having found that more satisfactory results were obtained with plants in a state of need than with those liberally watered every day, it was reasoned that perhaps still more significant results would be obtained if to the soil were added sodium chloride which would also inhibit the growth of the plants. Therefore, it was decided to test the effect of 1, 2, and 4% sodium chloride solutions, and the best results were obtained with the 1% solution. Subsequent experiments then involved the addition of 25 ml of 1% saline to the dry soil, followed by a week of drying at room temperatures, followed by the addition of 25 ml tap water on the first day of drying, and 15 ml tap water every other day thereafter until the end of the experiment.

Because satisfactory drying at room temperatures under our conditions required a week, and because it was felt to be desirable to keep experiments to as short a duration as possible, it was decided to attempt the drying of the pots in an oven. At first, the pots containing the salinated soil, but not the seeds, were dried at 100 C for 24 hours. The seeds were then placed in the soil which was then watered.

Significant results were also obtained by this method but the expected shortening of the experimental period did not occur because the seeds took longer than usual to germinate. Similarly, drying at 65-70 C was not entirely suitable and it was finally decided to adopt the procedure of drying the soil and seeds in an oven at 38-40 C for 48 hours. This gave good results and shortened the drying period from seven days to two days. The oven used for drying should be sufficiently large so that it can accommodate all the pots at one time, and should heat uniformly throughout so that pots in one place are not dried out more than those in another. Also, the pots

should be placed in the oven at the same distance from each other so that evaporation from all the pots is about the same. The same care should be taken when the pots are later placed on the table after removing from the oven.

Up to this point, experiments were being conducted in which treatment by Mr. E. involved the plants' being held in his hands for a short time each day and watering these plants with water similarly treated by him. The question then arose whether both forms of treatment were necessary, and experiments soon demonstrated that significant differences could be readily obtained without the need for Mr. E. to treat the plants with his hands, but it was enough simply to add water to them, water which he had previously treated. In these experiments, Mr. E. treated both the 1% NaCl solution added initially to the treated plants and also the water added subsequently to them. However, further study showed that equally good results were obtained when Mr. E. treated only the 1% NaCl solution added to the treated pots, omitting the subsequent treatment of the tap water added later to the plants. Such was the manner in which the technique described in the paper developed, a description of which follows.

METHODS AND RESULTS may be summarized as follows:

Experiment 1: Twenty-four conically shaped peat pots were utilized, 6 cm. high, 6 cm. diameter on top, and 4 1/4 cm. diameter on the bottom. Ordinary garden top soil, sifted through 1 mm. mesh was well dried at room temperature and 36 gm. were put into each pot. Twenty barley seeds (Montcalm 1960 variety, heavy grade) were placed on top of the soil in such a way that one seed did not overlap on another but otherwise in no special order, and covered with another 18 gm. of the same soil. The procedure up to this point was carried out by O. E.

Following this, another person, J. B., placed 350 ml 1% sodium chloride in each of two 500 ml beakers and gave one of them to O. E. for treatment in J. B.'s presence and under his observation. O. E. treated the water by holding the beaker between his hands for 15 minutes, his left hand supporting it from below, and his right hand 3 or 4 cm. above the surface of the water, taking care not to touch

TABLE 1
The Effect of 1% NaCl Held Between a Man's Hands on the Number of Barley Plants Growing in Pots

Day	Mean											
	Control	Treated	Control	Treated	Control	Treated	Control	Treated	Control	Treated	Control	Treated
Day 7	0	4	0	2	0	3	0	0	0	0	0	1
Day 8	9	10	11	11	11	11	11	11	11	11	11	11
Day 9	11	11	11	11	11	11	11	11	11	11	11	11
Day 10	11	11	11	11	11	11	11	11	11	11	11	11
Day 11	14	10	14	12	13	14	14	14	14	14	14	14
Day 12	14	12	14	14	14	14	14	14	14	14	14	14
Day 13	13	12	13	13	13	13	13	13	13	13	13	13
Day 14	14	14	14	14	14	14	14	14	14	14	14	14

the water. Thereafter, J. B. removed the treated water from O. E.'s presence, and when alone, he wrote an identifying letter on both the treated and control beakers. He then wrote down both letters on a sheet of paper, indicating which represented the treated group, sealed the paper in an envelope and concealed it in a place known only to himself. He then gave the two beakers to another person, B. G., who, when alone, used the random number technique to separate the 24 consecutively numbered pots into two equal groups.

To one of the groups he assigned a letter he saw on one of the two beakers given him by J. B., assigning the remaining letter to the remaining group. He wrote this information on a sheet of paper, sealed it in an envelope and concealed it. Therefore, J. B. knew which beaker contained the treated water and which beaker the control, but he did not know which pot received either the treated or control water. On the other hand, B. G. knew which pots received water from a given beaker, but did not know which beaker contained the treated water. O. E. had neither piece of information, nor so far as could be observed did he make any effort to discover it.

B. G. then watered each of the pots with 25 ml 1% saline, each pot receiving water from one or other of the two beakers, the saline being dispensed from a graduated syringe, one for each beaker. Care was taken to let the water fall gently on the surface of the soil so as not to create holes and uncover seeds. The pots were then randomly placed about 7 cm. apart in the central part of a drying oven (1 m long, 68 cm high, 66 cm wide) set at 38-40 C.

After a 48-hour drying period when the pots appeared quite dry, they were removed to a table in a small room (3.25 x 1.17 m) free of draughts, the only light source in the room being a 60 watt tungsten lamp 1.27 m above the surface of the table. The light was kept on continuously throughout the experiments. The mean and standard error of the temperature in the room throughout the experiments was 26.3, plus or minus 0.3 C. After placing the pots about 7 cm apart on the table in numerical order in 6 columns each with 4 pots (control and treated pots were therefore randomly arranged on the table), B. G. gently watered each of the pots in numerical order with 25 ml untreated tap water. Thereafter, the pots each received 15 ml untreated tap water every second day until the experiment was terminated on Day 14.

The Effect of 1% NaCl Held Between a Man's Hands on the Mean Height (Mm.) of Barley Plants Growing in Pots

TABLE 2

Day	Mean			
	Control	Treated	Control	Treated
Day 8	20	21	29	35
Day 9	32	35	36	39
Day 11	29	36	44	44
Day 12	43	45	38	41
Day 13	46	44	38	41

O. E. counted the number of plants per pot on Days 7 to 13 inclusive, and measured the height of each plant on Days 8, 9, 11, 12 and 13. Day 1 was the day the plants were first placed in the oven. Hence, three sets of figures were obtained: (a) the number of plants per pot, (b) the mean height of plants per pot, and (c) the yield per pot which was obtained from the total of all the heights of each plant in a given pot. In addition, B. G., working alone, separated the 24 pots into a treated and control group (without knowing which was the treated group) and photographed them on Days 10, 12, 13 and 14. After taking the last picture on Day 14, he and J. B. showed each other the information they had written down and concealed. This provided the data necessary for knowing which was the treated group and the control one. Then the film was developed and *t* tests were conducted to assess the statistical significance of differences in the height and yield of plants between the control and treated groups. In the case of the number of plants per pot, *t* tests were conducted by converting the counts to percentages of the total number of seeds per pot, and converting the percentages to angles by using the formula

$$\text{angle} = \arcsin \sqrt{\text{percentage}}$$

as described by Snedecor(7).

The results showed that there were significantly more treated than control plants on Day 7 ($0.01 > P > 0.001$), but not on Days 8 to 13 inclusive ($P > 0.10$), as seen in Table 1 and Fig. 1. Also, the treated plants were significantly higher on Day 8 ($0.02 > P > 0.01$), Day 9 ($P < 0.001$), Day 11 ($P < 0.001$), Day 12 ($P < 0.001$) and Day 13 ($0.01 > P > 0.001$) as seen in Table 2 and Fig. 1. Finally, the pots that received the treated water yielded significantly more plant material than did the control pots on Day 8 ($0.01 > P > 0.001$), Day 9 ($0.01 > P > 0.001$), Day 11 ($0.01 > P > 0.001$), Day 12 ($0.01 > P > 0.001$) and Day 13 ($0.05 > P > 0.02$) as seen in Table 3 and Fig. 1. The considerable differences between the two groups can also be seen in the photographs shown in Figs. 2 to 5 inclusive. This is a rough check on the measurements of the seedlings conducted by O. E.

Experiment 2: The purpose of this experiment was to examine whether or not significant differences would be obtained between two control groups of plants watered with 1% NaCl not handled

The Effect of 1% NaCl Held Between a Man's Hands on the Yield (Mm.) of Barley Plants Growing in Pots

TABLE 3

Day	Control	Treated	Mean
Day 8	211	324	182
Day 9	389	500	112
Day 11	534	530	76
Day 12	541	555	37
Day 13	532	560	45
Control	541	530	163
Treated	541	530	184
Control	541	530	153
Treated	541	530	125
Control	541	530	211
Treated	541	530	232
Control	541	530	62
Treated	541	530	120

Were it necessary for Mr. E. to treat the pots daily with his hands, then some kind of box would have had to be built in which to place the treated pots in such a way as to conceal them during

TABLE 5

Control Experiment Testing the Mean Height (Mm.) of Barley Plants Growing in Each of Two Control Groups

	Day 7		Day 8		Day 11		Day 12	
	Control I	Control II	Control I	Control II	Control I	Control II	Control I	Control II
1	5	11	13	38	44	51	45	51
0	4	12	10	33	42	39	39	51
3	7	10	15	34	40	43	43	50
5	4	14	12	46	43	57	57	53
5	6	12	12	48	39	57	57	45
4	8	11	14	47	44	56	56	53
12	13	22	17	49	34	55	55	43
10	0	17	10	55	39	64	43	43
1	11	8	19	39	66	46	46	74
11	8	15	19	53	53	53	53	63
0	6	9	14	43	53	52	52	63
4	26	15	19	38	58	40	40	68
Mean	5	8	13	44	46	51	51	55

treatment. Treatment under such conditions would probably result in damage to many plants. Also, the person transporting the box to Mr. E. would have to be kept in ignorance of the identity of the peat pots he was carrying, while the person who placed the peat pots in the boxes would have had to be kept in ignorance as to which of the two boxes was going to Mr. E. and which not. A good way to demonstrate the technical simplification involved in experiments

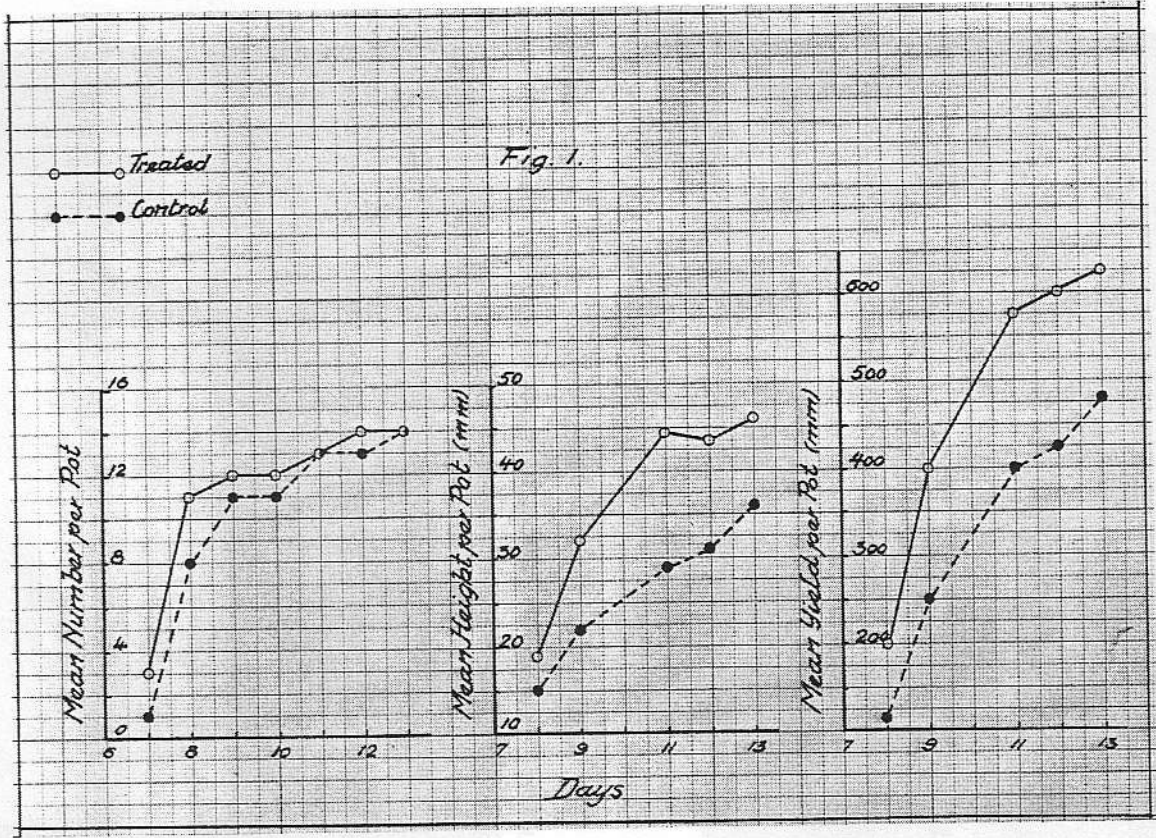


Fig. 1: Graphic Representation of Results of Experiment 1, given in Tables 1, 2 and 3.

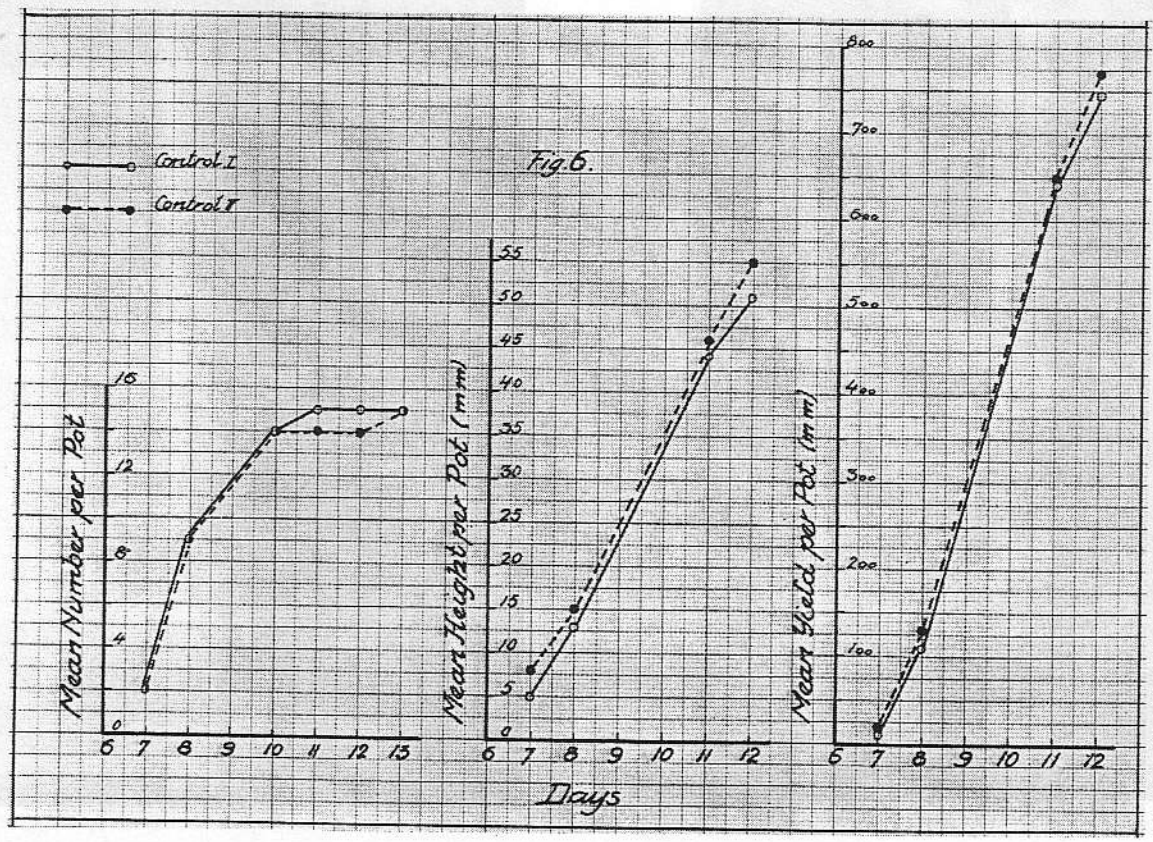


Fig. 6: Graphic Representation of the Results of Experiment 2, given in Tables 4, 5 and 6.

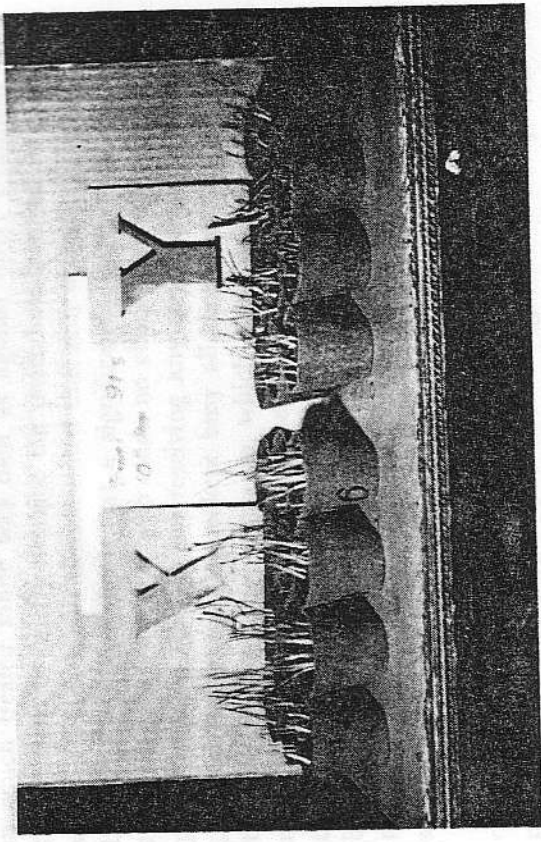


Fig. 2: Barley Plants of Experiment 1 on 10th Day. (X indicates the treated plants, Y the untreated control plants.)

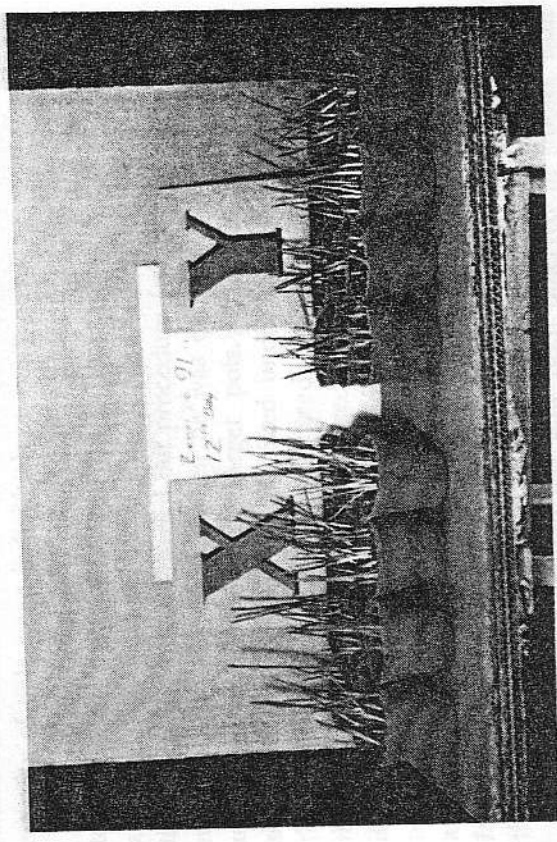


Fig. 3: Barley Plants on 12th Day of Experiment 1.

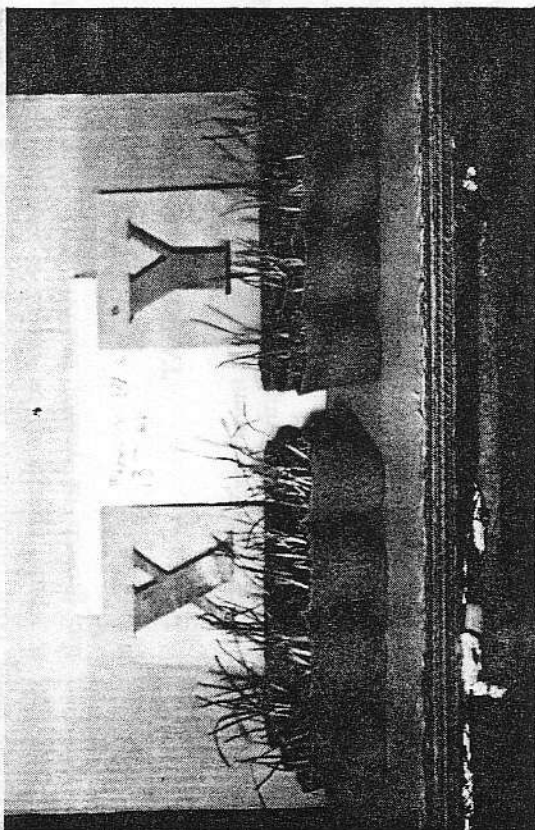


Fig. 4: Barley Plants on 13th Day of Experiment 1.

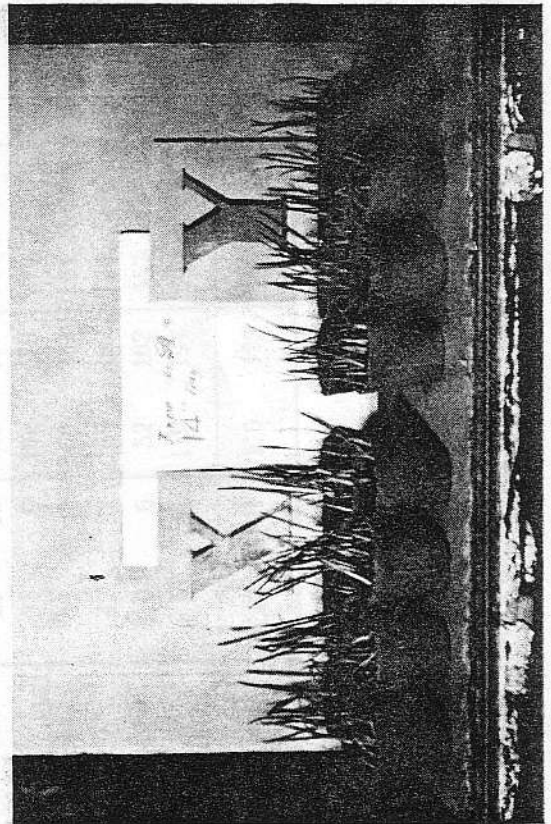


Fig. 5: Barley Plants on 14th Day of Experiment 1.

in which treated saline was used as against direct treatment with the hands is to briefly describe the procedure involved in an earlier study in which it was demonstrated that skin wounds of mice treated by Mr. E.'s hands healed at a significantly faster rate than those treated by other persons who made no claim of mediating a healing power or those wounds not receiving any treatment(6). In that experiment five persons were kept busy all day transferring 300 mice twice daily from the rooms in which they were housed to the room where Mr. E. gave his treatment. . . . Also, a complex system of transferring the animals had to be worked out to maintain the double blind. Had it been possible to use treated water in place of direct treatment with the hands, one person could have managed the same work.

The finding that a man could change the nature of a 1% sodium chloride solution by holding it between his hands for about fifteen minutes, so that its inhibitory effect on the growth of barley seeds was significantly altered, is of great interest. In contrast to the previous study on wound healing in mice, no comparison was made in the present study between Mr. E.'s capacity to influence the growth of plants with that of other individuals. However, the phenomenon retains its interest whether it is subsequently found to be within the capacity of only some individuals or everyone's.

Because of the lack of suitable technical assistance, O. E. had to be used in a technical capacity (a) to prepare the pots with soil and seeds and (b) to count the number of seedlings and measure their height. When he carried out procedure (a), the target pots had not yet been selected and when he was occupied with (b), he did not know which were the target pots. The fact, however, that significant results were still obtained under these conditions implies that his contact with the seeds or seedlings was of lesser significance than his contact with the saline used to water the seeds. However, if his contact with the pots did produce some effect on them, then both control and target pots were equally affected. In that case, had another person been used to perform functions (a) and (b), differences due to treatment would possibly have been bigger than those reported.

Significant stimulation has now been observed in studies with O. E. in the healing of skin wounds in mice and in the growth of

barley seeds, both phenomena involving stimulation of cell division. From this, it would appear to be useful to investigate Mr. E. in studies on the growth of yeasts, bacteria and other single-celled

TABLE 6

Control Experiment Testing the Yield (Mm.) of Barley Plants Growing in Each of Two Control Groups

	Day 7		Day 8		Day 11		Day 12	
	Control I	Control II	Control I	Control II	Control I	Control II	Control I	Control II
1	24	84	128	573	662	682	762	
0	4	71	102	497	667	631	820	
3	7	76	62	584	443	725	554	
15	8	112	104	603	730	736	898	
14	11	133	82	764	591	909	674	
8	24	131	113	752	571	901	683	
23	39	130*	117	544	536	609	695	
31	0	182	79	879	508	1017	558	
1	43	65	227	584	921	683	1038	
42	32	166	167	739	695	848	819	
0	6	52	162	557	790	621	945	
4	51	119	194	600	749	688	879	
Mean	21	110	128	640	655	754	777	

organisms, not only because of the additional information that could be gained, but also because of the increased advantage of the shorter duration of such experiments.

The studies on wound healing in mice and the present report on the growth of barley seeds do not by themselves indicate whether the influence associated with Mr. E. comes from his hands or other organs or his mind or from his body as a whole, or whether there

was a physical or chemical change in the saline which Mr. E. treated. Further studies with these questions in mind are contemplated.

Moreover, when these studies were first undertaken, it was felt that the question as to whether there were differences in the biological effect between control and target solutions should be investigated first rather than the question as to whether there were physical or chemical differences between them. This position was taken not only because it was more meaningful in the context in which we were working, but also because it was felt that biological differences might be observed between solutions between which biochemical or biophysical differences might not be detectable by present techniques. However, now that biological differences between control and target solutions have been observed, further investigation as to their biochemical or biophysical differences are also being undertaken.

(The author would like to express his gratitude to Dr. J. B. Rhine of Duke University and to Dr. J. Doupe of the University of Manitoba for their helpful criticism and suggestions, and to Mr. G. Welk of Washington, D.C., for bringing to his attention references describing earlier work in this field.)

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SUMMARY

An experiment is described which revealed that a man could alter 350 ml of a 1% aqueous sodium chloride solution by holding it between his hands for 15 minutes. Its alteration was apparent from the fact that, when used to water barley seeds in soil (subsequently also watered with tap water), the seeds produced a significantly greater yield of plants than did control seeds receiving the same amount of untreated 1% sodium chloride. Another experiment identical in every way to the one

just mentioned, except that the treatment of the saline was omitted, showed no significant differences between the two groups, providing further evidence that the likelihood of a difference of the magnitude observed in the earlier experiment occurring spontaneously was extremely remote.

The development of the technique used in these studies, as well as the technique itself have been described in detail.

RESUME

On a décrit une expérience qui a révélé qu'un homme pouvait modifier 350 ml d'une solution aqueuse à 1% de chlorure de sodium en la tenant entre ses mains pendant quinze minutes. Cette modification a été rendue apparente par le fait que, lorsqu'on l'a utilisée pour arroser des graines d'orge en terre (par la suite également arrosées avec de l'eau du robinet) les graines ont rendu une production plus grande (à un degré significatif) de plantes que ne le firent les graines de contrôle recevant la même quantité de chlorure de sodium à 1% non traitée. Une autre expérience en tout point identique à celle qui vient d'être citée, à ceci près que le traitement de l'eau salée a été omis, n'a montré aucune différence significative entre les deux groupes, apportant une preuve supplémentaire que la vraisemblance était extrêmement faible qu'une différence de l'amplitude observée dans l'expérience précédente se soit produite spontanément.

Le développement de la technique employée dans ces études, et tout aussi bien la technique elle-même, ont été décrites en détail.

ZUSAMMENFASSUNG

Hier wird ein Experiment geschildert, aus dem sich ergab, dass jemand 350 ml einer 1% Chlornatriumlösung in Wasser dadurch verändern konnte, dass er sie 15 Minuten lang in den Händen hielt. Die Veränderung ergab sich aus der Tatsache, dass beim Begießen von in die Erde gepflanzten Gerstenkörnern mit dieser Lösung (wozu später auch Leitungswasser verwendet wurde) diese Körner bedeutend mehr Pflanzen erbrachten, als Kontrollkörner, denen die gleiche Menge nicht behandeltes 1% Chlornatrium zugeführt wurde. Bei einem genau gleichen weiteren Experiment, in dem jedoch die Salzlösung nicht behandelt wurde, ergab sich keinerlei bedeutsamer Unterschied zwischen den beiden Gruppen, wodurch auch der Beweis erbracht wird, dass die Wahrscheinlichkeit eines zufälligen, spontanen Unterschiedes gegenüber der Wachstumsgröße im ersten Experiment äusserst gering ist.

Die Entwicklung der bei diesen Versuchen angewendeten Methode sowie diese Methode selbst wird in allen Einzelheiten geschildert.

SOMMARIO

Nel precedente articolo è descritto un esperimento, il quale ha mostrato che un uomo ha potuto alterare 35 centilitri di una soluzione acquosa all'1% di cloruro di sodio tenendola fra le mani per 15 minuti. Tale alterazione è stata dimostrata dal fatto che quando quell'acqua è stata adoperata per annaffiare semi d'orzo coltivati in terriccio (e che poi furono anche annaffiati con acqua comune), i semi stessi hanno prodotto più piante che non altri semi i quali avevano ricevuto la stessa quantità di soluzione acquosa all'1% di cloruro di sodio che non aveva subito alcun trattamento.

Un altro esperimento del tutto identico a quello menzionato (ma in cui però era stato omissa il trattamento della soluzione salina) non mostrò alcuna differenza significativa tra i due gruppi. Questo confermò ulteriormente il fatto che la possibilità che la differenza rilevata nel precedente esperimento fosse dovuta al caso era estremamente remota.

L'articolo descrive nei suoi particolari lo sviluppo delle tecniche adoperate in questi studi, e la tecnica stessa relativa.

RESUMEN

Se describe un experimento que revela que un hombre pudo alterar 350 ml de una solución acuosa de cloruro de sodio al 1%, manteniéndola entre sus manos durante 15 minutos. La alteración fué aparente porque, cuando se usó para regar semillas de cebada sembradas en tierra (a las que subsiguientemente se regó también con agua corriente), se encontró que esas semillas tuvieron un rendimiento significativamente mayor que un grupo de semillas de control que recibió la misma cantidad de cloruro de sodio al 1%, no tratado. Otro experimento en idénticas condiciones que el anterior, en todo sentido, salvo respecto del tratamiento de la solución, que fué omitido, no mostró diferencias significativas entre los dos grupos; lo cual proveyó evidencia adicional de que es extremadamente remota la probabilidad de que una diferencia de la magnitud observada en el primer experimento ocurriera espontáneamente.

Se describe en detalle el desarrollo de la técnica usada en esta investigación, así como también la técnica en sí misma.