

**SPEAKING IN E-PRIME:
An Experimental Method for
Integrating General Semantics
into Daily Life**

E. W. KELLOGG III*

I FIRST READ ALFRED KORZYBSKI'S *Science and Sanity* in 1976, and had felt deeply impressed by the manifest validity and comprehensive character of his work on non-aristotelian thinking. (1) Even so, I at first had very little success in incorporating the insights gained into my daily life. The principles seemed so transparently obvious in hindsight ("the map is not the territory," "the word is not the thing," the repeal of "the law of the excluded middle," etc.), that I made the common beginner's error of assuming that simply reading *about* general semantics would train one in the *use of* general semantics. Although some books proved very helpful to me (in particular Ken Keyes' *How To Develop Your Thinking Ability*, with those delightful and singularly apropos cartoons by Ted Key), it seemed clear that having an intellectual understanding of non-aristotelian thought does not necessarily allow one to practice it. (2)

I began a self-training program in which I focused on practically applying a single aspect of general semantics on any given day. For example, I might focus on the multiordinality of terms, and make a serious effort to increase my awareness of the orders of abstraction inherent in what I read, said, and heard during my daily activities. On another day I might try to eliminate the either-or, all-or-never orientation by thinking more in terms of possibilities and probabilities. As I gained experience, I found some small, but significant, changes in my "mental machinery" resulting from my self-training efforts, including an increasing number of *spontaneous* instances of non-aristotelian thinking. Even so, these efforts proved mostly ineffectual, as I continued to habitually think and evaluate in the old aristotelian way. Clearly, I needed a simple, but comprehensive system of discipline that would force me to incorporate the various principles of general semantics into daily life.

When I had almost given up on finding such a discipline, I discovered D. D. Bourlands' article, "A Linguistic Note: Writing in E-Prime," in a back issue of the *General Semantics Bulletin*. (3) In essence, the term E-Prime (abbreviated E') refers to an English language derivative that eliminates any

*Dr. Kellogg works as the Research Director of the Aletheia Foundation (1809 N. Highway 99, Ashland, Oregon 97520).

use of the verb “to be” (basically am, is, was, are, and were). In this article Bourland argued for the use of E' as a writing discipline that allows one to minimize many “false to facts” linguistic patterns inherent in ordinary English usage. Without going deeply into the advantages of E' at this point, its use automatically eliminates the false to facts “is of identity” (i.e. John is a man) and the “is of predication” (i.e. The leaf is green), two main stumbling blocks to non-aristotelian thinking. I decided to make E' an integral part of my self-training efforts. If I couldn't consistently *act* in accordance with general semantics principles I could at least *write* in accordance with them!

At first, my writing in E' sounded stilted and contrived, and I had to write first drafts in ordinary English, and then laboriously translate them. I used E' exclusively in my personal writing, and soon gained enough facility that I wrote, albeit awkwardly, first draft versions in it. Fortunately, at this point in my career I had the task of writing my dissertation. The exercise of writing the first draft in E-prime gave me a practical and personally convincing demonstration of the potential power of E' as a catalyst and clarifier of thought. The use of E' clarified many aspects of my experimental work, and made obvious many inherent assumptions that ordinary English usage had concealed. Although the final version did not make exclusive use of E' (I wrote too awkwardly in it for that), I had gained a great deal of experience in writing in E', and solid confirmation of its value as a tool in promoting non-aristotelian thought.

Over the next few years I wrote exclusively in E' in both personal and professional communications. As I gained experience, I found it easier to express myself, until I reached the point where writing in E' felt more natural for me than writing in ordinary English. During the summer of 1978, after explaining the value of E' to a few acquaintances, one of them asked me why I didn't *speak* in E' if I felt so strongly about its value as a transformational tool. I realized that I no longer had a satisfactory answer to that question. When I had originally begun writing in E', I had found it so difficult that I had not even considered the possibility of speaking in it, but in 1978 this situation no longer applied. Writing in E' had already proved itself to me many times over as a valuable training discipline in non-aristotelian thinking. Would not speaking in E' prove far more valuable?

Haltingly, and with many mistakes and errors, I began the task of learning to speak in E-prime.

How does E-prime work?

At this point, it seems appropriate to give a fuller explanation of how E-prime might work. In his book, *Language, Thought and Reality*, Benjamin Lee Whorf gives numerous examples of languages and cultures that support his “principle of linguistic relativity.” (4) This principle states that the structure of the language you use influences the way you perceive “reality,” as well as how you behave with respect to that perceived reality. Although one could describe E'

simply as English without any use of the verb "to be," such a definition misses the profound changes in personal orientation resulting from such a change.

In essence, E-prime consists of a more descriptive and extensionally oriented derivative of English, that automatically tends to bring the user back to the level of first person experience. For example, if you saw a man, reeking of whisky, stagger down the street and then collapse, you might think (in ordinary English) "He is drunk." In E' one would think instead "He acts drunk," or "He looks drunk," both of which statements obviously coming closer to an accurate description of the actual experience, and involving fewer covert assumptions than the English original. After all, one might have encountered an actor (practicing the part of a drunken man), a man who had spilled alcohol on himself undergoing a seizure of some kind, etc., etc. The E' statement still leaves these possibilities open, whereas the "is" statement does not. Although E' usually reduces hidden assumptions, it does not exclude them (for example, you may have seen a woman, or a robot, or an alien, etc. that looked like a man and acted drunk). E-prime fosters a worldview in which the user perceives situations as changeable rather than static, and where verbal formulations derived from experience indicate possibilities rather than certainties. Subjectively, I have found my creativity greatly enhanced, as many problems that "are unsolvable" in ordinary English only "seem unsolvable" in E'! This shift in attitude can make a great difference.

Thus, removing the "to be" verb from English results in a language of a more phenomenological character, in that this change automatically causes a reduction of the number of assumptions in even simple sentences. Statements made in E' almost always mirror first person experience far more adequately than the "is" statements they replace. E' also greatly encourages one to use the active voice ("Smith₁ did it") rather than the often misleading and information-poor passive voice ("it was done"). Of course, as Bourland pointed out, one can continue the modification of E-prime even further, adding for example the alterations and non-aristotelian tools that Korzybski recommended (dating, indexing, etc.), bringing one to E'₁. My own version of E' (E'_p) aims at a phenomenological ideal, of ever more adequately representing the territory of my experience while ever more clearly communicating with others.

Perhaps I can make the potential advantages of such a phenomenological approach clearer by drawing an analogy with computer languages. Computers operate with a variety of different programming languages, but these differ tremendously in their efficiency and inherent versatility. A beginner usually learns to program using BASIC, a computer language that most resembles English, which makes it easy to learn and so initially the most convenient language to use. But the novice programmer pays a price in using BASIC, in that the computer has to translate BASIC into the "machine language" it uses in processing information, and which actually corresponds to the "computer's experience." This translation takes time and also involves the inherent risk of errors entering the process. One also loses versatility, as BASIC (a language

composed of very high order abstractions for the computer) can only include a partial representation of the available operations programmable in machine language itself. Thus an operation programmed in BASIC may take thousands of times longer for a computer to execute than one written in machine language, while an operation available in machine language may prove impossible to program in BASIC. Thus one can draw the general conclusion that the more closely a computer programming language (the map) mirrors machine language (the territory), the greater the potential efficiency and accuracy of that language in communicating directions and information to the computer itself.

Although humans do not appear to process information as computers do, much of the analogy still applies. For humans, "machine language" corresponds to the "silent level" of experience. One might expect therefore that the more closely a language models the structures of experience, the more efficiently and accurately it could work in external communication (with others) and internal information processes (with oneself, thinking). As an example, let's take an ordinary statement in English, such as "The leaf is green," and make a gradient of translations, each perhaps more adequately representing the "silent level" of experience itself.

STATEMENT

the leaf is green

the leaf has a green color

I see a green leaf

LITERAL TRANSLATION

the leaf = green

the leaf has a green color for everyone

At this moment I see a green colored leaf.

SILENT LEVEL

As this example illustrates, an E' version of an "is" statement can increase the adequacy of the statement in conveying a "silent level" experience. Of course native speakers usually understand that one should not literally interpret a statement such as "the leaf is green" as "the leaf = green," and that it usually means something closer to "Look at the green leaf." But why not say so in the first place! Or to take another example—

STATEMENT

Smith₁ is a drunk

Smith₁ acts like a drunk

Smith₁ often acts like a drunk

LITERAL TRANSLATION

Smith₁ = drunk

Smith₁ acts like a drunk all the time

SILENT LEVEL

SOME POSSIBILITIES OF THE "SILENT LEVEL" EXPERIENCE

1. Smith₁ threw up on my rug at my party last night. (Actually he threw up because of eating spoiled fish.)

2. When Smith₁ walks he staggers, and he goes around in a state of mental confusion. (Actually, Smith₁ has Alzheimer's disease.)

3. Smith₁ drank a fifth of whisky at my party last night, acted in a belligerent and obnoxious manner, and then threw up on my oriental carpet. He has acted similarly several times before, keeps liquor in his desk at work, and smelled of whisky every morning last week. (Smith₁ really does drink too much!).

Obviously, one can reach a point of diminishing returns by describing experience too closely. E' or E'_k strike a nice balance in this regard, as they tend to "keep one honest" and aware of the divergence between described and experienced events (by the use of such words as *seems*, *appears*, *acts*, etc.). On the whole, E' statements use the same number of words as their ordinary English counterparts, while providing additional useful information in the who, what, and how categories.

Thus, writing and speaking in E-prime confer a number of advantages to anyone seriously interested in training themselves in non-aristotelian thinking. I have found speaking in E' an efficient and effective discipline, as its use forces me to incorporate general semantic principles in an integral way almost every time that I open my mouth! I also frequently translate the speech of others into E', and this has served me well as a buffer against signal reactions in my own thinking and behavior. I can often smooth out arguments in my vicinity simply by interjecting E' translations of key statements into conversation. For example, if someone says "That is a stupid idea!" I might reply "What don't you like about it?" rather than "It is not!" Principally because of this tactic, I haven't had a real argument with anyone in years, although I have had a number of heated discussions!

Still, what about the disadvantages of E-prime? Do any exist? Unfortunately, yes, and the prospective student will have to decide on the relative importance of them. First, you lose the helping verb function of "to be" indicating a continuous process. For example the statement "it is raining outside," translates to "it rains outside." One also loses the use of "to be" indicating a future tense, as in "he is coming." In E' one could say "he comes" (dramatic!), or "he will come later." The E' versions may sound awkward to some, but to me it seems more a matter of taste and convention than of any real loss of meaning.

To a large extent, one gives up much of the power of manipulation when writing and speaking in E'. A number of therapeutic disciplines, such as Ericksonian hypnosis, or Neuro-Linguistic Programming, depend on techniques involving ambivalence in language and primitive patterns of magical thinking (i.e. "the word is the thing," "the part is equal to the whole," etc.) to induce a state of confusion and suggestibility and finally a beneficial change in the patient. (5)(6)(7) Such therapists use "fire to fight fire," reportedly with a great deal of success. (8) Unfortunately, such methods of treatment foster, and depend on primitive thinking patterns, which stand in direct opposition to the intent behind E', or of general semantics for that matter. E-prime aims at clarification, not obscuration of language; at specificity, rather than ambiguity; at com-

munication, rather than manipulation. Its use might substantially handicap therapists of this kind.

Even outside of therapy, most routinely use language to manipulate others, to provoke a physical or emotional response. In many ways "is" statements have much greater emotional impact than their E'_k equivalents. "You are an idiot!" has a much greater emotional impact than "You act like an idiot sometimes!" "Is of identity" statements have the ability to powerfully stimulate signal reactions, not even giving a chance for the unprepared individual to buffer the blow. Speaking in E' may not seem like much of a disadvantage in this respect under ordinary circumstances, but it can constitute a handicap in using language of the form "You are a #@%&*!" However, spoken language has its emotional impact not only through *what* you say but through *how* you say it. Voice tone, rhythm, and inflection can drastically change the perceived meaning of a sentence. An innocuous "Yes dear," said sarcastically can provoke an explosive response ("Don't you use that tone of voice to me!"). Spoken language thus has both cortical and thalamic (or perhaps right and left brain) components that can work together congruently or antagonistically. In this sense, E' only modulates and does not control the affective content of speech.

In a more poetic context the E' user loses much of the power of metaphor ("He is a tiger"), although one can compensate for this loss by using similes ("He acts like a tiger!"). As E-prime aims at honesty and integrity in communication and thought, it may seem obvious that as it progresses toward this goal, the user correspondingly loses the ability to deceive, confuse and manipulate. Some used car salesmen might find this an insuperable obstacle, but therapists do have possible alternatives. For example, Albert Ellis' Rational Therapy might substitute for more manipulative techniques, as it has aims similar to those of general semantics. In fact, Ellis and others translated some of his major works into E' , which makes them perhaps the only books currently (1987) published in such a format. (9)

Of course, learning to write and speak in E-prime involves the considerable disadvantage that one has to devote a great deal of time and effort to the task, especially in the early stages. Writing acceptably in E' initially involves additional drafts, and even final versions may sound awkward and stilted in style until you learn the ropes. I've included an E' primer in a later section, in which I pass on some suggestions that might help an E' student during the transition period. At least when writing you usually have the time to polish your work—a luxury not usually available when speaking E' !

When I first tried speaking in E' I quickly found myself in trouble. Often, three-quarters of the way through a sentence I found myself with no way out but through an "is, was, are, or were." I left a lot of sentences hanging in the air because of this! Other times "to be" contractions (I'm, it's, you're) crept in, usually unnoticed until after I had finished a sentence. And worst of all, occasionally I found myself speaking in "pidgin E-prime" of the "Me Tarzan, You Jane" ilk, where I simply left a form of "to be" out of a sentence and hoped

for the best. Initially I talked much less than usual, and had to carefully consider and mentally rehearse each sentence before I said anything. I have no doubt I sounded rather odd during my early months of speaking in E', but strangely enough almost no one ever remarked on this. Actually, I did receive one comment on my speech about a year after I had begun speaking in E'. At a conference, a perceptive woman wondered about my nationality. She apparently had a very good ear for accents, but could not place mine, and wanted to know the country I had originally come from!

A Proposed Program for Learning to Write and Speak in E-prime

As a first step, concentrate on using E' in unimportant notes or letters you write, and in your personal diary. At first you may go through several drafts before you reach an acceptable version, but persevere. After you have practiced writing in E' for a week or so and feel comfortable with it to some extent, I *highly* recommend that you either write a biographical sketch of yourself (a page or two) in E', or better yet translate an already existing version (like your resumé) into E'. This exercise may demonstrate some of the inherent advantages of E' to you as nothing else can.

After you have gained some real facility in writing in E', begin to use it for more serious work. Although it seems a good idea to have a goal of 100% E' in a final draft, expect to have a few "to be" sentences in the text in cases where the E' version sounds overly awkward, etc. Count any reduction in the incidence of "to be" in your written work as an achievement in the right direction. With continued effort your expertise in writing in E' will increase to the point where few, if any, readers will detect any abnormality of writing style: more than likely you will receive compliments as to the clarity and improved quality of your finished work.

When you write easily, and feel satisfied with the way that you communicate in E-prime, you will probably already have begun to occasionally speak in it. At some point, if you really want to reap the full benefits of the discipline, you will have to make a serious commitment to speaking in E' *exclusively*, because *speaking* in E' forces one to learn how to *think* in E'. Just as with learning a foreign language, a time comes when you begin to think in the language rather than just translate sentences into it, so with learning to speak in E'. Unfortunately this process usually requires total immersion in the foreign language and culture, and a serious commitment on the student's part. As we do not live in an E' culture, this makes your own personal commitment to speak in E' doubly important.

A Primer for Writing and Speaking in E-prime (practical hints)

Simply put, E' proper allows you the use of the entire vocabulary of the English language with the following exceptions: be, is, am, are, was, were, been, being (as a verb), and the "to be" verb contractions of m's, 's, and 're. To begin, you need only focus on the simple(?!) task of not using any of these words.

E'_k adds to the basic E' structure by employing the extensional devices Korzybski recommended (indexes, dates, etc., quotes, hyphens) which encourage awareness of abstracting, while restricting language usage (for example avoiding "allness" statements) to forms that encourage a non-elementalistic, and non-absolutistic point of view. (10) See Korzybski (1, pp xlvi-1) and Keyes (2) for further information.

Finally we have my own preferred form of E' (E'_p), which operates from a phenomenological point of view. (11) This form includes the modifications already mentioned for E'_k , plus any others that allow the language that one uses to more adequately represent the territory of the "silent level" of one's actual experience. E'_p aims at a practical, yet transparent and presuppositionless language that reduces the discrepancies between the "map" and "territory" of experience to a bare minimum. This describes my goal in the continuing transformation of my personal language, and though not presently attainable, like the North Star, it has proved itself a useful navigational aid.

General substitutes for forms of "to be"—seem(s), appear(s), feel(s), act(s), look(s), etc. Try not to overuse these terms.

Suggestion #1 If you find it difficult to compose a sentence in E' , refer to the basic "silent level" experience and describe the actual event.

Examples:

STATEMENT

POSSIBLE E-PRIME
TRANSLATION

The World of Null-A is a great book!

I really enjoyed reading the book
The World of Null-A!

I am fine.

I feel fine.

This food is good.

This food tastes good.

Suggestion #2 Take an "is" statement at a high level of abstraction/assumption and bring it down to earth. Remove the assumptions and work with what you have left.

STATEMENT

POSSIBLE E-PRIME
TRANSLATION

Joan is smart.

Joan makes \$500,000 a year.

Cleve is smart.

Cleve scored 160 on an I.Q. test.

Linda is helpful.

Linda helped me.

Suggestion #3 Replace the "is" with an action verb.

STATEMENT

POSSIBLE E-PRIME
TRANSLATION

David is a doctor.

David practices medicine.

Risa is a teacher.

Risa teaches Epistemics.

He is a car mechanic.

He repairs cars.

Suggestion #4 Say what you mean.

STATEMENT

POSSIBLE E-PRIME
TRANSLATION

Is Leia there?

Can I speak with Leia?

What is your name?

What do you call yourself?

How are you?

How do you feel?

Suggestion #5 Change the sentence from the passive to the active voice.

STATEMENT

POSSIBLE E-PRIME
TRANSLATION

It was done.

Olof did it.

The experiment was conducted . . .

Mike conducted the experiment . . .

Jack was blessed.

The Pope blessed Jack.

In speaking E-prime in a non-E' world, I sometimes resort to "pidgin E-prime" in order to avoid statements which, although they make better logical sense than their English equivalents, sound awkward. For example, if someone asks me "Who are you?" instead of saying "I call myself Ed," I simply say "Ed." Of course, I assume the questioner really meant to ask "How do you label yourself?" and not "With what verbal concepts do you identify yourself as an existential being?" Other languages (for example French and Spanish) do in fact ask questions about one's name in a logical manner (Comment vous appelez vous?, Cómo se llama usted?). No matter how improved E' versions of idiomatic English phrases seem from a general semantics point of view, they may still sound a little peculiar and out of the ordinary to the unprepared listener. However, in general E' statements meet with as much social acceptance, and in fact seem more readily understandable, than the "is" statements they replace.

While first learning to speak in E-prime, you may have to mentally rehearse each sentence before you say it. For a while people might find your conversation a trifle limited, but they probably will not notice. Most people seem to like to hear themselves talk most of all, and they will appreciate your reticence! Nodding the head, looking intelligently interested and occasionally mouthing words and phrases such as "yes," or "perhaps," "I agree," "indeed," etc., etc., proves adequate in all but the rarest of conversations, where someone actually wants to talk *with* rather than *at* you! In such a case, if you take on an attitude of deep thought, even half finished phrases and pidgin E-prime may command respect! As mentioned earlier with respect to arguments, I have also found it

valuable to practice translating the statements of others into E' during conversations, and then echoing the E' statement back to the original speaker. Unfortunately, the opposite also occurs, and I have often found my E' statement repeated back to me (or obviously interpreted) as the "to be" counterpart. However, repeated applications of the E' version will usually drive the point across.

When you begin speaking in E' you may often find yourself half-way through a sentence before you find to your dismay that you have nowhere to go but "is." I suggest in such cases you either stop, and rephrase the sentence into E', or if you have already finished the sentence, either redo the sentence orally or mentally. As a final step to polishing your use of E', you might enlist a spouse or a close friend to monitor your speech. Offer them a dollar for each time they catch you using a form of "to be" in conversation, when you don't immediately correct yourself. Even though I have "mastered" spoken E' I still routinely find various forms of "to be" (particularly the dreaded contractions I'm, he's, she's it's and you're) creeping into my speech. This should not surprise anyone—I live in an "is-rich" linguistic environment that has an impact on me through the spoken and written word. E' cushions this impact, and can at least eventually lead to relative freedom from it in the privacy of one's own thoughts and speech.

Conclusion

To the public, the general semantics movement has offered many books that clearly and convincingly argue the case for the theoretical advantages and enhanced effectiveness of non-aristotelian thinking as compared to the habitual "normal" thinking of Western culture. If general semantics has a major defect it occurs not at a theoretical but at a practical level. Even some people who have a longstanding commitment to general semantics freely admit to having minimal success in *comprehensively* practicing it in daily life. Over fifty years ago in *Science and Sanity* Korzybski clearly envisioned general semantics as a discipline that would not only do more than simply facilitate "clear thinking," but that would profoundly affect the "whole man" in many aspects of daily life. Thus, although the aims of general semantics appear clear, general semantics needs more effective methods for attaining these aims.

In my experience, writing and speaking in E-prime has proven itself an effective discipline for integrating non-aristotelian thinking and behavior patterns even into so-called habitual or even "unconscious" levels. I not only write and speak in E', I think and even dream in it. Although E' does not train one in *all* aspects of non-aristotelian evaluation, it does a thorough job of training in some aspects, and facilitates the learning of many others. To my knowledge, objective studies of the actual benefits of writing and speaking in E' do not exist at this time (1987). Subjectively, I have found it to have significantly enhanced my creativity and problem-solving ability, as well as my interpersonal communication skills. K.L.R. Bourland made similar findings, when

he used both written and spoken E'_k to advantage in a work situation involving the development of a complex computer system. (12) In my opinion, learning to write and speak in E-prime can constitute the heart of an effective system of self-training in general semantics, and deserves serious consideration from anyone committed to the integration of non-aristotelian processing into their habitual thought and behavior.

REFERENCES

1. Alfred Korzybski, *Science and Sanity* (4th edition, Lakeville, CT: The International Non-Aristotelian Library and Publishing Company, 1958)
2. Kenneth S. Keyes, Jr., *How to Develop Your Thinking Ability* (New York, McGraw Hill Book Company, Ltd., 1950 & 1979)
3. D. David Bourland, Jr., "A Linguistic Note: Writing in E-Prime," *General Semantics Bulletin*, Vol. 32-33, pp111-114, 1965/1966
4. Benjamin Lee Whorf, *Language, Thought, and Reality*, (Cambridge, The M.I.T. Press, 1956). See also C. Weggelaar, "The Whorf Hypothesis: The Case of Dutch and English," *Et cetera*, Vol. 39 pp332-343, 1982
5. Richard Bandler and John Grinder, *Patterns of the Hypnotic Techniques of Milton H. Erickson, M.D., Volume 1*, (Cupertino, CA, Meta Publications, 1975)
6. Richard Bandler and John Grinder, *The Structure of Magic: A Book about Language and Therapy, Volume I*, (Palo Alto, CA, Science and Behavior Books, 1975)
7. Marcel Mauss, trans. by Robert Brain, *A General Theory of Magic*, (New York, W.W. Norton & Co. Inc., 1972)
8. Sidney Rosen, Ed., *My Voice Will Go With You: The Teaching Tales of Milton H. Erickson*, (New York, W.W. Norton & Co., Inc., 1982)
9. Albert Ellis and Robert A. Harper, *A New Guide to Rational Living*, (North Hollywood, CA, Wilshire Book Company, 1975), and Albert Ellis, *Anger: How to Live With and Without It*, (Secaucus, N.J., Citadel Press, 1977)
10. Alan Walker Read, "Language Revision by Deletion of Absolutisms," *Et cetera*, Vol. 42, pp7-12, 1985
11. For an introduction to phenomenology see Edmund Husserl's *Cartesian Meditations: An Introduction to Phenomenology*, trans. by Dorion Cairns (The Hague, Martinus Nijhoff, 1973) or Maurice Natanson's *Edmund Husserl: Philosopher of Infinite Tasks* (Evanston, IL, Northwestern University Press, 1973)
12. K.L.R. Bourland, "Coping with Semantic Problems in System Development," in *Coping with Increased Complexity: Implications of General Semantics and General Systems Theory*, Ed. by D.E. Washburn and D.R. Smith (New York, Gordon and Breach Science Publishers, 1975)
13. Those interested in seeing some examples of E-prime in action in my scientific papers might look up the following:
 - a. E.W. Kellogg III, M.C. Yost, and A.P. Krueger, "Superoxide Involvement in The Bactericidal Effects of Negative Air Ions on *Staphylococcus albus*," *Nature*, Vol. 281, pp 400-401, 1979
 - b. E.W. Kellogg III, "Air Ions: Their possible Biological Significance and Effects," *J. Bioelectricity*, Vol. 3, pp 119-136, 1984.
 - c. E.W. Kellogg III, and M.C. Yost, "The Effects of Long-Term Air Ion and D.C. Electric Field Exposures on Survival Characteristics in Female NAMRU Mice," *J. Gerontology*, Vol. 41 pp 147-153, 1986