LAYING-ON-OF-HANDS AND ENZYME ACTIVITY[1]

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ABSTRACT

The influence of psychic healers to enhance enzyme activity has been the subject of study of several researchers (Smith, Edge, and Kief). The results of Smith and Edge are positive, while Kief's results are negative. Since in the successful experiments the enzyme trypsin was used we set up two series of formal experiments. In the first only unselected (not gifted) subjects participated and in the second selected (gifted) subjects (psychic healers) as well as unselected. In the first series (with unselected subjects) we found an overall significant effect in the desired direction (meaning that the subjects were able to enhance enzyme activity). In the second series we could not confirm the result of the first series for the group of unselected subjects. We did find an overall significant effect for the healers group (in the opposite direction: more activity in the control tubes). Two out of 20 healers individually reached a significant result. We also found a significant difference in the mean number of scores in the right direction between the selected and unselected subjects (in favour of the unselected subjects). Questions resulting from these experiments give rise to new important approaches to healing, which are briefly discussed.

INTRODUCTION

Claims have been made from times immemorial that some people can alleviate illness in others, by techniques such as laying-on-of-hands or even by mental concentration. Moreover, such claims are not merely the vanished relics of a superstitious past but are being actively advanced in twentieth century society. How does a paranormal healer contribute to the process of healing? This question can be approached in two ways: *in-vivo* (in a living organism) or *in-vitro* (in the test-tube) studies. Here we present the results of an *in-vitro* study of the possible effect of laying-on-of-hands on enzyme activity.

The study of the influence of a healer on enzyme activity could be important for an understanding of some of the mechanisms of paranormal healing. For instance, Benor (1990) speculates, on the basis of a review of previous studies, that if enzymes can be influenced to show an increased activity *in vitro*, they could be involved in a wide variety of neuronal-controlled processes *in vivo* as well. Unfortunately, at present only a very limited number of studies have been published in this area.

It was Sister Justa Smith (1972, n.d.a, n.d.b), influenced by the studies of Grad with the healer Oskar Estebany, who carried out the first experiments. She set up an experiment with four conditions in which she used the enzyme trypsin. In one condition the trypsin was treated by Estebany; in a second condition the enzyme was first damaged by UV-light and then treated by

[1] This contribution is the final report of a study which, in part, informally circulated among our colleagues as "PK with the enzyme trypsin" by F. Snel and B. Millar. The preliminary results presented in that paper proved to be wrong and we suggest that no further references to that particular report be made.

Estebany. The other two conditions were control conditions: in the first the trypsin was not treated at all, and in the second the enzyme was placed in a strong magnetic field. The results (presented in graphs and not in tables) show a positive, significant effect on the activity of the undamaged trypsin as well as on the damaged trypsin. Smith finds it remarkable that when the graphs of the trypsin activity in the magnetic field are compared with the graphs of the damaged and undamaged trypsin, they appear to be identical. She suggests that healing by laying-on-of-hands might produce a magnetic field. Smith repeated the experiment herself, under less favourable conditions, but failed to obtain similar results. The experiment also was replicated by Edge (1979, 1980). His experiment is reported in detail in Edge (1979), while Edge (1980) is only an abstract. There were three conditions: in condition one the healer (Ann Gehman) tried to increase standard trypsin activity by laying-on-of-hands, while in the second condition she did the same after the trypsin was damaged by UV-light. In condition three the trypsin was placed in a strong magnetic field. When all the data of the five experiments in condition one are totalled, a significance level of $p < 0.01$ is reached, indicating some kind of paranormal influence. No effect was found for the experiments in condition 2. In condition 3; three out of the six experiments were significant; taken together reaching significance at the $p < 0.001$ level. In 1973 Kief experimented in a pilot study with the enzyme carbondioxy-deanhydrastase in order to explore the possibilities of carbon dioxide absorption as a dependent variable. In his study with non-gifted subjects compared with a control condition he found no differences. The enzyme monoaminoxydase was used in a study by Rein (1986), who had Matthew Manning as a subject. It appeared that Manning was able to influence the enzyme activity in damaged as well as undamaged cells.

The purpose of this study is to investigate whether the effect of laying-on-of-hands (bio-PK, or (direct) mental interaction with living systems, (D)MILS) by unselected (not gifted, non-healer) and selected subjects (psychic healers) can be detected on the activity of a standardized solution of the enzyme trypsin. This study is in part a replication of the studies by Smith and Edge with this difference: only non-damaged trypsin is used in both the experimental and the control condition.

Biochemical Background: Enzymes, Enzyme Activity, Trypsin

Enzymes are biological catalysts (substances that change the rate of a chemical reaction without themselves undergoing any permanent chemical change). Enzymes are proteins and consist of long chains of units called amino acids. The structure of the protein is not entirely determined by the order of the units composing it, however, since the long chains are generally coiled in complex ways and folded back upon themselves to make intricate three-dimensional shapes. The effectiveness of the enzyme is dependent on having just the right shape and this is a function of its environment (solvent environment, temperature, etc.). Not all the molecules of the enzyme present in a solution are active: another substance—known as a substrate—needs to be added for a reaction. A known quantity of enzyme is allowed to react with a known quantity of substrate (standard conditions); the rate of disappearance of the substrate it reacts with, or more commonly the appearance of a reaction

product, is used as a measure of activity. A quantitative measure of how well a given solution works is known as its 'activity'.

Trypsin is an enzyme which takes part in the digestive process. Specifically, it cuts up other proteins into shorter units. It does not, however, cleave all peptide bonds equally, but preferentially splits them at the basic amino acids lysine and arginine. Structurally trypsin consists of a single polypeptide chain. The activity of trypsin is routinely determined by the use of a special reagent (BAPA) which mimics its natural protein substrate. The advantage of this small molecule is that as it is digested it sets free a yellow-coloured compound, the rate of disappearance of which can be directly registered with a spectrophotometer. The reaction in this case involves the splitting of an amide rather than a peptide link.

Hypotheses

There are three main hypotheses in this study:–

1 The **first** hypothesis states that unselected subjects are capable of enhancing normal enzyme activity: we expect a significant difference between the experimental and the control trials, at the overall level as well as at the individual level. This hypothesis will be studied in the first series of experiments as well as for the unselected subjects in the second series of experiments.

2 The **second** hypothesis is the same as the first, only this time for the selected subjects (psychic healers). This hypothesis will be studied in the second series of experiments.

3 **Finally,** we hypothesize a significant difference between psychic healers and unselected subjects in the second series of experiments, with regard to the number of trials in which the enzyme activity is higher in the experimental tubes than in the control tubes.

METHOD

Subjects

The subjects in the first experimental series did not have any psychic ability; they were selected by FS and BM from among their friends, colleagues, etc. The total number of subjects in the first series was 9 (3 men and 6 women). The subjects in the second series were (professional) psychic healers and non-healers. The non-healers were again selected by FS and BM from among their friends and colleagues, while the psychic healers were specially recruited with the help of a professional organization of psychic healers. In total there were 40 subjects in the second series: 20 psychic healers (8 men, 12 women) and 20 non-healers (10 men, 10 women).

Technical Description

The whole experimental set-up, including the spectrophotometer, was temperature-controlled by 2 pumps circulating water from one waterbath, kept at 30° C by thermostat-controlled heating elements. Prior to the experiment standard stock solutions were made of BAPA and buffer for the whole experiment. These were stored at four degrees until required. A standard trypsin solution was also made and divided into small bottles (20 ml) which were stored at –20°C. Before each subject arrived two bottles of trypsin were

allowed to thaw to room temperature. 2 ml of the solution was pipetted into each of 16 small plastic tubes (with a coloured plastic bead for focusing the subject's attention). The tubes were sealed with a plastic stopper. All solutions used were kept in a waterbath at 30°C.

During the trials a specially-built dual water-jacket device was used through which the temperature-controlled water was pumped. Each small plastic tube (with trypsin) fitted closely into an inner glass tube surrounded by a larger glass outer tube. Thermostat-controlled water circulated between the two. The inner tube contained a few drops of water which filled the space between the trypsin sample tube and the inner glass tube. This construction not only provided for the required thermal contact with the circulating water, but it increased the transparency as well. The plastic trypsin tubes were protected in the depths of the inner tubes. Only a blocked hypodermal needle projected from the stopper for handling. The trypsin was thus separated from the subject by plastic, water film, glass, circulating water and glass again. Because of the optics of the device, however, the sample seemed to be separated from the subject only by one glass wall. Each water-jacket (one experimental, one control) was clamped on a stand at a height convenient for the subject. The distance between the jackets was two meters.

Procedure

A standard trypsin solution was pipetted into pairs of tubes prior to the arrival of the subject. On each trial one pair of tubes was transferred by the experimenter to the specially built dual water-jacket device. After the two tubes had been placed a pre-prepared random number table was consulted by the experimenter to determine which tube was to be treated on that trial. In total there were eight trials per experiment per subject; thus eight different pairs of tubes were used for each subject. Each trial lasted a standard 10 minutes. The subject was instructed to enhance the enzyme activity in the experimental tube and was allowed to touch the outer glass tube. After the treatment by the subject the tubes were transferred by the experimenter from the water-jacket to the technician. The tubes were only to be identified by labels 'A' and 'B'. Three months before the experiment started it was randomly determined for each trial which of the two tubes ('A', 'B') was to be the experimental and which the control tube. The experimenter knew which tube was to be treated and which one was not. The technician was blind to the conditions.

During each trial the activity of samples A and B from the previous trial were measured (in duplicate) by the technician and the experimenter took the next two tubes and inserted them in a standard way into the dual-water device and prepared the next trial. The activities of the technician were designed in such a way that it took as long as the completion of the experimental task of the subject. Only after the subject had completed all his/her trials, and after all the measurements had been done by the technician and checked by the experimenter was the code broken. The experimenter, the technician and the subject were in the same room during the trials, each of them working on their assigned tasks. Contact between experimenter and technician was not excluded, but highly unlikely, since they worked in different parts of the laboratory and were not facing each other.

Experimental Task

The subject was told that in each trial he/she was to increase the activity of the trypsin solution as compared with the control. Subjects were allowed to handle the outer jacket of the experimental tube ad lib for a maximum period of 10 minutes. The subject sat in front of the jacket designated as the experimental tubeholder for that trial.

Experimenter/Technician

FS and BM functioned as experimenters as well as technicians; in the experiments where FS was experimenter, BM acted as technician and vice versa according to a pre-prepared list. The role of the experimenter was to be sociable with the subject, explain the procedures of the experiment and to watch for correct handling of the water-jackets, according to procedure. He was also responsible for transferring the tubes to and from the water-jackets. The technician's role was to determine the enzyme activity of the two samples, while being blind to the specific conditions.

Measurements, Data and Data-Analysis

All measurements were performed with a single quartz microcuvette (1.5 ml), placed in a 1 cm lightpath. To prevent the built-up of deposits the cuvette was cleaned with chromic acid before each new subject. In addition, it was washed with water, then alcohol and finally blown dry with oxygen under pressure after each individual measurement. BAPA/Buffer mixture (0.75 ml) was pipetted into the cuvette, then trypsin (0.75 ml) added; the contents were thoroughly stirred and the cuvette inserted into the spectrophotometer (Beckman DB-GD); measuring the optical density at 405 nm. The spectrophotometer was connected to a linear chart recorder (Linear Instruments, Irving, California) running at a constant speed. The coloured compound set free by the reaction produced an inclined line which was recorded for one minute; if the line contained much artifact, measurement was prolonged. For each sample the measurements were carried out twice in a standard AB/AB order. The normal curve produced during the reaction has an inclination-angle of about 45°; the tangent of the inclination angle is determined as a dependent variable: if the inclination angle of the experimental trial is larger than the inclination angle in the control trials, then the trial is a score in the 'right direction'. We determined the score of trials in the right direction for each subject, as well as the difference in tangent of the inclination angles (MCE = 4).

To investigate the first hypothesis we calculated the differences per trial per subject and the overall score, using the Wilcoxon test for two matched samples. The same procedure was applied to analyse the second hypothesis. For the third hypothesis the differences between the conditions regarding the scores in the right direction were analysed using a *t*-test.

RESULTS

Experimental Series 1

The results of the first series of experiments with non-healers are presented in Table 1, and show 3 subjects with a score of 6 trials in the desired direction

(2 subjects scored 6 out of 8, one subject 6 out of 7). Two subjects (1 and 4) scored significantly on the 5%-level. The overall score (41 out of 71) is significant (W = 38; $p = 0.04$). Neither the scores for the men (W = 6; 16 out of 24), nor for the women (W = 15; 25 out of 47) proved to be significant.

Table 1

Results of the First Series

Ss-number	# +	W	p*	male/female	healer/non-healer
1	6	24.0	0.05	female	non-healer
2	3	21.0	0.73	female	non-healer
3	4	17.0	0.47	female	non-healer
4	6	29.5	0.05	male	non-healer
5	4	13.5	0.27	female	non-healer
6	4	17.5	0.47	male	non-healer
7	4	23.5	0.23	female	non-healer
8	4	17.5	0.47	female	non-healer
9	6	24.0	0.23	male	non-healer

* p-values are one-tailed when the number is above MCE (desired direction), and two-tailed when the number is below MCE.

Experimental Series 2

The results of the second series are shown in Table 2. In this experimental series there is one subject (7) who scores 8 out of 8 in the desired direction (W = 36, $p = 0.004$); two subjects (1 and 11) score 6 out of 8 (1: W = 31, $p = 0.04$; 11: W = 27, $p = 0.13$), two subjects (25 and 27) score 2 out of 8 (25: W = 6, $p = 0.10$; 27: W = 6, $p = 0.10$). Four subjects (16, 19, 23 and 34) score 1 out of 8 (16: W = 2, $p = 0.02$; 19: W = 2.5, $p = 0.04$; 23: W = 6, $p = 0.10$; 34: W = 5, $p = 0.08$). Overall, 4 out of 40 subjects score significantly; two of them are non-healers (one man—S7, and one woman—S1) and two of them are female healers (16, 19). There is no overall significant difference between the experimental and control trials (W = 25040, $p = 0.70$). There is, however, an overall effect in the group of female healers (W = 1571, $p = 0.01$). No differences were found in the group of female non-healers (W = 1918, $p = 0.13$), in the group of male non-healers (W = 1761, $p = 0.50$), nor in the group of male healers (W = 1003, $p = 0.81$). Taken together the groups of healers—male and female—show a significant effect (W = 5153, $p = 0.05$). No effect was found in the group of non-healers (W = 7327, $p = 0.13$). Furthermore, no overall sex differences were found (all women: W = 7185, $p = 0.37$; all men: W = 5408, $p = 0.71$).

The data in Table 3 with regard to the mean number of trials in the right direction show a significant difference between the healers and non-healers ($t(38) = 2.44$, $p < 0.02$). It also shows that the healers score below chance level.

Table 2

Results of the Second Series

Ss -number	# +	W	*p*	male/female	healer/non-healer
1	6	31	0.04	female	non-healer
2	5	19	0.47	female	non-healer
3	4	26	0.16	male	non-healer
4	3	14	0.64	male	non-healer
5	5	16	0.42	female	non-healer
6	3	8.5	0.20	male	non-healer
7	8	36	0.004	male	non-healer
8	4	20.5	0.37	female	non-healer
9	2	15	0.74	male	non-healer
10	4	22.5	0,27	female	non-healer
11	6	27	0.13	female	non-healer
12	3	13	0.27	male	non-healer
13	3	19	0.47	female	non-healer
14	4	14	0.32	male	non-healer
15	4	17.5	0.47	male	non-healer
16	1	2	0.01	female	healer
17	2	8	0.10	male	healer
18	4	14.5	0.32	female	healer
19	1	3.5	0.02	female	healer
20	3	19	0.47	female	healer
21	4	18.5	0.47	female	non-healer
22	3	18	0.53	male	healer
23	1	6	0.05	female	healer
24	3	14	0.64	female	healer
25	2	6	0.10	male	healer
26	5	26.5	0.32	male	healer
27	2	6	0.10	female	healer
28	5	29	0.07	male	non-healer
29	3	17	0.94	male	non-healer
30	4	15	0.37	male	healer
31	4	19	0.47	female	healer
32	4	21	0.37	male	healer
33	5	19.5	0.42	female	healer
34	1	5	0.08	female	healer
35	4	16	0.42	male	healer
36	5	27.5	0.10	male	healer
37	5	27.5	0.10	female	healer
38	3	11	0.38	female	healer
39	5	19	0.47	female	non-healer
40	3	14.5	0.64	female	non-healer

Table 3

The Mean Number of Trials (Standard Deviation) in the Right Direction for the Healers and Non-Healers

	n	mean	s.d.
healers	20	3.10	1.40
non-healers	20	4.20	1.45

DISCUSSION

Hypothesis 1 (unselected subjects are able to enhance enzyme activity) is confirmed; for experimental series 1 an overall significant effect was found. No overall significant effect could be established among the unselected subjects (control group) in experimental series 2. Individually, two subjects in series 1 and two (unselected, control) scored significantly in the desired direction; they were able to enhance the enzyme activity. The number of subjects is too low to confirm or deny the second part of the first hypothesis: significant at the individual level.

Hypothesis 2 (healers are able to enhance enzyme activity at the group level as well as at the individual level), a higher score in the experimental trials than in the control trials, could not be confirmed, neither at the group level nor at the individual level. The results show however, that the healers *de-activated* the enzyme activity significantly, both at the group level as well as at the individual level (six out of 20 healers scored significantly).

Hypothesis 3 (a significant difference between healers and non-healers), could be confirmed: healers score significantly fewer trials in the instructed direction (enhancing enzyme activity) than non-healers.

Research with unselected subjects is a mixed blessing. Smith reported non-significant results when she used students as subjects; healing research by Solfvin (1980a, 1980b) produced interesting results with non-gifted subjects. Our results with unselected subjects are ambivalent: at the group level the result of experimental series 1 reached significance, but not so for experimental series 2. At the individual level there are four subjects (two healers, two non-healers) with a significant result which on the whole is not significant. The overall results of experiment 1 suggest that non-gifted subjects could have some paranormal ability, which does not become visible at the individual level but only at the group level.

The results of the healers in experimental series 2 are similar to Edge's: a de-activation of trypsin. In our study the level of de-activation reached significance. Edge's result led him to the question whether enhanced enzyme activity is beneficial or not. According to Benor (1990) it is beneficial: ". . . many hormones are regulated by the nervous system and would thus be subject to influence by healing. In addition, MAO (the enzyme studied by Rein) has been found to correlate with depressed mood. A healer might thus improve a healee's mood, thereby producing reports by healees that they feel better, though no objective improvement is noted by others." (p. 11).

Comparing a group of gifted subjects with a group of non-gifted subjects

always leads to a hypothesis that there must be a difference. We did find that difference: healers significantly deactivated trypsin. The healers were, to a certain degree, motivated to participate because of the possibility of learning more about their psi-healing ability. They perceived the experimental set-up (to influence the activity of an enzyme in a tube) as an interesting, non-threatening challenge and as a vehicle for coming to a better understanding of their gift. Clear and specific instructions were given that were well understood: to increase the enzyme's activity. Nevertheless, our results (and those of others mentioned above) indicate that specific instructions, a positive motivation and full co-operation are not in themselves sufficient to produce the expected results. There is also the problem of the changing of the agreed direction of the treatment, depending on the experimental subjects/conditions (sometimes intentionally, sometimes unconsciously) by the subject, without informing the experimenter (see Snel & Van der Sijde, 1995).

Edge's question and the outcome of our experiment beg the questions of 'intent' and 'competence'. Patients go to healers expecting to experience improvement after (a number of) treatment(s). It is not unreasonable to assume that healers treat their patients with the positive intent to fulfil that expectation. Healers characteristically present themselves (with some justification) to be competent to do just that. Experimental results however suggest that that is not always the case. The expected results of the professional healers in the experiment described above did not materialize, their 'positive intent' and 'professional competence' notwithstanding; they produced a de-activation of the enzyme's activity. Our study does not answer the questions arising from the studies by Edge, Kief and Smith, but it designates an area of increasing importance for future studies: (direction and effectiveness of the) intent to heal, the ability to competently control the direction of treatments by professional healers and probably the nature of 'volition' in healing situations.

What do our results imply? For the education and training of paranormal healers (in The Netherlands paranormal healers can participate in a two-year course) it indicates that healers should not only have sufficient knowledge about anatomy, physiology and pathology, but also about the nature of their gift, their intentions and their competence to treat patients adequately.

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APPENDIX

FOLLOW-UP SERIES WITH 14 SUBJECTS

From all the subjects in experimental series 1 and 2 a total of 14 subjects were selected for follow-up experiments. These experiments were not intended as formal experiments and each subject was involved in four new experiments. In view of the statistical measures we used to analyze the data, four experiments is too small a number. Nevertheless, we present the data of these experiments in combination with the experiments described earlier (series 1 and 2). The procedure used in the follow-up experiments was the same as described above.

Subjects

The subjects are selected from the two experimental series based on their scores. Selected subjects either scored 'low' (meaning 0, 1 or 2 trials in the desired direction) or 'high' (scoring 6, 7 or 8 trials in the desired direction). The number of selected 'low' scoring subjects was 8 (3 male and 5 female) and the number of 'high' scoring subjects was 6 (3 male and 3 female).

Results

Table A1 gives an overview of the results of the selected subjects in both the experimental series and the follow-up series.

None of the subjects scored significantly in the follow-up experiment, nor is there an overall significant result (26 out of 56). Neither is there a significant result for just the 'low' scorers (12 out of 32), nor for the 'high' scorers (14 out of 24). We did not find significant results for the women-high-scorers (8 out of 12), nor for the women-low-scorers (7 out of 20), nor for the men-high-scorers (6 out of 12) nor for the men-low-scorers (5 out of 12).

When we combine the results of the first series and the follow-up experiments, we find an overall significant difference between the experimental and control conditions (76 out of 167; $p < 0.10$). The score of the low-scorers is significant ($p < 0.01$); they score 24 out of 96 in the desired direction, while the score of the high-scorers is significant ($p < 0.01$); they score 52 out of 71.

Table A1

The Results of the Follow-Up Experiments of the Selected Subjects and their Results in the Experimental Series 1 or 2

Ss-number*	m/f	healer/non-healer	n-series	# +	n-follow-up	# +
2-9	male	non-healer	8	2	4	1
2-1	female	non-healer	8	6	4	3
1-9	male	non-healer	8	6	4	2
2-14	female	non-healer	8	6	4	2
1-1	female	non-healer	7	6	4	3
1-4	male	non-healer	8	6	4	2
2-23	female	healer	8	1	4	1
2-7	male	non-healer	8	8	4	2
2-17	male	healer	8	2	4	2
2-25	male	healer	8	2	4	2
2-27	female	healer	8	2	4	1
2-34	female	healer	8	1	4	1
2-16	female	healer	8	1	4	1
2-19	female	healer	8	1	4	3

* in the Ss-number the first number refers to the experimental series in which he or she participated and the second number to his/her number in that series.

+ refers to the number of experiments in which the tubes in the experimental condition are in the desired direction

The results for the men-low-scorers is significant (11 out of 36; $p < 0.10$) as for the women-low-scorers (13 out of 60; $p < 0.01$). The results for the high-scorers are also significant. The men-high-scorers produced 26 out of 35 experiments in the desired direction ($p < 0.005$) and the women-high-scorers produced 26 out of 36 ($p < 0.01$).

Discussion

The results of this follow-up experiment can be viewed in light of the discussion of the formal experiments described above.