

ORIGINAL PAPERS

In Vitro Effect of Reiki Treatment on Bacterial Cultures: Role of Experimental Context and Practitioner Well-Being

BEVERLY RUBIK, Ph.D.,^{1,2} AUDREY J. BROOKS, Ph.D.,^{3,4} and GARY E. SCHWARTZ, Ph.D.^{4,5}

ABSTRACT

Objective: To measure effects of Reiki treatments on growth of heat-shocked bacteria, and to determine the influence of healing context and practitioner well-being.

Methods: Overnight cultures of *Escherichia coli* K12 in fresh medium were used. Culture samples were paired with controls to minimize any ordering effects. Samples were heat-shocked prior to Reiki treatment, which was performed by Reiki practitioners for up to 15 minutes, with untreated controls. Plate-count assay using an automated colony counter determined the number of viable bacteria. Fourteen Reiki practitioners each completed 3 runs ($n = 42$ runs) without healing context, and another 2 runs ($n = 28$ runs) in which they first treated a pain patient for 30 minutes (healing context). Well-being questionnaires were administered to practitioners pre–post all sessions.

Results: No overall difference was found between the Reiki and control plates in the nonhealing context. In the healing context, the Reiki treated cultures overall exhibited significantly more bacteria than controls ($p < 0.05$). Practitioner social ($p < 0.013$) and emotional well-being ($p < 0.021$) correlated with Reiki treatment outcome on bacterial cultures in the nonhealing context. Practitioner social ($p < 0.031$), physical ($p < 0.030$), and emotional ($p < 0.026$) well-being correlated with Reiki treatment outcome on the bacterial cultures in the healing context. For practitioners starting with diminished well-being, control counts were likely to be higher than Reiki-treated bacterial counts. For practitioners starting with a higher level of well-being, Reiki counts were likely to be higher than control counts.

Conclusions: Reiki improved growth of heat-shocked bacterial cultures in a healing context. The initial level of well-being of the Reiki practitioners correlates with the outcome of Reiki on bacterial culture growth and is key to the results obtained.

INTRODUCTION

According to the National Center for Complementary and Alternative Medicine, biofield therapies are those modalities including Reiki, *qigong* therapy, and Therapeutic Touch, among others, performed by trained practitioners

who manually and/or via intent interact with energy fields of the patient. Such energy fields, or biofields, have been hypothesized to be the active organizers of homeodynamics and are therefore central to health and healing.¹ Biofield therapies are among the most widely used complementary therapies, and demand for them has been growing.² How-

¹Institute for Frontier Science, Oakland, CA.

²Union Institute and University, Cincinnati, OH.

³Department of Psychology, University of Arizona, Tucson, AZ.

⁴Center for Frontier Medicine in Biofield Science, University of Arizona, Tucson, AZ.

⁵Departments of Psychology, Surgery, Medicine, Neurology, and Psychology, University of Arizona, Tucson, AZ.

ever, there are very few studies that have been done that scientifically support them.

Reiki literally means “universal life energy.” Developed in Japan a century ago by Mikao Usui, it was introduced to the West in 1937. Reiki involves specific initiations, spiritual teachings, and a lineage of official masters. A Reiki treatment consists of a sequence of 12 hand positions placed either on the body or within a few centimeters from the body. The hands-on approach is light and not manipulative. Reiki is distinguished from other biofield therapies in that the Reiki practitioner is considered to be a passive conduit for the universal life energy and unable to transmit directly or otherwise manipulate the energy flow. Reiki is practiced with intent for the highest good, but without any specific intentions of the practitioner toward a specific medical outcome.

Reiki has grown to several hundred thousand practitioners worldwide.³ It is widely used in clinical settings such as hospices, emergency rooms, psychiatric settings, and surgery areas. The practice of Reiki in these settings varies from direct patient treatment to the training of medical personnel, patients, and family members for self-care, as well as the treatment of others.^{4,5}

Despite its increasing popularity in clinical settings, most studies on Reiki are limited to case studies,^{6–8} or in the case of clinical studies, by small sample sizes and/or lack of a control condition. Recent clinical studies of Reiki include anxiety,⁹ human immunodeficiency virus,¹⁰ stroke,¹¹ cancer,¹² and seizure disorders.¹³ While the findings in these studies are mixed, the methodological shortcomings and minimal number of studies make it impossible to draw any firm conclusions concerning the effectiveness of Reiki.

Only a few studies to date have been done on the biological effects of Reiki. In one study, the hemoglobin levels and hematocrits of 48 subjects receiving Reiki training compared to a control group showed a significant increase.¹⁴ Using electrodermal testing, Brewitt, Vittetoe, and Harwell¹⁵ identified changes in three acupuncture meridians associated with the neuroendocrine-immune system in chronic illness patients receiving Reiki treatment. Wardell and Engbretson⁹ found some support for biological stress-reduction mechanisms being responsible for the relaxing effect of Reiki.

Although we suspect that mind–body mechanisms of action are present in the case of Reiki performed on patients, there may also be direct effects at a biophysical level due to a purported “universal life energy” as maintained by the lineage. It is important to conduct studies that look for evidence of such energy, which may also relate to the energy field associated with and emitted from humans. While there is no generally accepted scientific theory or mechanism of action explaining Reiki, by examining the effects of biofield therapies on biological systems in the laboratory, one could test for the presence of a therapeutic energy field associated with the treatment without the possibility of any placebo effect.

Basic science studies on Reiki are notably lacking. By contrast, there are a substantial number of basic science studies on other biofield modalities. Various studies on the physical and biological effects of *qigong* therapy have been conducted in China.¹⁶ However, many scholars question these studies due to poor experimental design and the prevailing Chinese cultural belief in *qigong* and its efficacy. Recent rigorous well-controlled basic science studies on *qigong* treatment have also been published. One study showed that directed healing intention from *qigong* practitioners on brain cell cultures *in vitro* stimulates their proliferation.¹⁷ However, a replication study failed to show the same effect.¹⁷ There are a number of other studies documenting positive effects of different types of biofield practitioners on cells, including yeast, fungi, and mammalian cells in culture. Over half show beneficial effects on growth, respiration, protection from heat stress, and in the case of red blood cells, protection from hemolysis.¹⁸

Much earlier, Rubik conducted basic science experiments previously on a self-proclaimed energy practitioner from the Eastern Orthodox Christian tradition who combined laying-on-of-hands with prayer. We observed positive growth effects from her treatment on *Salmonella typhimurium*.^{19,20} Variable results observed from day to day apparently correlated with the practitioner’s mood, suggesting that the psychophysiological state may be key to observing positive growth effects.²⁰

We developed a simple, rapid, standardized microbial growth bioassay to assess the effects of a purported “universal life energy” that may be associated with Reiki and other biofield therapies.* We employed this here to investigate whether Reiki involves transmission of a “universal life energy” that might stimulate the growth of *Escherichia coli* cultures *in vitro* under conditions where growth has been thwarted. Because growth is a measure of vitality and well-being in microbial cultures, we expected that Reiki might enhance growth.

Mind and emotions are important components of complementary and alternative medicine (CAM).²¹ Along with these, there are many subtleties in CAM practices that may play a role in practitioner performance, patient expectations, and the medical outcome. Three dimensions that we took into account here include: (1) the venue—a contemplative, humanistic, therapeutic setting; (2) the practitioner–patient relationship; and (3) the presence of a patient in need of medical care. Most basic science studies on biofield therapy have ignored all of these, taking place in conventional laboratory environments with only researchers present. We recognize that medicine, especially CAM, is contextual, and that the more subtle therapies such as these may be affected by context more than most. Thus, we compared results of Reiki under two different conditions that engage the practi-

*Rubik B, Brooks AJ, Schwartz GE, in preparation.

tioners to different degrees: (1) a “healing context,” assessing the effects of Reiki on bacterial cultures immediately following Reiki treatment of an acute pain patient; and (2) a “nonhealing context,” assessing the effects of Reiki performed solely on bacterial cultures with no patient present.

The purpose of this exploratory study was to determine if there is a consistent change in growth rate of heat-stressed bacterial cultures treated by Reiki under two different contexts. This study addressed three main questions:

- (1) What are the effects of Reiki on the growth of *in vitro* cultures of growth-challenged bacteria?
- (2) Does “healing context” influence the effects of Reiki on bacterial culture growth?
- (3) Does practitioner well-being influence the effects of Reiki on bacterial culture growth?

MATERIALS AND METHODS

Overall research design

The study utilized a rigorous experimental design, including: (1) blinded observation by the experimenters; (2) random assignment of bacterial cultures to control and test groups; (3) bacterial control samples matched to test samples in pairs; and (4) matched pairs of samples processed in randomized order (to control for time-ordering effects). The protocol for use with human subjects was approved by the Institutional Review Board of the University of Arizona, Tucson, AZ.

Laboratory environment

Physical environment. To create a more humanistic venue consistent with how Reiki is clinically practiced, we set up our treatment room in consultation with 3 Reiki practitioners. Part of the laboratory represented a typical Reiki treatment room, with carpeting, soft incandescent lighting, artistic wall hangings, comfortable chairs, and a massage table.

Ambient electromagnetic field controls. Special consideration was given to reduce ambient electromagnetic pollution due to the extremely low level fields that may be involved in the Reiki. The treatment and control rooms were matched in residual electromagnetic pollution, measured using a multimeter for DC electric (0 mV), extremely-low frequency (ELF) magnetic (<10 nT), microwave (0), and very-low frequency (VLF) (0) fields.

Experimental procedures

Heat-shock preparation. Wild type *E. coli* K12 cultures were grown overnight in Vogel-Bonner citrate with 1% glucose (VBCg) aqueous medium.²² The cells were harvested in mid-logarithmic phase, centrifuged at $5000 \times g$, and resuspended in fresh VBCg at a density of 0.150–0.200 absorbance units at 600 nm, as measured in a ultraviolet-vis-

ible spectrophotometer. Five (5) mL of culture samples were prepared in triplicate with paired control samples. From the moment of sample preparation throughout the assay, samples were randomized and manipulated in matched pairs. All 6 samples were heat-shocked for 25 minutes in a 49°C water bath just prior to Reiki treatment.

Reiki treatment procedures. Following heat-shock, samples were randomly assigned to the control or treatment condition. The samples were placed in plastic racks into 2 identical sealed cardboard boxes. One box was placed in the control room, while the other was brought to the Reiki practitioner for treatment.

After completing the well-being questionnaires, the Reiki practitioners placed their hands on the covers of the boxes about 10 cm from the cultures. The practitioners were instructed to connect with the bacterial cultures for 15 minutes, to give Reiki to the bacteria to help them recover and grow, and to keep their hands in position for the full 15 minutes, even if the energy flow had stopped. Following treatment, the practitioner completed well-being and satisfaction measures.

Following treatment, all samples were incubated at 37°C for 1 hour to facilitate growth. Then samples were incubated for 3 minutes at 0°C to stop growth, before serial dilutions in 0.15 M of phosphate-buffered saline (pH 7.2) up to 1:10E5 were made. The plate-count assay, which is the standard method of determining the number of viable growing bacteria, was used in duplicate to plate 0.1 mL of the 1:10E5 dilution for each sample. Plates were incubated overnight at 37°C and counted under blinded conditions 4 times the next day, using an automated colony counter.

Context. Each practitioner ($n = 14$) performed 3 runs in which bacteria alone were treated with Reiki, for a total of 42 “nonhealing context” runs, and also 2 runs in which a 30-minute patient treatment preceded bacterial treatment, for a total of 28 “healing context” runs. All runs were done in midday, typically between 2 and 3 PM Pacific Standard Time, and were completed over several months, during which time practitioners were randomly scheduled.

Subjects

Practitioners. Sixteen (16) Reiki practitioners including Level II and Master Level practitioners were recruited; 14 participated in the study. Thirteen (13) of the practitioners were from a documented *Usui* lineage; the fourteenth practitioner had nontraditional training. Practitioners had been practicing an average of 7.2 years, ranging from 2.5 to 16 years. Eight (8) practitioners (57%) were also Reiki Masters. Fifty percent (50%) of the practitioners gave Reiki to clients at least 3 times per week, with an average of 4.4 clients per week (range 0–12). Ten (10) practitioners (71%) used only Reiki, while the remaining practitioners

sometimes combined Reiki with other treatment methods (e.g., massage). Two practitioners specialized in Reiki for animals.

Patient. A single patient, female, age 53, with an acute ankle sprain, was recruited to receive Reiki for the “healing context” condition. This patient was treated twice by each practitioner in the study, on different days for 30 minutes. It is believed to be impossible to overtreat with Reiki, because the energy is said to be imbued with an “intelligence” and goes where it needs to go, like water flowing downward to fill up the low levels first.

Well-being assessment measures

A modified Arizona Integrated Outcomes Scale (AIOS)²³ was used to assess change in practitioner mood for each session, pre- and postbacterial treatment, and if healing context was used, also postpatient treatment. The AIOS is a single item measuring overall sense of well-being on a scale from 0 to 10. Separate well-being items measuring physical, mental, emotional, social, and spiritual well-being were added. Practitioners also rated their levels of relaxation and connections to Spirit. Three additional post-test items assessed satisfaction with being an energy conduit, comfort giving Reiki, and satisfaction with treatment effectiveness.

RESULTS

Effect of healing context on bacteria count

A repeated measures general linear model (GLM) was conducted on the paired Reiki/control bacteria plate count with healing context as the independent variable controlling for plate order. A significant healing context by treatment condition interaction was found ($F(1,408) = 3.865$; $p < 0.05$). The bacteria count was greater for the Reiki-treated bacteria only in the healing context condition (see Fig. 1).

In addition to analyzing the bacteria count, a Chi-square analysis was conducted to compare the percentage of runs

in the predicted direction (Reiki greater than control) by healing context. Fifty-nine percent (59%) of the runs in the healing context were in the hypothesized direction versus 45% in the nonhealing context ($\chi^2(1) = 15.51$; $p < 0.001$).

Effects of practitioner mood on direction of effect

A repeated measure GLM with posthoc Tukey tests as needed was conducted on each AIOS item. A group variable was created by splitting the sample by the direction of the run, Reiki greater than control versus control greater than Reiki. *T*-Tests were conducted on the single satisfaction items in the nonhealing context condition. Repeated measures GLM was conducted on the satisfaction items in the healing session (post-patient and post-bacteria ratings). Separate analyses were conducted for each context due to the varying number of time points.

Nonhealing context. The bacteria count was greater for the Reiki-treated bacteria in 19 of the 42 runs. Significant time by run direction interactions were found for social ($F(1,40) = 6.71$; $p < 0.013$) and emotional well-being ($F(1,40) = 5.73$; $p < 0.021$). A trend for the overall well-being item was also found ($F(1,40) = 3.55$; $p < 0.067$). In all instances, practitioners in the control-greater-than-Reiki group started the session with lower ratings of well-being that improved at post-test, while practitioners in the Reiki-greater-than-control group began with higher ratings of well-being that were maintained at the end of the session (see Table 1). A significant main effect for time ($p < 0.001$) was found for relaxation, physical well-being, mental well-being, and connection to Spirit, with practitioners reporting increased well-being at post-test. Spiritual well-being and the satisfaction items were nonsignificant.

Healing context. AIOS data were available for 23 of the 28 runs. The bacteria plate count was greater in the Reiki condition for 14 of the 23 runs. Significant time by run direction interactions were found for physical ($F(2,20) = 4.05$; $p < 0.030$), emotional ($F(2,20) = 4.39$; $p < 0.026$), and social well-being ($F(2,20) = 4.15$; $p < 0.031$). A trend for mental well-being ($F(2,20) = 3.43$; $p < 0.053$) was also observed (see Table 2). While all practitioners showed improved well-being post patient treatment, initial mood ratings were lower in the control greater than Reiki group. These improvements were maintained post bacteria treatment. Consistent with the nonhealing context, all items showed a statistically significant main effect for time ($p < 0.001$; see Table 3), showing improvement in well-being after the patient healing session which was maintained after treating the bacteria. For the satisfaction items, a time main effect trend was observed for satisfaction with treatment effectiveness ($F(2,20) = 3.60$; $p < 0.072$); satisfaction was higher following the patient treatment (mean 9.64 ± 0.79) than post bacteria treatment (mean = 9.41 ± 0.91).

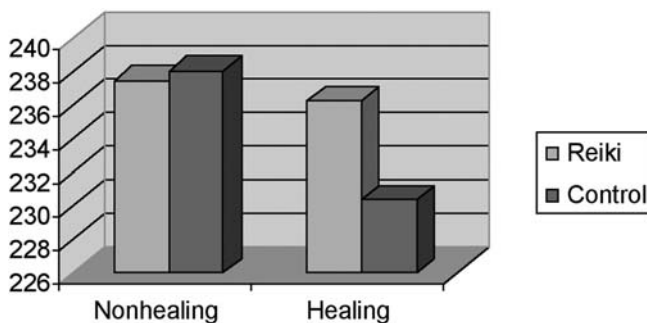


FIG. 1. Mean bacteria plate count—healing context by treatment condition.

TABLE 1. PRE-POST MEANS AND STANDARD DEVIATIONS AIOS NONHEALING CONTEXT

Variable	Group	Pre-test mean (SD)	Post-test mean (SD)
Social well-being	Reiki > control	8.11 (\pm 0.7)	8.26 (\pm 1.1)
	Control > Reiki	7.61 (\pm 1.6) ^a	8.35 (\pm 1.3) ^b
Emotional well-being	Reiki > control	7.95 (\pm 1.2) ^b	8.47 (\pm 1.0)
	Control > Reiki	7.30 (\pm 2.1) ^a	8.57 (\pm 1.4) ^b
Overall well-being	Reiki > control	7.95 (\pm 1.2) ^{b,c}	8.47 (\pm 1.0) ^d
	Control > Reiki	7.48 (\pm 1.6) ^a	8.43 (\pm 1.4) ^b

AIOS, Arizona Integrated Outcomes Scale; SD, standard deviation.
Post-hoc Tukey $p < 0.05$, a < b, c < d.

DISCUSSION

The results answered the 3 research questions: (1) Reiki has a growth-promoting effect on *in vitro* bacterial cultures, under certain conditions; (2) the healing context showed a statistically significant growth effect of Reiki on bacterial cultures; and (3) practitioner well-being influenced the effects of Reiki on bacterial-culture growth.

This is the first study to our knowledge in which healing context with a patient has been introduced into a basic science study to examine the effects of biofield therapies and/or spiritual healing on laboratory organisms. The results suggest that context is important for Reiki, with Reiki-treated bacteria counts greater than control occurring only in the healing context. This is no surprise, since context is crucial to human performance in many arenas of human endeavor. Moreover, this implies that typical studies to measure effects of biofield practitioners and/or spiritual healers on laboratory organisms may not be measuring optimal therapeutic effects on those organisms. Our findings may explain the difficulty other researchers have encountered in attempting to replicate such effects on cells.¹⁷ This could be due to uncontrolled contextual parameters. In addition, practitioner satisfaction with the Reiki treatment was higher following patient treatment in the healing context than after the subsequent bacteria treatment, suggesting that there is a need to provide a research environment more in keeping with how the specific biofield therapy is normally practiced.

The results of this study, if replicable and also reproducible with other biofield practices, may set a new research protocol for conducting basic science studies, in which healing context is used to optimize the effects of biofield therapy in a laboratory setting. Healing context may also improve replicability of results. Moreover, such effects on bacterial systems can be further analyzed using refined tools of physiology, biochemistry, and genetics of simple organisms to understand the *modus operandi* of biofield therapies at the cellular level.

We observed apparent effects of initial mood and other well-being parameters of the practitioners that correlated with the observed effects of Reiki on bacterial culture growth. If practitioner well-being scores were initially high, then the positive effects of Reiki on bacterial growth were more pronounced. If they were initially low, then lesser, even negative growth effects, on the bacteria were observed. Performing Reiki on a patient also raised the practitioner well-being scores. It is possible that in the case of healing-context experiments, improved practitioner well-being may be one of the factors underlying the greater positive effects of Reiki on bacterial culture growth observed.

The fact that apparent negative effects of Reiki on bacterial growth were observed in some experimental runs suggests that there may also be negative energetic emissions that thwart, rather than stimulate, bacterial growth, associated with the human biofield in certain psychophysiological states. Numerous reports from China²⁴ show that external

TABLE 2. PRE-POSTHEALING POST BACTERIA MEANS AND STANDARD DEVIATIONS AIOS HEALING CONTEXT

Variable	Group	Pre-test mean (SD)	Post-patient mean (SD)	Post-bacteria mean (SD)
Physical well-being	Reiki > control	6.71 (\pm 2.0) ^a	8.00 (\pm 1.6) ^b	7.93 (\pm 1.9) ^b
	Control > Reiki	6.33 (\pm 2.1) ^c	7.56 (\pm 2.0) ^d	8.56 (\pm 1.8) ^d
Social well-being	Reiki > control	7.57 (\pm 1.3)	8.29 (\pm 1.4)	8.57 (\pm 1.2)
	Control > Reiki	6.56 (\pm 1.9) ^a	8.67 (\pm 1.2) ^b	9.11 (\pm 0.6) ^b
Emotional well-being	Reiki > control	7.43 (\pm 1.6)	8.42 (\pm 1.0)	8.50 (\pm 1.2)
	Control > Reiki	6.00 (\pm 2.6) ^a	8.56 (\pm 1.4) ^b	9.11 (\pm 0.6) ^b
Mental well-being	Reiki > control	7.57 (\pm 1.5)	8.29 (\pm 1.6)	8.36 (\pm 1.4)
	Control > Reiki	6.22 (\pm 2.5) ^a	8.33 (\pm 1.6) ^b	8.89 (\pm 0.9) ^b

AIOS, Arizona Integrated Outcomes Scale; SD, standard deviation.
Post-hoc Tukey $p < 0.05$, a < b.

TABLE 3. PRE-POSTHEALING POST-BACTERIA: MEANS AND STANDARD DEVIATIONS

<i>Variable</i>	<i>Pretest mean (SD)</i>	<i>Postpatient mean (SD)</i>	<i>Postbacteria mean (SD)</i>
Feel relaxed	6.65 (\pm 2.5)	8.39 (\pm 1.6)	8.83 (\pm 1.2)
Physical well-being	6.57 (\pm 2.0)	7.83 (\pm 1.7)	8.17 (\pm 1.9)
Mental well-being	7.04 (\pm 2.0)	8.30 (\pm 1.6)	8.57 (\pm 1.3)
Emotional well-being	6.87 (\pm 2.1)	8.48 (\pm 1.5)	8.74 (\pm 1.1)
Spiritual well-being	7.70 (\pm 1.7)	8.87 (\pm 1.1)	9.04 (\pm 0.9)
Social well-being	7.17 (\pm 1.6)	8.43 (\pm 1.3)	8.78 (\pm 1.0)
Overall well-being	6.83 (\pm 1.8)	8.30 (\pm 1.5)	8.39 (\pm 1.3)
Connected to spirit	7.65 (\pm 1.9)	8.87 (\pm 1.1)	9.00 (\pm 0.9)

SD, standard deviation.

qi emitted from the hands of *qigong* masters can either increase or decrease the numbers of bacteria, and normal and cancer cells, demonstrating two forms of external *qi*: positive *qi*, with its beneficial effects; and negative *qi*, with deleterious effects on cells. In a study demonstrating effects of external *qi* on leukocytes, researchers noted that during the time the *qigong* master was ill, no significant effect on the cells was found.²⁵

In this study, practitioners did not hold any particular intention to increase or decrease bacterial growth. We may speculate, however, that positive well-being scores correlate with life-enhancing biofield emissions from the practitioners' bodies, whereas lower well-being scores correlate with life-thwarting, or at most, neutral, biofield emissions. The latter may cancel or override any positive effects of "universal life energy" delivered in Reiki. In addition, there is the possibility that the "universal life energy" contains intelligent information²⁶ and goes where it is most needed, which may be to improve practitioner well-being, so that no positive effects on bacteria are seen with practitioners who themselves need Reiki. One theory of Reiki seems to support this interpretation. Reiki is described as "being drawn through the practitioner according to the recipient's need, within the ability of the practitioner to carry the vibration."⁵

CONCLUSIONS

Our results showing an apparent influence of healing context as well as practitioner well-being scores on the outcome of Reiki on bacterial cultures, challenge certain concepts about Reiki maintained by the *Usui* lineage. One of these teachings is that the Reiki is completely independent of the practitioner, who is considered to be a passive conduit "out of the loop." Another is that Reiki can effectively be practiced in any state of practitioner consciousness. The results here suggest that Reiki, whether or not a "universal life energy" from a cosmic or divine source, may be modulated by the human biofield in certain psychophysiological states.

How might Reiki modulated by the human biofield have an effect on bacterial growth? Bioelectromagnetics has

shown that organisms including microbes may respond to externally applied electromagnetic fields so weak that they have less energy content than the physical thermal noise limit.²⁷ Some of these therapeutic windows of intensity and frequency are similar to emissions from the human body.

More recently, it has been shown that biochemical reactions inside bacteria can be accelerated by an extremely weak, externally applied, magnetic field of the order of millitesla.²⁸ This is the first time that biochemical reactants isolated from living cells showed a reaction-rate sensitivity to ultraweak magnetic fields *in vitro*. This discovery suggests that further research might someday identify a molecular mechanism for the enhanced growth effects from Reiki, which may include the ultraweak electromagnetic frequency components of practitioner biofields.

As an initial study with a small group of Reiki practitioners ($n = 14$), we were able to observe statistically significant results on bacterial cultures in healing context runs. Despite this, no definitive conclusions can be made due to the small number of practitioners. Future studies should be conducted with a larger sample size, with other biofield therapies, and in clinical trials to confirm and extend these findings.

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Address reprint requests to:
Beverly Rubik, Ph.D.
Institute for Frontier Science
6114 LaSalle Avenue, PMB 605
Oakland, CA 94611

E-mail: brubik@earthlink.net