In the Beginning Was the Word
By Tom Zinnen

Aleksandr Solzhenitsyn has been credited with this admonition: Guard every word, for every distinct word expresses a distinct idea, and when the word dies, so does the idea.

Although we live in a popular culture driven by images, the spoken word remains the most common and most personal form of communication. Words have at least two advantages: they're portable and they're infectious. Words can be toted and shared in two forms: spoken or written. Unlike projected visual images, your audience can take home word images, and they can share them with others.

A dictionary that not only defines words but explains their origins is useful to help you as a speaker or teacher show connections between words and the ideas they represent. Using word plays allows you to start with something familiar to your audience. Connecting something new to something familiar strikes me as a good way to learn.

Some Interactive Word Plays: The "Gen" Words

Here's an example of how a progression of related words can illuminate the evolution of related ideas. Take these words: genesis, genes, genie, genius, ingenious, ingenuity, ingenieur, engineer. All but the French word "ingenieur" are non-technical, ordinary English. Going through these words will help an audience understand why the term "genetic engineering" can generate gut-level concern in some people. Try a question-and-answer approach, with the audience answering.

- What's the first book of the bible? Genesis, and it's about origins, beginnings, inheritance.
- What do you get if you knock off the "is"? Genes.
- What do you get if you rub a lamp, and you're lucky? A genie.
- And if the genie's real smart, what can you can call it? A genius.
- If it's skillful with its hands, how can you describe it? It's ingenious.
- In French, someone with ingenuity can be called an "ingenieur". In English, what do we call "ingenieurs"? Engineers.

In most other languages from western Europe, the word for someone who designs and builds still retains the "ingenuity" root. I find the dyslexia of English in its spelling of "engineer" dismaying because that "e before i" has disconnected the word from its origins.

This series of Gen Words doesn't define "genetic engineering" in a rigorous sense. But it captures some of the key connotations of a term that is traceable back to the early 1940's--30 years before cut-and-splice recombinant DNA techniques.

The Essence of Tools

"Just what is biotechnology?" is the most common question audiences ask me. Defining biotechnology shows the usefulness of etymological roots. Using the dictionary, you can set forth the wide meaning of "using living organisms to make a product" or the narrow meaning of "recombinant DNA techniques." But using the same dictionary, you can mine more ideas from underlying words of "biotechnology".

As every biology student know, "bios" is ancient Greek for "life." The "techno" comes from another Greek word meaning "tools" or "skillfully made." It's the same word used in the Greek "Pentateuch" referring to the first five books of the Bible, meaning the "five tools."

"Logos" is remarkable in its depth of meanings. Most people know it means "study of." But it also can mean "word" or "essence" as used in the New Testament. Using the lexicographer's lever, the root ideas of biotechnology become "the essence of tools from living things."

As a distinct term, Robert Budd of the Science Museum in London has traced "biotechnology" back to at least 1917, when during the World War Europeans used the term to describe yeast-based industrial processes developed to supplement or replace industrial processes based on petroleum.

This illustrates for the audience the fluid nature of the meanings we assign to words, and how older terms sometimes are applied to newer tools, while connotations dance and dodge with denotations. It also prepares them to analyze how proponents and opponents of a technology try to put their own spin on words.

What distinguishes "science", "technology", and "engineering"?

This question is not just semantics. Science teachers at all levels need to be able to describe how science differs from other ways of knowing. At the university level, this question is at its core about the academic freedom to pursue new knowledge. At the industrial level, it's about the regulation of the use and commercialization of new tools and products that may result from new knowledge.

I once asked a representative of the National Science Foundation to distinguish between "science" and "engineering." Since NSF had distinct funding categories for science and for engineering, I figured they had a good definition to distinguish between the two. The NSF person adroitly replied that NSF makes the same distinctions that scientists and engineers make.

So, how do *you* define "science"? Here the ancient origins can help make modern distinctions between similar ideas.

Science comes from the Latin "scio" meaning "I know." Scio derives from the Latin infinitive "scire" meaning "to know," and is akin to "scindere" meaning to cut or to split. Scindere is traceable to the Greek "schizein" meaning to split, and that's traceable to the Sanskrit "chinatti" meaning 'he splits'.

So science is not just encyclopedic catalogs: it's splitting, separating, discerning among ideas. It is reductionist to its etymological core.

This introduces the concept of Science as Scissors. It takes two opposing knives to make a scissors; it takes at least two opposing ideas to do experimental science. As Thomas Chamberlin wrote a century ago, science is about the testing by empirical experiments of multiple competing hypotheses. The generation of many competing explanations, and the use of empirical intellectual scissors to test those explanations, are key differences between science and other ways of knowing.

Using this approach, science refers to "knowledge", technology refers to "tools" and engineering to "ingenuity" in innovation. They are not mutually exclusive and are arguably mutually dependent. Yet they are different words expressing distinct ideas.

Just as genealogical studies won't answer all aspects of the question "Where did I come from?", etymological word plays won't answer all aspects of "What does this word 'science' mean?" But they are good places to start.

Biotechnology vs biotechnology industry.

The NSF guy declined to "prescribe" a meaning to the two words, assigning one correct meaning to the exclusion of others. Instead he attempted to "describe" the meanings people use. Dictionaries can take a "prescriptive" or a "descriptive" philosophy. A prescriptive dictionary prescribes the "correct" meaning and by implication proscribes other meaning as incorrect or non-standard. A descriptive dictionary is not so authoritarian: it describes various meanings applied to a term. It may arrange competing meanings by age or by how commonly they are used. But it doesn't prescribe and proscribe. For example, word pairs such as "ravel & unravel" or "flammable and imflammable" are look like opposites yet actually are used to mean the same thing--they are functionally synonymous. Take "biweekly and semiweekly": to some people, the first means twice a week and the second means every two weeks; to others, the first means every two weeks and the seond means twice a week. A descriptive dictionary will merely report these two opposing meanings, and let the user figure it out.

Technology refers to "tools" and engineering to ingenuity in innovation. What about science? It derives from the Latin "scire" meening to know, and is akin to "scindere" meaning to cut or to split. Scindere is traceable to the Greek "schizein" meaning to split, and that's traceable to the Sanskrit "chinatti": 'he splits'. Science is not just encyclopedic catalogs: it's splitting, separating, discerning among ideas. It is reductionist to its etymological core.

The concept of Science as scissors, and it takes two opposing knives to make a scissors. As Thomas Chamberlin wrote a century ago, science is about the testing by empirical experiments of multiple competing hypotheses. These empirical intellectual scissors are key differences between science and other ways of knowing. Another name for scissors is shears. Shear ironically also meaning "to see through."

A dictionary that not only defines words but explains their origins is useful to help teachers show connections between other words and the ideas they represent. Using word plays allows you to start with something familiar to your audience. Connecting something new to something familiar strikes me as a good way to learn. Dictionaries can be precsriptive or descriptive. Prescriptive means they present "correct" or authoratitative definitions, while descriptive meanst

In talking with the public, we face the challenges of communicating, translating, and interpreting. Communicating is exchanging ideas, in some cases using words. Translating is needed when communicating between two people who use different languages. Interpreting is explaining, and is needed to flesh out the literal translation.

Using language also is a way to refer to many ethnic backgrounds

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Prove, probe, test

While the French may have their Academie Francaise to ensure the integrity of the French tongue, I don't see a need for an Academy Biotechnology. But I would like to see a way to share systematically ways to define or describe technical concepts in ordinary English. Such a tool would best be mult-media, using all the But the tongue is one tool that needs no tool box to tote it. The tongue goes wherever the eyes and ears and brains of its owner goes. We need to sweat about the ways we speak and write, and spend time and money on verbal images just as we do on visual ones.

I stopped by Stanford on a night in November. I'd never been there before, and still haven't seen it by day, but it looked appealing by the full moon. one of the libraries was open, so I stopped in. They had a Websters Third New International Dictionary, the big mother, on a stand. I did the Alex Haley thing and looked up the roots of science: L. scire = to know, akin to scindere = to cut or to split; from Greek schizein = to split; from Sanskrit chinatti = he splits. Science as splitting, separating, discerning; reductionist to its etymological core. Science as scissors, and it takes two opposing knives to make a scissors. As Thomas Chamberlin wrote a century ago, science is about multiple competing hypotheses--intellectual scissors. Another name for scissors is shears. Shear ironically also meaning "to see through." Your place is a good place to be on a Saturday night.

Shaman: extracts impart spirit; for example, extracts of eagles provide the vision and hunting spirit of the eagle. Compare to taboo of putting pig genes in tomato.

Another name for scissors is shears. Shear ironically also meaning "to see through."

When I asked what that distinction was, he answered that he didn't know, but whatever the distinction scientists and engineers make, that's the one that NSF uses.

I don't know an explanation for the switch. I only know that when I was little I figured engineers were they guys who drove the train engines. It wasn't till I read that the French gave Leonardo da Vinci the title of "Ingenieur" that the etymological lightbulb clicked.