

# The Synthesis of Effective Learning

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## Introduction

"It is nothing short of a miracle that modern methods of instruction have not yet entirely strangled the holy spirits of curiosity, imagination and creativity."

Albert Einstein

This text required 32 years of preparation and even though never to be complete, I am pleased and appreciative for having this opportunity to share it with others. Furthermore, I am honored to be among such sophisticated company as a professional communicator from my own undergraduate alma mater, and a university President who at one time roamed the same Illinois academic prairies where I first encountered pedagogical perils and pleasures.

This is a humbling experience for which I feel terribly inadequate, but in the same breath, consider it a challenge of paramount dimensions and one I plunge into with reckless, blind abandonment with hopes that we will all be the richer for having had the experience. And if I should get too carried away with the remainder of my thoughts, I consciously remind myself by sharing with you those sobering words by Louis Lasagna in Houston Peterson's text of *Great Teachers* (1946), in which the ideal teacher is so thoughtfully perceived,

"Does it seem too far-fetched to picture the young Helen Keller as the symbol par excellence of every student that ever lived? We are all Helen Kellers in some degree – vision beclouded, ears indiscriminating, speech uncertain and untrue. We have all needed at one time or another, to have truth spelled out slowly for us, to have our capabilities redefined and reevaluated, and the limitations of our sensations and perceptions suggested. It is no mean epitaph for any teacher to have it said of him that 'He rendered all whom he taught less deaf, less dumb and less blind.'"

I have divided this presentation into four parts. The first identifies a formula and a flow sheet for isolating effective learning. The second outlines some views I have collected about the various functions related to the day-to-day transformation of thought. The third includes several chosen thoughts I am convinced will set you apart from the average teacher. The last provides an accumulation of seven approaches of transferring thought that I call "Pedagogy Personified."

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*Reciprocal Meat Conference Proceedings, Volume 42, 1989.*

## This I Believe . . . and Profess About Teaching

### On Motivation

- A. Know the student.
  1. Use student profile sheets with photographs.
  2. Visit with students to let them know you're human.
  3. The teacher is working for the student, not vice versa. (They have invested time, energy and money, therefore they should demand and receive a good education.)
  4. Ask questions in class.
  5. Maintain subtle, sophisticated humor. Don't ever let things get too serious and complicated.
- B. Demand perfection but don't always expect it.
  1. Develop a written plan of attack in advance so students know exactly what is expected: schedule of subjects, assignments, testing, etc.
  2. Always review material, ask for questions, and welcome them.
- C. Know the subject well.
  1. Minimize on use of notes, if possible.
  2. Use research as it fits to relate current findings.
  3. Select a good text or don't use one.
  4. Unravel subject as a story rather than a smattering of facts.
  5. Maintain eye contact with students and continually test the student's reactions and environment, watch for signs (drowsiness, disinterest).
  6. Expect students to read assignments. Review it and include your impressions and concerns but don't repeat it as such. The classroom is a place to raise controversy, solve problems and misunderstandings and resolve difficulties, not to spew out facts in a neat package and then close shop.
  7. Don't try to cover everything that's known, it's impossible.
- D. Use a variety of methods to transfer thought.
  1. Use movies, slides and handouts with care and planning; don't overkill: a) preview first and don't waste students' time with junk, b) check all available sources and keep up with new ideas.
  2. Blackboard artistry. Learn to write clearly and neatly, learn to draw proportionately, but if you can't, at least make it clear – the message is paramount.
  3. Field trips can be excellent or terrible, depending on the planning and purpose.
  4. Develop special projects to involve students.
  5. Provide laboratories to demonstrate ideas and principles.
  6. Every teacher should write or attempt to write a text. It makes them cognizant of organization, stimulates their imagination, and makes them more appreciative of what's already available.

## E. Develop showmanship.

1. Act interested about the duller of subjects.
2. Speak on a one-to-one basis – even if there are hundreds in class.
3. Move about.
4. Use stories to relate a principle, fictional or real-life.
5. Treat every student equally, constantly guard against biases, favoritism, etc. (Try to overlook appearance, mannerisms, criticisms.)
6. General appearance can help – neat, clean, hair combed, etc. Sometimes informal appearance may be better. Whatever you do, be natural, not superficial. Be yourself.
7. Use quotes to start things off. Maybe about subject or maybe about something more general that reflects on life, on education, etc. Campbell's book "*In Touch with Students*" is full of ideas.
8. Make learning fun by challenging students to excel and still have fun in the process.
9. Be pleasant, courteous and considerate, even when you don't want to be.
10. When you don't know an answer to a question, be honest and admit your limitations rather than bluff through it (they generally won't know the difference, but a bad answer will come back to haunt you like a bad check).
11. Develop a creative imagination to continually discover better ways to teach. There are always better ways and they should never go untested.

**On Testing**

## A. Develop a philosophy as to what it should do.

1. Measure student's progress in understanding.
2. Measure teacher's performance in transferring thought.
3. An experience in learning itself.
4. Just prior to exam, be ready to review material with students.
5. Testing should be done often – a small dose to keep students and teacher on track. (Depends on size of class and how tested.)

## B. What a test should include.

1. Variety such as essay, true or false, matching, identification, fill in the blank, editing incorrect information, problem solving. (Combination is best).
2. Should they be able to answer everything correctly? Generally, no, not even the best students. If so, the challenge isn't great enough.
3. Should they be able to finish? Yes, but not always.
4. Should they be permitted to omit portions? Yes, on a limited basis, especially when there have been several persons involved with teaching.
5. Types of situations.
  - a) written exams
  - b) practical lab exams
  - c) oral exams (limited to small classes)
  - d) combination will give everyone a chance. (However, good students do well on any type of exam and the same is true for poor students doing poorly.)
  - e) If possible, lecture and lab exams should be

combined to emphasize totality of course (all parts should fit together).

- f) right minus wrong grading (generally, I don't recommend because it's too stressful. It may be desirable on a portion of the exam.)

## C. Types of questions.

1. Minimize memorization. Most of it will disappear sooner or later.
2. Maximize on questioning the student's ability to think and demonstrate an understanding of subject material.
3. True or False (if false, tell why). Don't leave it in a black or white situation because many things are gray if the students are thinking clearly.
4. Multiple choice. Experts claim they are so difficult to write that one should avoid them because they tend to leave hidden meanings, or not whole truths in all answers.
5. Matching (more answers than necessary, always use "none of the above").
6. Clues can be fun and also challenging and motivating.
7. Crossword puzzles, fun but very difficult to compose (some students are afraid).
8. Oral. Can be nerve-racking for students. They can express themselves in a new dimension that will emphasize strengths and weaknesses.
9. Practicals. Identifying, working problems, testing material are especially good for labs.

**On Grading**

## A. Philosophy

1. Grading is very important as it curbs mediocrity, demands perfection, is challenging and it establishes a goal of excellence to pursue.
2. It can sometimes be overemphasized and will miss point of learning.

## B. Method

1. Establish the characteristics of each class based on previous classes. Is it average, above, or below?
2. Establish a standard that is acceptable.
3. Consider the subject and why students are enrolled (most courses I teach are passable by all if effort is provided). Therefore, don't assume the standard curve which suggests that average is C and there will be A's and F's.
4. Consider difficulty of examinations. When doubtful, express average scores as % of high mark and consider both % of total points and % of highest score.
5. The amount of emphasis placed on each part that makes up final grade is not as important as is variation that occurs in each part, (i.e. a test contributing 15% of weight may spread students more than another test contributing 25%). Don't lose sleep on a % each test is worth.
6. Except for special circumstances, the A grade should be reserved for your outstanding students.
  - a) one should first decide what an average grade should consist of, C or BC, etc.
  - b) decide subjectively what highest and lowest

scores should be and let all the rest fall between on a % basis.

- c) must then draw lines for grades in between.

### On the Use of Computers

- A. Make them work for you, not dictate your program.
- B. Opens up a new dimension of what can be handled in adverse circumstances (large numbers of students, many calculations, limitations of time, minimize errors).
- C. Uses.
1. Simulated projects such as:
    - a) testing genetic affects
    - b) probability problems
    - c) future trading
  2. Scoring daily exercises.
  3. Providing printout quickly for feedback to students (market animal evaluation).
  4. It provides a tool for students to analyze data for projects: analysis of variance, regression analysis, graph production, etc.
- D. Problems.
1. Need a good programmer for special needs (don't need for routine statistical programs).
  2. Time consuming to develop a useable program.
  3. Students must know computer capabilities and limitations.
  4. Bad in – bad out.
  5. Changes create errors.

### On Special Experiences

- A. Projects can be used with advanced students to culminate a college experience.
1. Answer a practical problem.
  2. Experience compromise.
  3. Opportunity to apply information learned in lecture and laboratory.
  4. Disadvantages include
    - a) students become independent and may procrastinate
    - b) time required of instructor is high/student
    - c) sometimes requires extra financial aid
- B. Special problems, not for everyone.
1. They expose individuals to experimentation.
  2. Student should be inspired and come to instructor with interest and ideas.
  3. Ideas can be generated by instructor, but shouldn't encourage all students to participate.
  4. For some students, it is better to take an organized course rather than to flounder with a special problem.
- C. Field trips should be supplements, not substitutes.
1. Limitations. They are time-consuming so they'd best be well planned when possible. Limit student travel, bring things to students if possible because:
    - a) higher % of time can be spent on problem
    - b) fewer other classes are missed
    - c) expenses are minimized
    - d) conditions are usually better
  2. Musts for a successful field trip.
    - a) Should represent principles, ideas, objects not

available in classroom.

- b) Should relate to an environment of importance not available in the classroom.
- c) Thorough planning in advance.
- d) Recording of interviews to: review trip and discuss misleading and controversial points; and supplement and emphasize parts in future lectures.
- e) Provide for adequate time at each stop to permit for complete, uninterrupted discussions. Teacher should be prepared to monitor the pace and be ready to ask questions at low points, to encourage students to ask questions.
- f) Schedule field trips in latter part of course so students have adequate background.
- g) They should not be exhaustive.
- D. Internships. Not for everyone but another kind of experience to expose students to an industry they may become a part of, and to expose industry to the student (job possibilities). Problem: some students may ruin program for others because of poor job. Recommendation: students initiate the internship, not advisor or teacher.
- E. Special group projects in lab.
- F. Involve students in state-wide projects that permit exposure to the real world.
- G. Competition, every course should have it.

### On Advising Students

- A. Don't try to take the place of their mother or pastor.
- B. Be available, but don't be their slave.
- C. Students can demand and take a lot of time. Be aware of this and get at the problem.
- D. Cut through red tape by making appropriate calls to the University administration that will get quick answers for students.
- E. Create an atmosphere that makes the student feel welcome. Have them call you at home if necessary.
- F. Beware of problem students that have deep trouble beyond your capacity to help.
- G. Help with job hunting but don't feel obligated to insure they'll get one.
- H. Advise student to drop school or change departments if need arises (difficult when department wishes to increase numbers).
- I. Set the record straight early by calling all advisees together and explain to them how you operate.
- J. Invite students to your home to get to know them better and to draw out problems – do this on a group basis so new and old advisees mix.
- K. Don't be afraid to get tough and set things straight if you anticipate problems.
- L. Call a spade a spade when evaluating your advisees as well as other students applying for jobs. Tell it as it is and don't look through 'rose colored glasses.'
- M. Recommend courses with good teachers as well as or in lieu of good subjects.
- N. Continually poll students about desirable and undesirable courses (however, sometimes their opinion may have severe limitations).

### On Training Graduate Students to Teach

- A. Require that all graduate students have some teaching experience.
- B. Develop an attitude that the assignment is a challenge rather than an uneventful duty.
- C. What to do:
  1. Recognize that all graduates may be thrust into teaching soon after receipt of their degree.
  2. Realize that many students are not born educators.
  3. Provide some practical advice by scheduling special seminars.
  4. Have students sit in on courses to evaluate and obtain ideas.
  5. Send students to hear and see both good and poor lectures and labs.
  6. Don't overwork, make it a challenge but don't strap them with a whole semester.
  7. Go over the plan ahead of time and let them design a lab, with guidance.
  8. Let them start with a subject of interest and familiarity.
  9. Let them help design and grade exams.
  10. Evaluate their performance.

### On Improving Laboratories and Minimizing on Expenses

- A. Laboratories exist to:
  1. Extend, supplement, demonstrate and discover principles, ideas, and concepts already provided in lectures and text books.
  2. Introduce skills and techniques that can't be taught as affectively by other methods.
  3. Motivate the students to maximize their learning potential. Virgin hypotheses aren't taught, they're conceived through laboratory experiences.
  4. Teach students to be good observers and how to conduct an experiment.
- B. A quality laboratory should:
  - Link the lecture to the laboratory.
  - Allow for adequate organization (before, during and after) and supervision.
  - Benefit the student by demonstrating and discovering principles and methods.
  - Organize procedures to permit a "reasonable" pace.
  - Require relevant and realistic information.
  - Attempt to deal with deductive reasoning.
  - Tempt and motivate the imagination and initiative of the student.
  - Obligate instructor to be selective in course content.
  - Require continued update of procedures that are provided in advance.
  - Yield educated and inspired students that are good observers.
- C. Fourteen suggestions that may improve the laboratory, and that minimize expenditures and appropriated assistants (extra teachers) at a time of increasing enrollments.
  1. Examine the objectives and critically and unbiasedly evaluate if a lab is necessary. What are the alternatives and the consequences if selected? Don't be a victim of tradition and a creature of habit! Does the lab motivate rather than malign? Supplement rather than sabotage? Teach techniques rather than toy with trivialities? Will pictures and demonstrations satisfy the needs? Perhaps, and if well done, can substitute for some labs.
  2. Reduce number of laboratories to the necessities. Don't pad up to the number available in a whole quarter or semester if less will suffice.
  3. Don't expect perfection. When it's an introductory experience, much time can be wasted in setting goals ridiculously high.
  4. Decide what a maximum number of students/lab is that will maintain maximum net educational return. Set up new sections or limit enrollment because there's danger of diluting too far and creating a catastrophe. Don't kid yourself that the addition of five more can't hurt, because it could wreck it for the rest.
  5. Encourage free-loaders to drop the course if they disrupt the lab and simply fill vacancies but have little if any interest in learning. (A touchy solution to a knotty problem.)
  6. Seek grants within college, university or from national agencies such as NSF for support to take time off to improve teaching techniques and to obtain equipment.
  7. Establish group or team projects to replace individual exercises to economize on supervision.
  8. When facilities (equipment and/or space) are limited, develop opportunities for individually scheduled laboratory times so that students' time, lab equipment and space can be used efficiently.
  9. Select appropriate experiments and exercises that give dramatic results to maximize the transfer of thought.
  10. Develop your own laboratory notebook and update it often. This minimizes expenses for students and encourages continual revision and use of current information.
  11. Whenever possible, don't grade laboratory exercises and notebooks, spend the time discussing what should be done, how it should be done and what the results imply. Use written and practical examinations for evaluation. In my opinion, grading 'canned' laboratory manuals is an exercise in futility.
  12. When many laboratories are involved, prepare prelab video tapes (if equipment is available) to standardize all information needed prior to starting an exercise or experiment.
  13. With careful selection, use upper-class undergraduates who have completed the course. Establish special problems or internships for them. One problem is that there are a limited number of such qualified students.
  14. Don't be hesitant to seek advice of others on campus who have devoted much of their professional life to the establishment of quality laboratory experiences.

## On Interacting with the Administration

### A. Genesis

Teaching and research must be united so that each of them will experience a meaningful and long-range success. Teaching must be recognized for what it is by careful evaluation and supervision by an administration that is willing to pursue, promote and support programs that are alive, attractive and challenging. Then, teaching will be treated with genuine responsibility and will be considered a privilege rather than a disappointment in the professional life of the teacher.

### B. Exodus

The following ideas and suggestions are ones that will help reward good teaching and stimulate good teachers to grow and continue in their ability to convey information and transfer knowledge and wisdom to the students they interact with.

1. Don't let a potentially good teacher rot on the vine. Research programs supplement teaching, and vice versa. Research is the air supply, blood flow and the feeding intake that perpetuates the heartbeat of creative teaching. Research maintains and updates the teacher's specific background expertise. Conversely, teaching keeps research honest and useful and stimulates new ideas, new ways of thinking and beckons new questions about old subjects.
2. Administrators should and must insist on "living teaching programs" that are continually evaluated and re-evaluated to keep up with the times. They must look beyond the superficially satisfied student who appreciates easy assignments, clever stories, no exams and high grades. Just how creative is their teacher? Do they challenge? Do they provide the battleground for debate and re-evaluation of the facts and fancies? Do they stimulate thought? Are they continuously struggling for better approaches, more opportunities, greater accomplishments for the sake of knowledge and understanding and wisdom?
3. If there are good teachers in the flock, don't let them do it all. Don't burn them out. Pass it around and let all sit at the pools of privilege and satisfaction which is the prime reward of teaching. Let it never be said that there is not enough teaching to go around. Give everyone a piece of the action. Provide a challenge and opportunity, not an assignment and chore.
4. The administration must not overdo it to the extent of de-emphasizing research and the programs that strongly supplement teaching. The pendulum can swing too far in either direction.
5. Teaching may be an art but it can be an accomplishment all can enjoy and thrive on. If the teaching program is conscientiously developed, then it's a profession that can get better with age, if aged properly. Formal education courses won't make great teachers, but it is the alert, smart, clever scientists that are a bit nutty who can really carry the mail. They know their stuff; they know they know their stuff; they are perfect and they expect perfection; and they live their subject. What better ingredients would one want, unless we might throw in a dash of

controversy, a pinch of antagonism and then stir in a pile of enthusiasm so that students will think it's the greatest dish they've ever relished?

### C. Revelation

If administrators and teachers alike would give some thought to this, then teaching would not only survive but flourish. It would become a joy for the teacher to teach and the administrator to administer. It would provide an environment in which students will crave to learn and develop wisdom and knowledge. The poor teachers will improve and those that don't will quit. The good teachers who excel at their profession will thrive even more and will look toward tomorrow with greater enthusiasm, greater expectation, and be glad that they are teachers.

## I Dare You to Refute These Generalities

- A. Learning is an experiencing process! Therefore, use a variety of ideas and approaches to breathe life into their experience.
- B. Don't assume that students know how to effectively solve problems. If you expect them to solve problems, then it's productive to lead them through logical sequences of events that serve to exemplify your approach. Such items as understanding and identifying the problem, knowing the facts and principles and recognizing reasonable solutions are crucial.
- C. Develop acronyms and clever clues when helping students remember important facts. I still remember the 10 essential amino acids because Al Jensen told me about "Pvt. Tim Hall" more than 30 years ago.
- D. There is always a better way to transfer thought. As long as you believe this and are willing to give yourself some time to use your imagination and be creative, it's likely the learning process will improve. The teacher usually profits as much as the student!
- E. Each time you start preparing, treat the subject as if you've never taught it before and make every effort to replace less desirable material, as well as methods to convey the material, with new, more worthwhile and exciting information and approaches. Continue reminding yourself that there's always too much to include, and asking yourself, "just what does the student need to know most – now?" When you examine the student, always ask too, "What ideas, concepts and information should have been understood and retained?"
- F. Provide opportunities for more cooperation and less individual isolation for experiments, problem-solving and examinations. This will better prepare the student for the real world.
- G. A picture, example or demonstration will nearly always excel over an isolated explanation. Continually search for these because they will quickly and efficiently transform words into realities.
- H. I've been severely criticized for my coordinated approach to education. Some say I'm always getting others to do my work! I believe the pooling of people's knowledge and ideas for a specific task, subject or project is more productive and more interesting for both students and instructors involved. Coordinating learning activities

WELL is difficult, but will reap unlimited rewards.

### Pedagogy Personified

As quoted from John Campbell's *"In Touch With Students,"* "People seldom improve when they have no other model but themselves to copy after," therefore, we must "place the petty jealousies and vested interests of individuals and groups aside and give all our attention to the best interests of the student." Now, "there are three kinds of teachers; those you listen to, those you can't listen to and those you can't help but listen to." The seven I have chosen for this exercise are ones that deserve your attention.

Why seven? Well, it took God seven days to create our world, there are the seven wonders of this world, there were the seven heroes and seven wise men of ancient Greece, there were seven hills on which Rome was built, there were the seven deadly sins, the seven basic food groups, the seven dwarfs and even the seven-year itch. Now, I'm not suggesting that my colleagues are wonders of the world, heroes, wise men, sinners or even dwarfs. However, they are teachers representing seven virtuous approaches that include SHOW, SIMULATE, SIMPLIFY, SWAY, SUGGEST, SENSITIZE and SUPPORT. They are teachers possessing an ability to transfer thought in this unique and effective manner.

I asked each teacher to represent the one "S" I thought he would do best. The presentation was restricted to a maximum of three minutes, and I would need the video tape by May 25. I was both amazed and pleased that all seven still agreed to assist, and I sincerely thank them.

### Show

The first approach is to SHOW students. What better describes this than the modified Chinese proverb, "One demonstration can be worth a thousand words." Here's Bruce Marsh to discuss thaw rigor. See what happens.

*Dr. Bruce Marsh, University of Wisconsin, Madison*

We've talked about cold shortening and the great effect it can have on meat tenderness. Now there's another sort of post-mortem shortening that can also cause tenderness problems. It's called thaw shortening and it takes place much more quickly than cold shortening so it's rather easy to demonstrate. It occurs when we freeze muscle early post-mortem during the prerigor period and then thaw it quite rapidly. During this fast thawing, calcium is released and triggers a contraction that re\_\_\_\_\_ 60% or 70% of the muscle's original length.

To show this thaw shortening in the space of a minute or two, I've prepared several frozen strips of muscle. Some of them were taken a few minutes post-mortem from one neck muscle of a steer and the others were taken the next day from the other neck muscle of the same carcass. All of them were frozen quickly as soon as they had been prepared. I'm going to thaw them all at the same time in water and you'll soon see which

were frozen prerigor and which were frozen only after rigor onset.

This demonstration works best if the water temperature is around the mid 30°C, around about 35° is fine; and the muscle strips ideally, to show the full effect, ought to be about pencil thickness. I'm going to lower them into this 35° water and I'd like you just to keep an eye on what is happening in the course of the next 30 seconds or so. If we make the strips much thicker, of course, they're going to take longer to thaw; if we make the water too cool, it is also going to take longer. So this particular combination (pencil thick samples and water at about 35 or 36°C) is usually optimal to demonstrate the effect.

There's not much doubt at this stage as to which two samples were frozen in the prerigor state. They are going through quite enormous contortions as the contraction occurs, perhaps more on one side of the strip than on the other, and already I would guess about a 50% shortening relative to the controls. Well, you can imagine the effect if this happened on a large scale, as it can do with very fast freezing conditions and early post-mortem freezing. The distortion alone would be quite dramatic on the cut of meat; if in addition the toughness increased appreciably, it could be quite a devastating effect.

### Simulate

Next is to SIMULATE for students. As one author suggested, "A wisely chosen analogy is almost essential to fasten the truth upon the ordinary mind; no teacher can afford to neglect this part of his or her preparation." Here is bashful Howard Swatland to cleverly and quickly simulate a T-tubule as it might structurally relate in muscle. It's interesting to see how useful a balloon can be!

*Dr. Howard Swatland, University of Guelph, Ontario, Canada*

This is a transverse section of skeletal muscle at high magnification made with the electron microscope. You can see a transverse tubule pushing into the interior of the muscle fiber from the surface. Transverse tubule is rather like a finger pushed into a balloon. It carries the surface membrane deep inside the muscle fiber where it can conduct action potentials to turn on contraction.

### Simplify

Ralph Waldo Emerson once said, "A teacher like an author is never successful until he has learned to make his words smaller than his ideas." How often it is that a student simply doesn't understand a concept. Marion Greaser has skillfully developed a table that assists him to SIMPLIFY how four myofibrillar proteins interact as they are involved in muscle contraction. Note the clear, precise nature in which Marion carefully leads students through this complicated maze.

Dr. Marion Greaser, University of Wisconsin, Madison

Today I'd like to talk about the calcium regulatory mechanism of muscle contraction. We know that in muscle, calcium is involved in activating contraction. When the calcium ion concentration reaches about  $10^{-5}$  molar, muscle contracts, whereas if it is lowered down to  $10^{-9}$  molar the muscle is relaxed. There are four proteins that are involved in this mechanism of contraction, myosin, actin, tropomyosin and troponin. In addition, the troponin is composed of three subunits, troponin T, which is involved in binding troponin to tropomyosin, troponin C, which binds calcium, and troponin I, which inhibits the actomyosin ATPase.

We can study the interaction of these proteins by mixing them together in the test tube and measuring the rate of ATP splitting. ATP splitting is high in the presence of calcium and muscle and it's very low in the absence of calcium. In the table that's shown, we've made various mixtures of the different contractile proteins. There are two columns, a + calcium and - calcium corresponding to the  $10^{-5}$  molar calcium and  $10^{-9}$  molar. We've also normalized all of the values to that of myosin and actin alone. As you can see, with just myosin and actin, both in the presence of high and low calcium, the ATPase activity is about the same.

If we add tropomyosin or troponin alone to myosin and actin, we find no change in calcium sensitivity. However, if we add troponin and tropomyosin, we have a strong increase in ATPase activity in the presence of high calcium and a decrease in ATPase in the absence of calcium. We can look at the effect of the different troponin subunits also in this system. If we add troponin T or troponin C alone, there is no effect on the ATPase activity. However, if we add troponin I alone, we have a strong inhibition both in the presence of high and low calcium. We can also make combinations of different pairs of troponin subunits. The troponin T troponin C combination is just like troponin T or troponin C alone. Troponin T + troponin I behaves like troponin I did. In other words, strong inhibition both in the presence and absence of calcium.

The troponin C + troponin I complex though, results in an abolition of troponin I inhibition. If we mix the three troponin subunits together, it results in a high ATPase activity in the presence of high calcium and a very low ATPase activity in the presence of high calcium and a very low ATPase in the absence of calcium. This mixture of the three subunits is just like the original troponin. This shows that we can fully reconstitute the activity in a functional form when we mix the three subunits together. This table demonstrates the utility of using an ATPase assay to look at protein function and the mechanism of calcium regulation in muscle.

**Table 1. Aspects of meat quality to measure on-line.**

| PROPERTY     | MUSCLE                 | FAT                 |
|--------------|------------------------|---------------------|
| Color        | Myoglobin content      | Carotene content    |
|              | Residual hemoglobin    | Residual hemoglobin |
|              | Paleness-darkness      | Translucency        |
| Fluid status | Water holding-binding  | Melting point       |
| Structural   | Tensile strength       | Layer adhesion      |
|              | Firmness-softness      | Firmness-softness   |
|              | Fascicular size        |                     |
|              | Gristle content        |                     |
| Chemical     | Marbling fat           | Volatile substances |
|              | Flavor components      |                     |
|              | Residues               |                     |
| Pathological | Muscle degeneration    | Adipose pathology   |
|              | Parasites              |                     |
|              | Microbiological status |                     |

### Sway

SWAYING or persuading or even daring students to learn more requires considerable imagination and much enthusiasm. Ralph Waldo Emerson has also told us that "nothing great was ever achieved without enthusiasm." Here's Gary Smith to catch us up in this approach. Notice Gary's eye contact, deliberate voice control and friendly, humorous 'homespun' manner as his persuasion unfolds.

Dr. Gary Smith, Texas A&M University, College Station

The third issue is antibiotics, and I do need to tell you that I gave a series of talks to women who are married to men in the feedlot business in a Texas cattlefeeder association and I was asked to go out and talk to them about why your husbands pump animals full of chemicals. Is it because they are cold and crass and cruel and commercial and just want to make a buck, or is there really some reason that they do these things? And so the first thing I talk to them about is antibiotics.

I say that if you put a group of animals in a pen and they've been used to eating grass or milk, and all of a sudden you feed them a bunch of grain, they get a big-time tummy ache. They have acid that builds up on the inside of their stomach, and pretty soon that acid will eat a hole in the side of stomach and bacteria escape over into the bloodstream. When that occurs, the livers abscess, and boy, that animal is big time sick. He doesn't feel very good. What do we do as human beings? We come home from a party like that and say "bring me the bromo!"

You know, cattle can't tell the guy that runs the feedlot, "I've really got a problem with acid indigestion." So what we've done over the years, we've put a buffer in the ration to try to ameliorate the pH difference and then we've put a real

low level of antibiotics in the ration so that if any of those bacteria escape through that ulcer and get over in the bloodstream, that antibiotic killed them and it didn't instead go over to their liver and create these big old pus pockets. So why we use sub-therapeutic antibiotics, is because it helps us with footrot, bacterial diarrhea, and it helps us prevent liver abscess. Sure, sure it increases average sale gain and feed efficiency, wouldn't you imagine it would if you did have this versus didn't have this in your liver? Are we doing that just simply because we want the money. NO!

### Suggest

The fifth "S" stands for SUGGESTIVENESS. Perhaps the words 'subtle' or 'clever' are more appropriate because Dave Topel very uniquely lets students know what he believes to be true about the virtues of livestock judging – without ranting or raving. Confucius once said, "The essence of knowledge is, having it, to apply it." Listen carefully as Dave leads us to his views.

*Dr. David Topel, Iowa State University, Ames*

Greetings to each of the participants of the Reciprocal Meat Conference. A few weeks ago, Dr. Bob Kauffman called me at 11:30 Saturday evening and asked if I would help him out and do a three-minute tape on provocative examples of instruction. I decided to accept his challenge. I went to the meat laboratory and made an eloquent presentation on provocative methods of meat judging and livestock judging. When I finished, I realized it took 18 minutes.

Well, we had to reduce this down to three minutes and use a different approach and I decided I would use a different teaching aid than I've used in this example here, so I scouted around the Meat Lab at Iowa State University and found a good example of modern steers, Choice steers, Prime steers. So we brought this example into the classroom and I'd like to discuss with you at this time some outstanding features of Choice and Prime steers illustrated on this chart. You'll notice the trimness and the conformation of Prime and the Choice steers. As we move down in the lower grades – oh my goodness. I realize now that this is an example of the modern steers in 1920. As a matter of fact, this is the first chart produced by the USDA when they established the grading standards for Choice, Prime, Good, Standard and Utility steers.

Oh well, as we look at these steers, you see that they do have the same characteristics as the modern steers in 1989, and it reflects that in judging we've made the complete cycle, and what was modern in 1920 is modern in 1989. We've made many changes in the composition of animals in this time period, but probably had little impact on improving the composition of

meat-producing animals. I notice that my time is up, I have to say so long now, sorry I couldn't be with you today, but I'm committed to judge a pork contest in Madison, WI later today. Have a good conference, So long.

### Sensitize

What is more important than for a teacher to be SENSITIVE to students' needs, and to recognize how to go about the process? Joseph Pulitzer said it well, "Put it before them briefly, so they will read it; clearly, so they will appreciate it; picturesquely, so they will remember it; and above all accurately, so they will be guided by its light." Notice how Dick Warren is serious but SENSITIVE and sincere in outlining his expectations, and how he uses others' names to reinforce the importance of the subject. His no-nonsense approach attracts attention.

*Prof. Dick Warren, University of Nebraska, Lincoln*

You're juniors and seniors in agriculture here at the University of Nebraska. You've gone through the sorting gates of mathematics and chemistry and English, science and perhaps humanities. Further you've invested \$55 per credit hour in this course, and I expect you to be serious; and I think with that commitment, you expect to be serious.

If you say "well, is this course any good," you might check with past governors of Kansas or Nebraska, or perhaps Dr. Clayton Yuetter, the Secretary of Agriculture under President Bush, he got three degrees at the University of Nebraska, Animal Science, law degree and Ph.D. in Agricultural Economics. He thought one of the most important courses he had was Livestock Judging.

This course has been more stressed towards horse evaluation, and perhaps your earlier experiences involving animals had to do with hip heights or wither heights; that was important, or maybe it was ears, or inside gaskins. But now we expect to give you more information; and to continue this judgment, we expect you to have better judgment, because of the more information you have.

Someone in China once said "tell me and I'll forget; show me and I may remember; but if you involve me, I'll understand." We expect to involve you in a lot of written and oral reasons in this course. We expect you to be better writers and better arguing people, and decision makers because of these exercises. I expect you to pledge yourself to "I can change," and I think you will change. For instance, a 1000-lb horse will carry 600 or 650 pounds on his front legs. Because of this, 90% of his unsoundnesses will occur from his knees down. With this kind of information, we expect you to discuss the halter horse as to his front leg structure, slope, texture of his feet, shape, and the way he moves, and I expect you to visit about that when you evaluate halter

horses.

Chemical stimulants have never proven to be an asset to anybody's decision making. It will not be tolerated in this course or as we travel around the state. Personal sacrifices toward your self-improvement are very lasting and they'll be noted by your employer. Your habits and attendance will be important in this class. We'll have adequate play time, but we'll also need for you to be serious, so that you can really reap the most benefits in the offerings of this course.

## Support

Then, there's a need for SUPPORT of students when they are under stress attempting to excel through competition. As Henry Clay noted, "Of all human powers operating on the affairs of mankind, none is greater than that of competition." For the last personification, here's our Wall Street Journal star, Tom Carr, to SUPPORT, encourage and prepare his meat-animal evaluation team for the Aksarben Contest. It's interesting that Tom is so calm, and yet how masterfully he drops the subtle but stimulating reminder that Illinois' tradition and reputation is dependent on the student's performance. This SUPPORT surely played a role in the team's success!

*Dr. Tom Carr, University of Illinois, Urbana*

Team, this is the opportunity of the contest that we've been looking forward to all spring. Each one of you has worked very hard in preparation for this particular educational event, and I'm very proud of those efforts. Each one of you have had several contests that you've experienced. You have seen the pitfalls, the highs and the lows of those contests. You have an idea of what to expect. Now we're down to the nitty-gritty and there are several things I'd like to emphasize to you: 1) you're representing the University of Illinois; 2) you're representing those teammates who didn't get to make the trip, that didn't have enough points to be on the team for this particular event; and 3) you're representing those teams that have been here before you and have established a very high standard of excellence in this particular contest.

Now as you get ready for the first section tomorrow, I know you're going to be a bit nervous. You're going to have a few butterflies, and that is to be expected. Personally, I'd be very concerned if you weren't a bit nervous in preparation for this contest. But you have to maintain your cool. If you're about to hit the panic button, make sure you back away from the class. Let common sense prevail. The main secret to success here in this contest is total concentration.

You must be intense at all times. The moment you let down mentally is when you're going to make a silly mistake. You're going to mismark a card, you're going to miscalculate a yield grade, you're going to miscalculate a price.

For instance, about six years ago, we had an individual who mismarked a beef carcass card, placed it from right to left rather than from left to right. It cost that individual a top ten placing and cost the team first place. Don't let this happen to you.

One little final piece of advice, when you come out of the cooler on Saturday, I want each one of you to be able to say "I gave it my best shot." I want you to feel proud of your efforts. I'm confident that if you give it your best shot, that you'll do well as an individual and the team will succeed. The best of luck to each one of you.

## Final Thoughts

As a finale to this morning's session, here are some modified thoughts of Kahlil Gibran's *The Prophet*.

"Then said a teacher, speak to us of teaching, and he said: No man can reveal to you aught but that which already lies half asleep in the dawning of your knowledge. The teacher who walks in the shadow of the temple among his followers, gives not of his wisdom, but rather of his faith and his lovingness. If he is indeed wise he does not bid you enter the house of his wisdom, but rather leads you to the threshold of your own mind. He who is versed in the science of muscle can tell of its structure and function, but cannot conduct you thither. For the vision of one man lends not its wings to another man. And even as each one of you stands alone in God's knowledge, so must each one of you be alone in his knowledge of God and his understanding of meat science."

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## ACKNOWLEDGEMENTS

The author expresses his sincere appreciation to Dr. Tom Carr, University of Illinois, Urbana; Dr. Marion Greaser and Dr. Bruce Marsh, University of Wisconsin, Madison; Dr. Gary Smith, Texas A&M University, College Station; Dr. Howard Swatland, University of Guelph, Guelph, Ontario, Canada; Dr. David Topel, Iowa State University, Ames; and Professor R.B. Warren, University of Nebraska, Lincoln, for their pedagogical contributions, and to the multitude of students and teachers who have provided the experience, insight and inspiration for the author to develop this presentation.

This work was supported by the College of Agricultural and Life Sciences, University of Wisconsin, Madison. Muscle Biology Laboratory Manuscript No. 256.

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