Underwood Lecture 8/19/94

Vitamin C and Illiteracy

Thank you Ted, Chancellor Stephenson, President Maguire, fellow staff, and faculty members.

I would especially like to thank Annabelle Underwood for attending and I would like to recognize and introduce my family. My lovely wife of 32 years, Susie is here, she wanted to hear the speech just one more time. My daughter Angela is here, Angie is a product of Florissant Valley and I might add an excellent middle school math teacher in the Rockwood School District. Angie not only got her Associate's Degree but found her husband Roy at this fine institution. Roy is one of our engineering graduates. My son Clint attended Florissant Valley and went on to get a Ph.D. in Nuclear Engineering. Clint is here from Albany, New York where he works for the Department of Energy and does something with nuclear research. Clint will not tell his father what he does. The baby of the family is Barry (known to many as Boo) who also graduated from Florissant Valley and went on to become a biochemist. Barry works for Ortho Pesticides and has killed almost as many bugs as we have administrators in the JCD. Barry married a biochemist (Jessica) and she is with us today. I would like to thank all of them for attending.

It has become something of a tradition for the Underwood recipient to tell how the award was announced. In my case, I received a telephone message at home on a Saturday evening (April 16th) from Dr. Ted Finkelston. The cryptic message simple said "Jack, please call me, my nephew is interested in your chemical technology program. Needless to say, I was excited as always to have a new Chem Tech recruit and it is especially flattering to have a relative of a colleague. I returned Ted's telephone call the following day and upon explaining my enthusiasm about his nephew. Ted Finkelston laughed hysterically and stated that "HIS nephew would NEVER be interested in my chemical technology program. He further stated that he simply used that excuse knowing that I would return his call immediately. He then explained that I was the Underwood lecturer for 1994 and that I could tell no one else until the official announcement on Friday, April 22nd.

I was hired in 1970 by Dean David Underwood. I had seen an employment advertisement in the St. Louis Post-Dispatch for an "industrial chemist". I thought maybe Florissant Valley had a sewer or waste treatment plant with problems. I was employed at that time as a petroleum chemist with the Amoco refinery in Wood River. I applied and found that the college was interested in implementing a chemical technology program. With a $4000 annual cut in pay, I left the refinery on a Friday afternoon at 4:30 and began my teaching career the following Monday at 8 o'clock. I was very insecure in those days about my ability to teach. I had never taken any education courses and had no previous teaching experience. After only one year at Florissant Valley, I discovered to my shock that David Underwood's son was on my General Chemistry II roster. I had never taught this very difficult course and figured that my teaching career was over with a little Underwood in my classroom. Fortunately, Dan Underwood was very bright, he got an A and went on to Rolla to become an electrical engineer. My point in telling this story is to demonstrate David Underwood's commitment and confidence in Florissant Valley and the community college movement in general. I personally have had many of your family members in my classes and have always been flattered by this very special recognition. I see that several of those family members are in the audience today and I thank them for attending. I know that many of you have shared this same experience of teaching.
faculty and staff family members. There is no stronger testimony that can be offered as to one's confidence in an institution than to allow your children to attend it.

Since the Underwood announcement, several people have congratulated me and said they had heard my name many times, but did not really known me. That is quite common with many of us. Because we are located in thirteen different and detached buildings, we really do not have many opportunities to interact outside of our own departments. In reviewing the past Underwood lectures, I have enjoyed most, the personal thoughts and anecdotes of my colleagues. Some personal information about myself: I am left handed, I am not from Iowa, and I do have a twin sister named Jill. And since Ted Finkelston talked about heroes in his Underwood address, my heroes are Dr. Linus Pauling, Walter Cronkite, and Benny Hill. As is true with many community college teachers, I entered the teaching profession, as already stated, without benefit of any education courses or student teaching experience. My formal education consisted of a bachelor of science degree in chemistry and a masters of science degree in organic chemistry. I had spent the first seven years of my professional career as an industrial chemist which is certainly valuable experience for a chemical technology teacher, however this does not necessarily prepare one for classroom teaching. During my twenty-five year tenure at Florissant Valley, I have taught both college-transfer chemistry courses and chemical technology courses. I have also served as chemistry department chairperson, science division chairperson, and associate dean of the science, engineering, and technology division.

Recent studies have shown that the United States is losing its preeminence as the world's technological leader. Traditional science courses do not prepare students to enter the many non-science occupations or simply to become informed citizens dealing with daily technology. Conventional science courses also tend to neglect the needs and interests of the vast majority of students, the 90.4% who will not enter college and major in science, math, or engineering fields. The fact that nationally some 25% of all high school students drop out before graduating is perhaps a direct result of this perceived, irrelevant education. I wanted to do something to improve science education in this country, so in 1987, and at the age of 46, I returned to graduate school to pursue a doctorate in science. Fortunately, I became involved a National Science Foundation-funded science curriculum project. My dissertation was entitled "The Validation and Development of a High School Instructional Unit: called Rivers Chemistry." This instructional unit utilizes river systems (the Mississippi, Missouri, or any local stream) for the laboratory component in a thematic way to introduce and create an interest in high school chemistry. I am proud to report that over 300 high schools have used this instructional unit and telecommunications system (a modem and personal computer) to report and share their river data with hundreds of other high schools using a centralized electronic bulletin board at SIU. These students have an opportunity to investigate the real world in a chemistry class. In some cases, now documented, these students have actually improved the quality of their environment. One case occurred at Grafton High School, a group of chemistry students using the Rivers Chemistry modules, analyzed Elsah Creek specifically for nitrates, phosphates, and fecal coliform. Elsah Creek passes directly through the quaint little town of Elsah, Illinois. The students armed with their test kits discovered an excessive level of fecal coliform which would indicate the presents of human or animal waste. Upon tracing the pollutant upstream to its source, they discovered an improper sewer water treatment facility in a new subdivision. Needless to say, the Illinois EPA become involved and the situation was corrected. The students were very proud of their contribution to their community and hopefully found that science education is indeed relevant even to teenagers.
In chemistry, the highest recognition for a chemist is the Joseph Priestley Award. Prestley is credited with the discovery of oxygen in 1774. My comment here would be, who could not discover oxygen, you simply have to strike a match. All of the easy stuff in chemistry was discovered long before I got into this business. I am the 19th person to receive the Underwood Award and felt at first like perhaps I was a little late in this business as well, all of the easy topics had already been discussed. No actually, I am the most fortunate of all the Underwood lecturers. In reviewing the past presentations, I found a common concern, "What will the topic be?" I am the only Underwood recipient to have the lecture topic predetermined. Allow me to play a brief part of Sid Reedy's Underwood Lecture given last year.

BOB, PLEASE PLAY THE TAPE: Jack Ballinger has suggested the topic "virtues of Vitamin C"

Thank you Sid and by popular demand needless to say my topic will be Vitamin C and perhaps a little discussion on illiteracy.

SLIDE 1: VITAMIN C and ILLITERACY

In 1911, a Polish biochemist, Casimir Funk, coined the word "vitamine" based on his review of diseases induced by deficiency in the diet.

SLIDE 2: VITAMINE

"Vita" meaning life and the chemical term "amine" represents the nitrogen-containing groups normally found in the first vitamins that were discovered. Chemical analysis has shown that not all vitamines contain the amine group so these compounds are simply referred to as vitamines. To date, scientists have identified 13 organic substances that are commonly labeled as vitamines. Vitamins play a vital role in helping to regulate the chemical reactions that protect cells and convert food into energy and living tissue. Some vitamins are produced within the body. For example, vitamin D is manufactured in the skin during exposure to sunlight (orange color in slide exactly 500 nanometers for vitamin D synthesis). Three other vitamins (K, biotin, and pantotenic acid) are produced inside the human digestive system by resident bacteria. However, most vitamines have to be ingested. Many exaggerated claims have been made about vitamines from the ability to cure cancer and heart disease to improving your love life. Historically, most reputable scientists have chosen not to become involved in the vitamin controversy. Pharmaceutical companies do very little vitamin research because the potential profits are low since vitamin formulas are public domain and can not be patented. The medical profession in this country has not place a high priority on nutrition again perhaps because of low profit potentials. However, recent worldwide population studies have uncover a consistent link between diet and health.

SLIDE 3: DIET LINKED to HEALTH

A diet rich in fruits and vegetables has been associated with lowered incidences of cancer, heart disease, and many other diseases. Currently, most of the excitement about vitamines involves the antioxidants: vitamin C, vitamin E, and beta-carotene.

SLIDE 4: ANTIOXIDANTS

These nutrients appear to be able to defuse the toxic substances, known as oxygen free-radicals that are the by-products of normal cell metabolism.
SLIDE 5: FREE RADICALS

These free-radicals are also created in the body by exposure to sunlight, x-rays, ozone, and other pollutants. Many researchers now believe that these free-radicals damage DNA and kill cells outright causing cancer, heart disease, and even contributes to the overall aging process. Countries like Japan and Norway, where diets are rich in these anti-oxidant vitamins, have lower incidences of lung, colon, and other cancers. Ironically, there is no current Recommended Daily Allowance (RDA) for beta-carotene, but scientists speculate that 25 mg or more per day is needed. In 1993, the Food and Drug Administration actually lowered the RDA for most vitamins from being based on the needs of teenage boys to a more generalized population. In 1990, the U.S. Government issued some rather ambitious guidelines for a proper daily diet of fruits, vegetables, grains, and so forth. However, only 9% of American adults consume the recommended daily servings of fruits and vegetables according to the National Center for Health Statistics. Americans simple do not eat enough fruit and dislike vegetables. The most prominent examples: President George Bush who openly detested broccoli and described carrots as orange broccoli. And remember, Dan Quayle who couldn't even spell potato. The good news is that our view of supplemental vitamins is improving. The pharmaceutical giant Hoffmann-LaRoche is so enamored with beta-carotene that it is building a plant in Texas to produce 350 tons of this nutrient annually.

Vitamin-deficiency diseases like beri-beri, rickets, and scurvy have plagued the human race since the beginning of time. It is now known that vitamin B1 can prevent beri-beri, vitamin D can prevent rickets, and vitamin C can prevent scurvy. All industrialized countries supplement foods with these vitamins (enriched flour, fortified milk, etc.) For this report, Sharon Fox (reference librarian extraordinary) attempted to find the latest number of deaths attributed to beri-beri, rickets, and scurvy in the United States and the World. Upon calling the Center for Disease Control in Atlanta, she ask to speak to someone about beri-beri, rickets, and scurvy. The person replied "are those diseases?" Sharon found according to the Nutritional Surveillance Center in Washington D.C. that no federal agency tracks statistics on beri-beri, rickets, or scurvy because reported cases are almost nonexistent. In 1990, approximately 2500 deaths in the United States were attributed to all types of nutritional deficiencies. Ironically, statistics on these common deficiency diseases are not available from the plagued third world countries because they do not have the financial resources or expertise.

I would like to limit my discussion today to just one vitamin, vitamin C. Maybe I can return another year with another vitamin topic-NOT.

SLIDE 6: VITAMIN C

Vitamin C and ascorbic acid are both common names for the organic compound 2,3-didehydro-L-threo-hexano-1,4-lactone (See Figure 1). The real action in an ascorbic acid molecule occurs at the enol/keto grouping sites. Ted, it is probably best that your nephew didn't pursue this stuff. In 1937, Albert Szent-Gyorgyi, a Hungarian biochemist, was given the Nobel prize in Medicine for research on ascorbic acid (vitamin C). You really have to admire these early pioneers for their dedication and tenacity. For example, Dr. Szent-Gyorgyi worked meticulously for over a year to isolated and purified 25 grams of ascorbic acid from the adrenal glands of cattle donated from slaughterhouses. Dr. Szent-Gyorgyi would be delighted to know that in 1993, the United States synthesized and consumed over 16,000 tons of vitamin C with over 50 million people taking vitamin C supplements daily.
The history of scurvy and its causes is an interesting study in science, medicine, and accidental discovery. Scurvy is cause by a lack of vitamin C which can result in sore gums, tooth lose, hemorrhages, and even death. In 1795, the British Navy ordered a daily ration of lime/lemon juice for every sailor. Thus the name "Limey" for an English sailor. The Great potato famine that occurred in Europe between 1845 and 1848 involved vitamin C. The potato was the main source of vitamin C in the Irish diet and over one million people died directly from scurvy and scurvy-induced typhus because of their weakened condition. During the American Civil War, the Union Army reported over 45,000 deaths directly from scurvy and scurvy-induced diarrhea and dysentery. Deaths have even occurred from scurvy in this century, during the Soviet famine of the early 1930's an estimated ten million people died from various diet-deficiency diseases and starvation.

In 1907, two Norwegian researchers Holst and Frolich were credited with discovering the cause of scurvy, even though it was quite by accident. Holst and Frolich were studying the disease beri-beri using pigeons. The Norwegians needed a mammal but disliked the rat because they were regarded as infection-carrying pests. Dogs were being used in Germany and France for medical research but were expensive. The guinea pig had just been introduced as a popular children's pet in Europe and was found to breed rapidly like rats but were much cheaper than dogs. This rather arbitrary selection of the guinea pig for a beri-beri study was very fortunate. As it turns out, human beings and guinea pigs are about the only mammals that can not synthesize ascorbic acid (vitamin C) in their bodies. The guinea pigs quickly developed scurvy on this deficiency-diet designed to produce beri-beri and the relationship between scurvy and vitamin C was discovered.

In 1970, a Nobel prize-winning chemist, Linus Pauling wrote a controversial book entitled *Vitamin C and the Common Cold*. Linus Pauling has won two Nobel prizes, 1954 Chemistry and another for his world-peace efforts in 1962. Dr. Pauling took on the multibillion dollar pharmaceutical industry with his advocacy of "orthomolecular medicine." Pauling defines orthomolecular medicine as the preservation of good health by varying the concentration in the human body of substances that are normally present. Common colds are caused by many different bacteria and viruses. Ascorbic acid plays a vital role in the formation of collegens for white blood cells and the production of interferon which combats virus infection in the body. It is difficult to overdose on vitamin C, since it is a water-soluble and excesses are excreted in the urine.

In 1979, Pauling and a Scottish surgeon, Ewan Cameron, published yet another controversial book, *Cancer and Vitamin C*. The book presents evidence that vitamin C decreases the incidences of heart disease and cancer. Dr. Pauling takes 12,000 mg of ascorbic acid per day as compared to the 60 mg recommendation from the U.S. National Research Council. Pauling's recommended dose of vitamin C was determined from his research on the quantity of ascorbic acid that animals in natural settings (especially gorillas and goats) consume and synthesize daily per body mass. For those of you that might be skeptical of Linus Pauling's theory, I should mention that he is 93 years old, in excellent health, and is still quite active at the California Institute of Technology.

I have come to the conclusion that teachers are like vitamins and illiteracy is like a disease. I can demonstrate this relationship with ten observations.
Observation 1: There are some thirty deficiency diseases which affect the world’s population. Vitamin B\textsubscript{1} is necessary to prevent the deficiency disease, beri-beri. Vitamin D is necessary to prevent the deficiency disease, rickets. Vitamin C is necessary to prevent the deficiency disease, scurvy. Teachers are necessary to prevent the deficiency-based disease, illiteracy.

SLIDE 8

Observation 2: The cures for illiteracy and many other deficiency-based diseases are well known, but are not practiced in all populations, especially among the poor. Illiteracy and poor health go hand in hand. Ethiopia (a third world country) has a 90.7% illiteracy rate for men and an unbelievable rate of 99.5% for its female population. Approximately 250,000 children went blind last year in these third world countries simply because they lacked a sufficient supply of vitamin A in their diets.

SLIDE 9

Observation 3: A single vitamin table or short term dosages will not prevent diseases. Likewise a single exposure or limited quantities of teachers will not cure illiteracy. There are currently 3.8 million elementary, secondary, and college-level teachers in the United States. In 1994, the U. S. Department of Education estimates that approximately twenty-seven million adults are currently functionally illiterate and another forty-five million adults are marginally illiterate in general knowledge. This is not true throughout the world. Japan and Germany have illiteracy rates for both the male and female populations of less than 0.1%.

SLIDE 10

Observation 4: We expect too much of vitamins and teachers. Vitamins can not cure all diseases and teachers can not solve all of society’s problems. Dysfunctional families, drugs, gangs, violence, over-crowding, lack of financial support, and so forth tend to poison even the best teachers.

SLIDE 11

Observation 5: Not all vitamins are equal, some are ultra-pure (pharmaceutical-grade), some are generic and carry impurities, some are simply minerals and not effective as vitamins. Some teachers are indeed pharmaceutical grade, but others are nothing more than placebos, pretending to cure but actually doing very little. In addition, in order to produce better teacher, better credentials are needed. I am sorry to report that according to a recent SAT study, the bottom 25% of college students enter the teaching profession, not the top 25%. In another study and in my own discipline, the American Chemical Society reports that 67% of all high school chemistry teachers do not meet suggested guidelines. But what do you expect in a country where the average teacher earns $30,000 per year and the average major league baseball player earns $1.2 million and is out on strike for more.
SLIDE 12

Observation 6: Teachers, like vitamins are not appreciated until after the damage has been done. We take vitamins and nutrient for granted until an illness appears usually later in life. The public and politicians neglect educational needs until society's problems are enormous, then suddenly show concern. Many politicians have been elected on campaign promises to improve education and quickly forget this vital issue. Gambling has become legal in Missouri and many other states, with the promise to support the noble cause of education. As gambling revenues increase the amount of financial support to education has not followed as promised.

However, no worse example of political abuse can be found than with the Reagan Administration in 1986. An outstanding social science teacher from a middle school in New Hampshire was selected to demonstrate the government's appreciation for teachers. The rest of this story is a matter of history. Christa McAuliffe along with six other crew members on the Space Shuttle "Challenger" died. The space shuttle was launched at an inappropriate time weather-wise, but at an excellent time for publicity. This political attempt to demonstrate support of education is in many ways symbolic of our government's attitude toward education. Shouldn't we all be more concerned about an educational system that has a 25% drop-out rate.

SLIDE 13

Observation 7: Vitamins and teachers are desperately needed in this country and throughout the world. Teachers have prevent more diseases and suffering through education than all of the humanitarian aid, political rhetoric, and medical intervention efforts combined. Malnutrition continues to deny nearly one billion human beings in the world their basic human rights. Twenty million people died last year as a result of hunger and starvation. Again this situation can only be corrected through education (teachers). There is an old Chinese proverb that is appropriate here. "Give a man a fish and he eats for a day. Teach a man to fish and he has food for a lifetime."

SLIDE 14

Observation 8: The effectiveness of both vitamins and teachers is apparently still controversial. Not much research on vitamins is currently being done by the U.S. government, medical profession, or pharmaceutical companies. Likewise, there seems to be a great deal of disrespect for our educational system and teachers in general. Personally I am offended and find very little humor in the expression: "Those that can-do and those that can not-teach."

Everybody (politicians, retired people, industrialists, parents, and so forth) would appear to be better teachers than the professional teachers themselves. As a profession, if we are indeed that, we seem to be very tolerant. The legal and medical professions certainly do not experience as much disdain from the public. Having been sick does not make you a doctor or watching a couple of episodes of Perry Mason does not qualify you to be a lawyer. Why is it then that anybody who was ever a student knows more about teaching than the teachers themselves. One of my favorite comedians, Lily Tomlin, has a routine as a telephone operator. She is arguing with a person on the telephone and says "look! don't mess with me I am a high school
graduate." Everybody laughs. Does this make a statement about our educational system. I wonder if the Japanese, or Koreans would find any humor.

SLIDE 15

Observation 9: Vitamins like good teachers, especially science teachers, are difficult to synthesize or produce. According to the International Association for the Evaluation of Educational Achievement, United States test results in mathematics and science achievement have steadily declined since 1960. During this same period, achievement scores in Asia and Europe have been on the rise. One recent study indicated that by age 10, United States students ranked eighth among 15 countries with Japan, Korea, and Sweden ranked the highest. By the 12th grade, United States students who had taken chemistry, physics, and biology in high school ranked eleventh, ninth, and thirteenth respectively, out of the 13 countries participating in the study. By the way, students in the United States average 180 school days annually for 5.5 hours, while Korean students attend 270 school days for 10 hours.

Only forty percent of all high school students take a course in chemistry, while only 19 percent of all high school students take a course in physics. There is frequently an incorrect assumption that only certain children are capable of learning science. Some schools identify these students at an early age and track them into additional science and mathematics courses, losing many other potentially good science and mathematics students in the process. Female and minority students especially fall into this early tracking away from science and mathematics. In 1990, only 16 percent of all employed scientists, mathematicians, and engineers were women. Blacks and Hispanics each constituted about 2 percent of the scientific work force. Today only 7% of U.S. College students earn degrees in engineering as compared to some 22% in Japan. Last year, fifty-four per cent of all doctoral degrees granted in science, engineering, and mathematics in this country were to foreign nationals. Should we be asking the question, where is the next generation of vitamins (teachers) to come from?

SLIDE 16

Observation 10: Many elements must work together forming bonds to produce an effective vitamin. Likewise, many individual efforts are necessary to produce an effective teacher.

SLIDE 17: PERIODIC TABLE

There are some 107 elements now known that make up our entire universe.

SLIDE 18: GROUP PHOTOGRAPH

We have 364 full-time and countless part-time employees at Florissant Valley. This brings a whole new meaning to the term elementary education.

SLIDE 19

People like Dee Orr who truly personifies the excellent clerical help that we have. What a secretary, Dee can spell phenolphthalein and draw its structure if your interested.
SLIDE 20

Jim Campero in financial aids provides a service that helps our students to stay in school. This is a vital service, since poverty seems to be a prerequisite for many of our students. Jim, remember that student who was so poor that he could even pay attention.

SLIDE 21

My man, Milt Woody, who meets the students coming and going. Milt as the Registrar is one of the first contacts for these students and as director of commencement he is perhaps the last person to see them.

SLIDE 22

People in counseling like Pat Wedle who consistently provides academic advise and personal counseling to students really in need. Did you know that Pat Wedle and Joyce Brothers's brother went to different schools at the same time.

SLIDE 23

We should not neglect or forget elements like Gloria Milan in housekeeping that keep our buildings clean. We have this routine, I say "Gloria how is business" and she always response "it is picking up!"

SLIDE 24

And Gary Huffstutter in maintenance who can fix anything on this campus except a student's grades.

SLIDE 25

Special elements like Richard Booker in the campus police department who can give you a ticket or sing the national anthem, but never at the same time.

SLIDE 26

I am always glad to know that the campus nurse, Carolyn Davis, is standing by for any medical care. Carolyn has many talents, she once removed the appendix from a bad chemistry book for our department.

SLIDE 27

Indispensable services as found in instructional resources (which of course includes media services) and as personified by Sharon Fox. Sharon was so good at locating information for this presentation, that I just submit a request for the map to the Lost Dutchman mine.

SLIDE 28

I will admit that ever administrators in the form of Alice Warren and many others are necessary elements in this bonding process to abate illiteracy. Sorry about the bug analogy,
but Ted Finkelston said that it would be funny!

SLIDE 29

My friend Florence Eagaini (queen of the bean counters) in our business office who keeps us all from becoming encumbered. What ever that means Florence?

SLIDE 30

I must recognize fellow teachers like Roy Pearson, the Pied Piper of the math department. Roy has a greater following than Ross Perot use to have. I would be remiss if I neglected the past Underwood recipients at this point and would ask them simply to stand and not give a speech. I wanted this audience to see what pharmaceutical-grade teachers look like.

Mike Marty (1976)  Carol Edwards
Ron Eldringhoff (1977)  Emily Liebman
Gladys Thum  Ken Boyer
Marvin Barnum  Stan Kary
Lea West  Carolyn Davis
Jim O'Grady  Carl Bruns
Bill Miller  Jeanette Kimbrough
Pete Kellams  Ted Finkelston
Ken Smith  Sid Reedy (1993)

Folks, I could have mentioned another 320 individuals, but I am already run overtime.

SLIDE 31  FVCC GRADUATES

During my twenty five years at Florissant Valley, these elements known generically as Florissant Valley staff, faculty, and administrators have taught 90,623 students and produced 18,305 graduates, including 301 world-class chemical technicians.

SLIDE 32  VITAMIN C stands for COMMITMENT

Like vitamins, you have cured a deficiency disease - ILLITERACY. Vitamin C stands for COMMITMENT.

This last slide is a picture of as gift that I have for each of you.

SLIDE 33  GIFT

It is a vitamin C table and a used piece of Florissant Valley chalk humetically sealed in Florissant Valley air and dated to remind you that You do make a difference. Sherryl Ruder has agreed to hand these out in the lobby somewhere near the orange juice. I hope that you find 1994-95 to be a very productive year in your continuing battle against illiteracy. Thank you.
ASCORBIC ACID
(VITAMIN C)

FIGURE 1