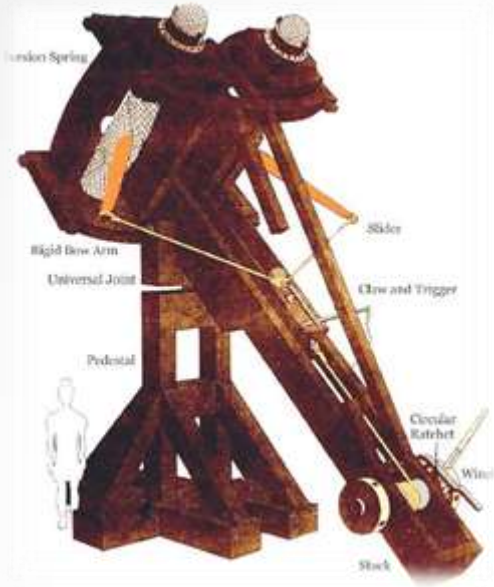


Science and Technology Content for English Composition Courses

"What does it mean to be human?"

Resynthesizing humanities and arts with emerging STEM disciplines.

CCBC
THE COMMUNITY COLLEGE OF BALTIMORE COUNTY
http://www.ccbcmd.edu

Andrew Rusnak
&
Greg Campbell

Section 1:

Courses developed; Materials used; Rationale—why it's imperative to write well in today's STEM workforce.

Section 2:

Deeper, historical perspective/rationale; Synthesizing Humanities/Liberal Arts with Science and technology—Will the future require a return to 19th century thinking?

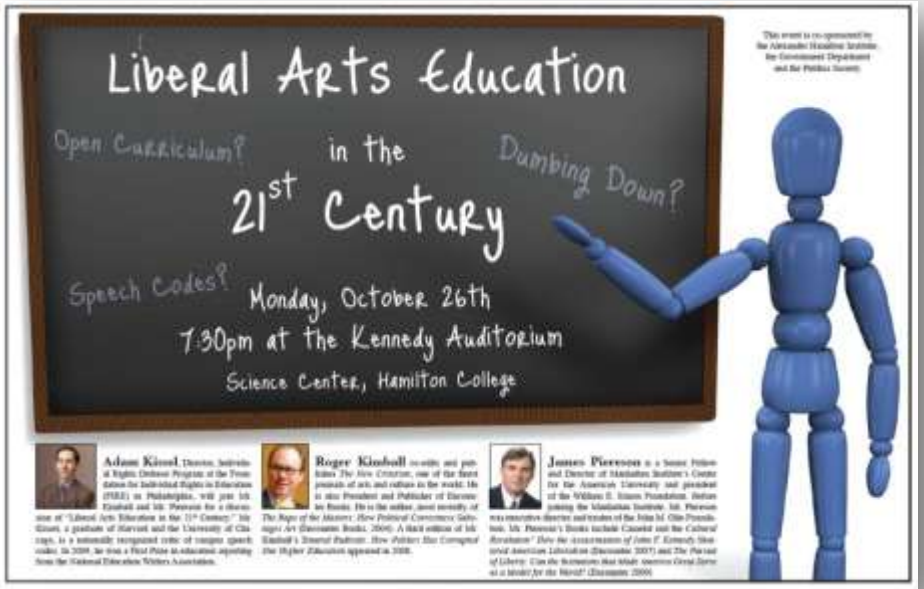
The creation of STEM-focused English composition courses at CCBC

In a progressive attempt to meet the demanding needs of students majoring in science, technology, engineering, math, and the health professions, the Community College of Baltimore County is offering English 101 and 102 credited composition courses that focus content on STEM disciplines.

Science and Technology Content for English Composition Courses

The purpose of developing a STEM-focused English 101 and 102 composition sequence at CCBC is to:

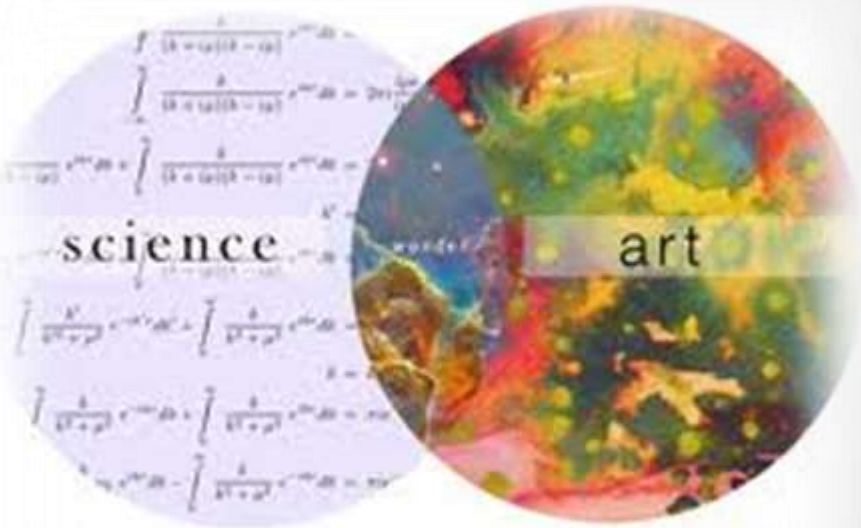
- Offer a writing curriculum alternative that is more germane for students in science and technology certificate and degree programs or transfer options;
- Provide reading content and writing assignments concentrated in science and technology;
- Better prepare students for upper level STEM course work and specific job requirements that include writing;



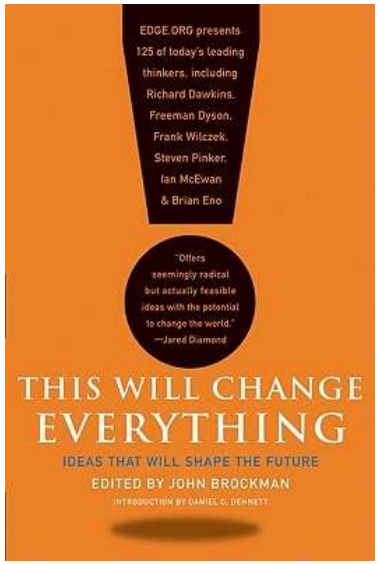
- Reinforce rhetorical principles/strategies found in the conventional English composition canon and that ALSO ask the questions humanities asks;

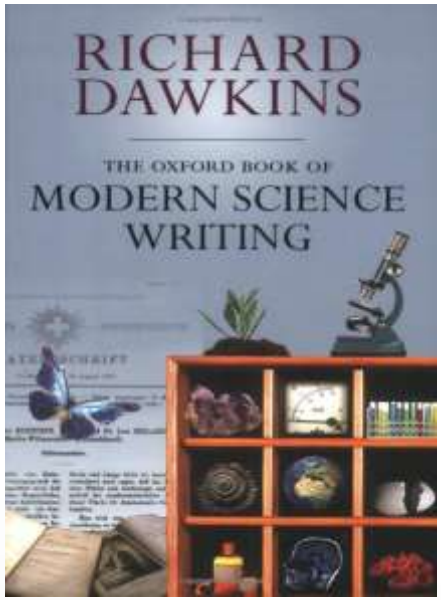
Purpose cont. :

- Split writing/research assignments designed to emulate those required in science and technology professions, e.g. reports, manuals, articles, essays, case studies, presentations with assignments designed to apply humanities thinking to science and technology;
- Globalize assignments; and
- By offering a historical overview of science and technology writing, philosophy of technology and science, and the impact of technology on culture, bridge any misconception that liberal arts and humanities are somehow antithetical to physical/social science disciplines and vice versa. Preserving a strong humanities influence is essential to educating the next generation science and technology workforce.



Science and Technology Content for English Composition Courses





Textual material:

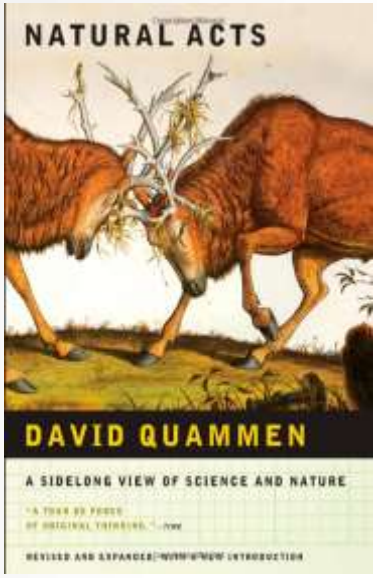
Text is of two types:
1) Expository writing by SMEs for general consumption; and
2) Science journalist reporting on research and trends.

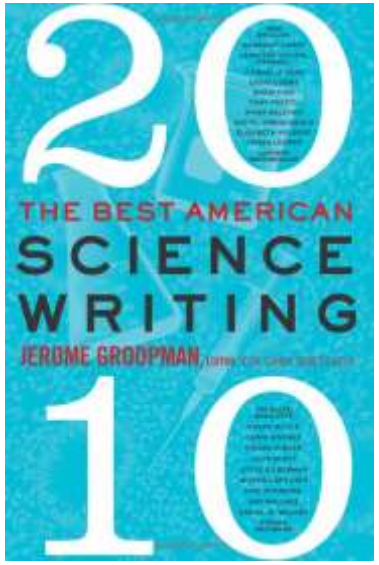
Topics Explored:

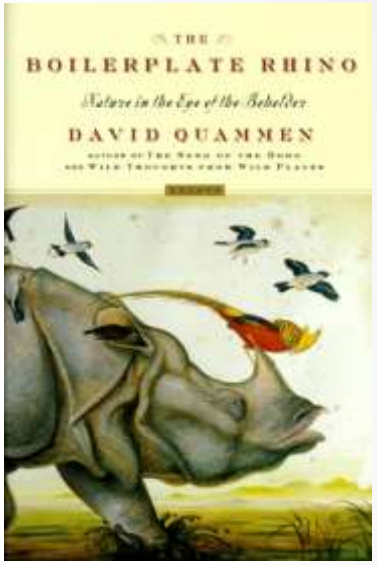
- Molecular biology – Genetic Engineering and Bio-Tech.;
- Climate Science;
- Medical Research;
- Nanotechnology (materials and medical applications);
- Artificial Intelligence – future of computing (quantum computing);

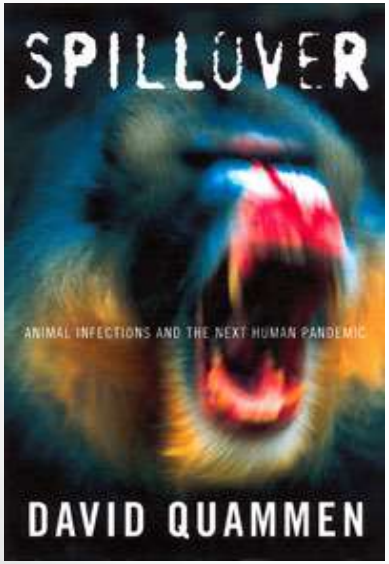
Science and Technology Content for English Composition Courses

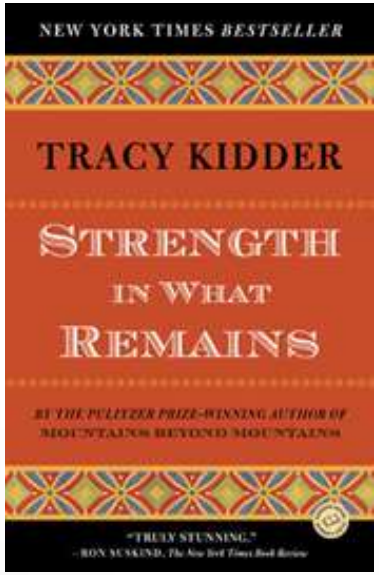
Textual material:

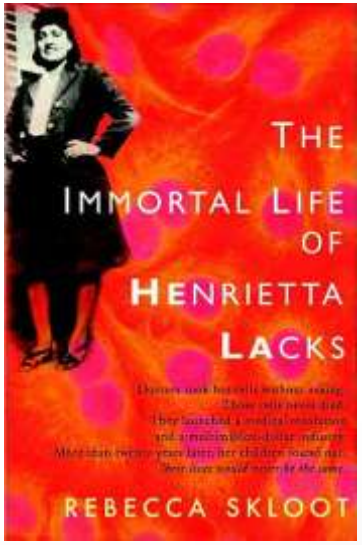








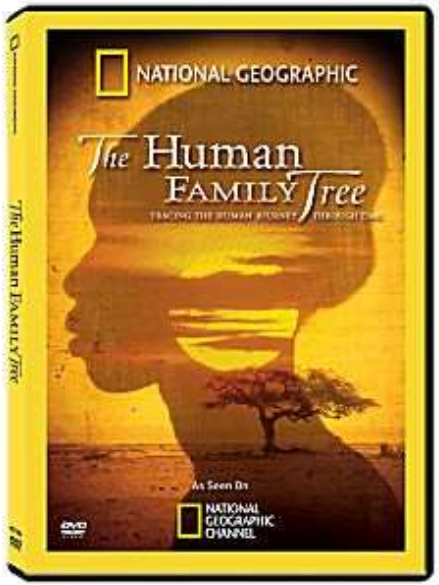




Textual material:

- Scientific American
  Scientific American Mind
- Discover
- Edge.org
- Institute for Emerging Ethics and Technologies

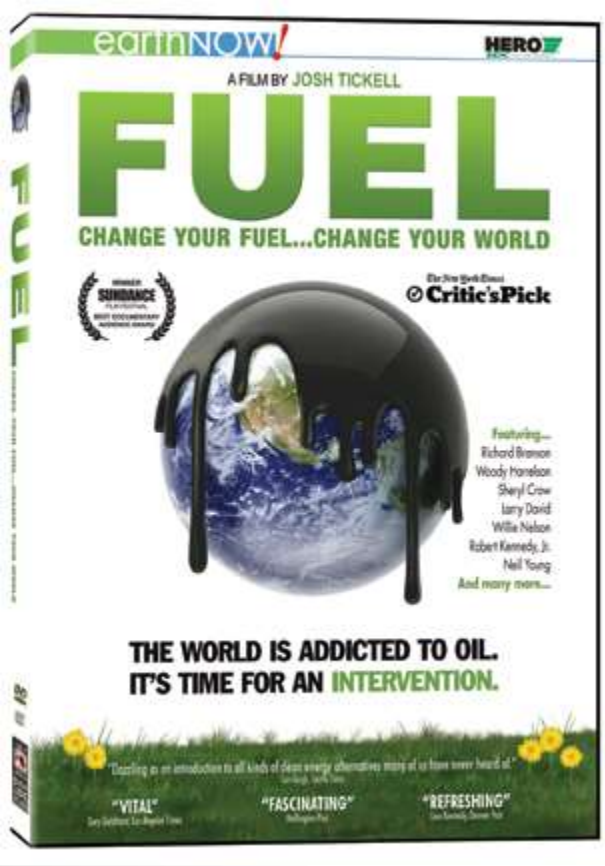
Science and Technology Content for English Composition Courses

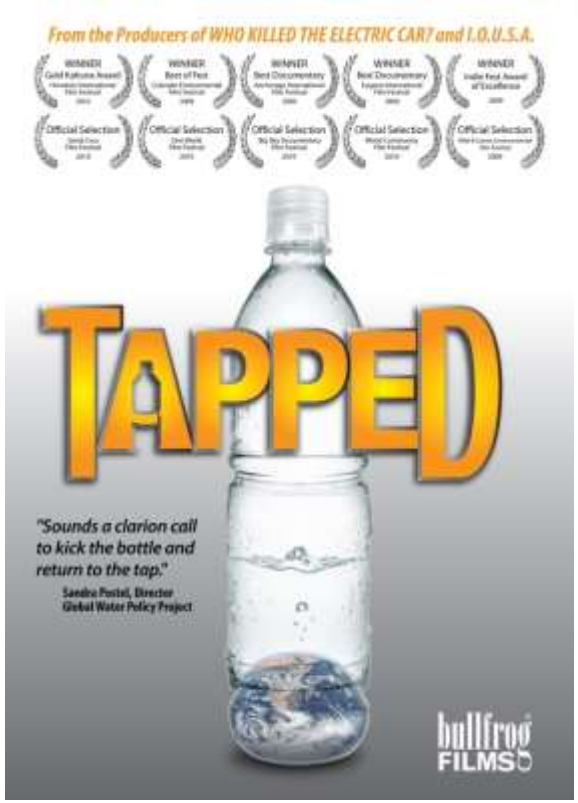


National Geographic scientists swab the cheeks of some 200 random New Yorkers-hoping to reveal clues about our ancestral footprints and prove we are all cousins in the "family of man." Cutting edge science, coupled with a cast of New Yorkers-each with their own unique genetic history-helps paint a picture of these amazing journeys. The Human Family Tree answers some of humanity's most burning questions-who we are and where we come from-and forces us to change how we think not only about our relationships with our neighbors, but ourselves.

Technology will accelerate exponentially. Within 25 years, computers will have consciousness. Humans will soon be bionic. These predictions make bestselling author Ray Kurzweil (The Singularity Is Near) a prophetic genius to some, and a "highly sophisticated crackpot" to others. There is no question, however, that he has predicted the future with more accuracy than anyone else in history. The film outlines Kurzweil's theory of singularity--the point when change occurs so rapidly that humans will need to merge with technology to keep up.

Science and Technology Content for English Composition Courses





Videos:

Many videos on

Types of writing assignments …

(p. 5) DNA; Writing the Software of Life, Craig Venter: Venter is one of science's leading, progressive thinkers and creative minds. He writes, **"Science is changing dramatically once again, as we use all our new tools to understand life and perhaps even to redesign it.** The genetic code [what we, through natural selection, have embodied and perpetuated and passed on] is the result of over 3.5 billion years of evolution and is common to all life on our planet. We have been reading the genetic code for a few decades and are gaining insight into how it programs for life. In a series of experiments to better understand the code, my colleagues and I have developed new ways to chemically synthesize DNA in the laboratory." In other words, Venter and his colleagues are using computers and chemicals to actually create life in the laboratory. His claim is that, "We can start with genetic information and four bottles of chemicals and write new software of life to direct organisms to processes that are desperately needed, like the creation of renewable biofuels and the recycling of carbon dioxide. **As we learn from 3.5 billion years of evolution, we will convert billions of years into decades and change not only how we view life, but life itself."** Venter wants to use his research for positive, what seems like ethically sound causes. But, is there a possibility that others can use this research for unethical purposes? Or that the research inadvertently turns out to cause more damage than good? In 1,500 words, citing three legitimate outside sources to support your thesis, write an essay that looks at the negative impact of creating life in the lab. Be serious, don't write an essay on Frankenstein. Where and how could a negative scenario be possible? Focus on one implication and elaborate. Need a strong thesis and a Works Cited page. One source may be a video, two written.

- http://www.cbsnews.com/video/watch/?id=7369820n **Venter on 60 Minutes – 14 min.**
- http://blog.ted.com/2010/05/21/unveiling_synth/ **Venter on creating Synthetic Life – 18 min.**

On the pragmatic side …

"With this year's application cycle in full swing, aspiring premeds across the country will be aiming to submit their applications early. While many parts of the AMCAS and other application systems involve data entry and other finite tasks, the personal statement is often the least predictable part for students—and the one most likely to derail many submission timelines.

Why is the personal statement so challenging?

First, many students, particularly premeds, may not have enough writing experience under their belt from science-heavy undergraduate curricula. Second, a substantial number may not realize how much reflection and introspection it requires to prepare, edit, and polish a strong essay."

U.S.News & WORLD REPORT

From a recent (2011) U.S. News and World Report article

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Science and Technology Content for English Composition Courses

RALEIGH, NC, Jan 20, 2012 (MARKETWIRE via COMTEX) –

"Check any online job-hunting Web site for science, technical, pharmaceutical, biotech and medical jobs and you'll find one common requirement: 'excellent communication skills,'" writes Stephanie Roberson Barnard and Deborah St. James in their new book, "Listen. Write. Present -- The Elements for Communicating Science and Technology" (Yale University Press; 2012), www.ListenWritePresent.com .

Unfortunately, the science-rich education required for health-care professionals leaves little room for learning how to craft a message for a particular audience. And that's essential not only for getting jobs, but for keeping them and winning promotions, says Barnard, a communications consultant who specializes in training medical professionals to speak and write clearly and effectively.

MarketWatch

Press release, Jan. 20, 2012 http://www.marketwatch.com/story/listen-write-present-offers-communication-tips-for-science-professionals-2012-01-20

The National Commission on Writing Schools and Colleges

- Writing is a "threshold skill" for both employment and promotion, particularly for salaried employees;
- People who cannot write and communicate clearly will not be hired and are unlikely to last long enough to be considered for promotion;

Survey mailed in 2004 to 120 HR Directors in corporations associated with the Business Roundtable, CEOs of leading U.S. corporations, yielded a 53.3 percent response rate

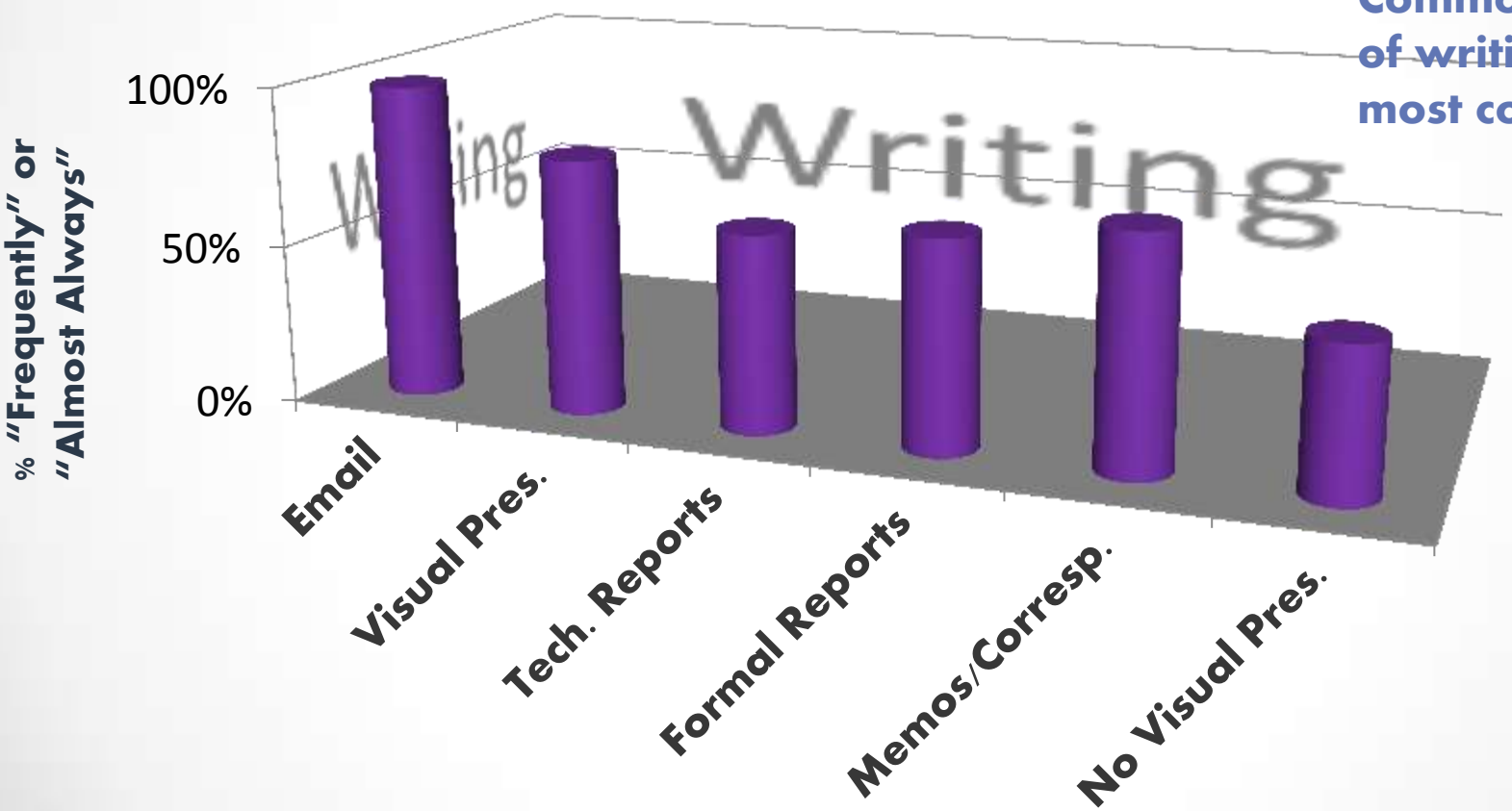
http://www.youtube.com/watch?v=JvAiE7owmeI **Writing In the Workplace pt. 1**

http://www.youtube.com/watch?v=t1p46avxJno&feature=relmfu **Writing in the Workplace pt. 2**

2004 Survey of Business Leaders. *Writing: A Ticket to Work …Or a Ticket Out*

The National Commission on Writing Schools and Colleges

Common forms of writing in most companies



2004 Survey of Business Leaders. *Writing: A Ticket to Work …Or a Ticket Out*

What we like to tell our students :

There is a direct correlation between your ability to "language," your ability to read and interpret text of all manifestations, your ability to write, your ability to communicate orally, to present, and your ability to be successful in your chosen profession. The more you know about how your own mind works and how to develop and refine your language skills in the workplace, the more successful you will be. Good writers and communicators in the work environment are "go to" leaders.

And what do employers want?

A recent national survey of businesses and nonprofit leaders conducted by **The Association Of American Colleges And Universities** found:

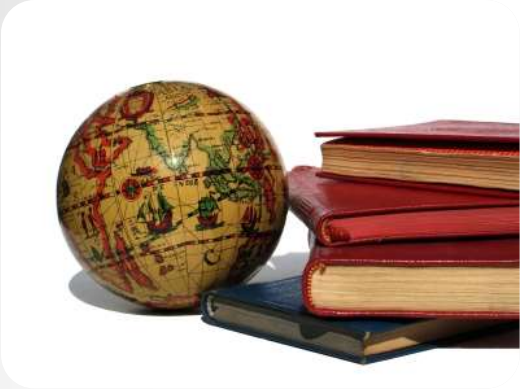
- Nearly all employers surveyed **(93 percent)** say that "a demonstrated capacity to **think critically, communicate clearly, and solve complex problems** is **more important** **than [a candidate's] undergraduate major.**"
- More than three in four employers say they want colleges to **place *more emphasis* on helping students develop five key learning outcomes, including: critical thinking, complex problem-solving, written and oral communication,** and applied knowledge in real-world settings.
- **80 percent of employers** agree that, regardless of their major, **every college student should acquire broad knowledge in the liberal arts and sciences**.

Rob Jenkins, *The Chronicle*, " Liberal Arts are Work-Force Development" 7/12/11

Two-year colleges occupy a unique position in the national debate over the value of the liberal arts.

For students who are not liberal-arts majors, the core-curriculum courses they are "forced" to take as freshmen and sophomores will probably constitute the extent of their dabbling in the liberal arts. Those who go on to study business, engineering, or computer science are unlikely, as juniors and seniors, to sign up for additional classes in literature, biology, psychology, or art appreciation.

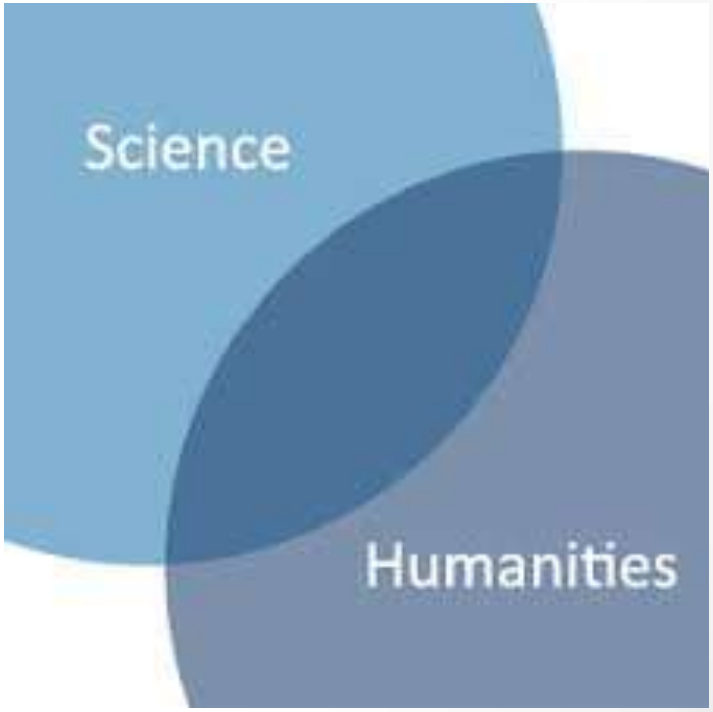
Now consider that, according to the American Association of Community Colleges, about half of all freshmen and sophomores are enrolled at the nation's 1,300 two-year colleges, and many of those students transfer to four-year institutions. For a large percentage of people who earn bachelor's degrees, then, the liberal-arts portion of their education was acquired at a two-year college.



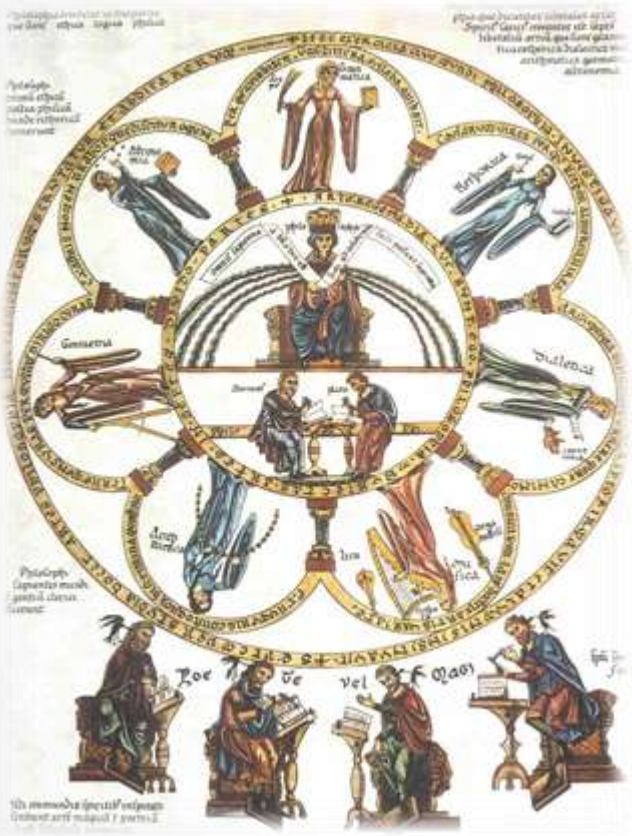
Next, factor in all of the community-college students who enter the work force after earning two-year degrees or certificates, and whose *only* exposure to the liberal arts occurred in whatever core courses their programs required.

The conclusion becomes obvious: Two-year colleges are among the country's leading providers of liberal-arts education, although they seldom get credit for that role. Many Americans learn at a two-year college most of what they will ever learn—in a formal setting, at least—about writing, critical thinking, the history of our culture and civilization, the environment, and human behavior.

Synthesizing Humanities/Liberal Arts with Science and Technology. How did we get here?



History: In the classical world …



The 7 liberal arts of the classical world included math and science.

The Trivium (The three roads):

- **Grammar**
- **Rhetoric**
- **Logic**

The Quadrivium (The four roads):

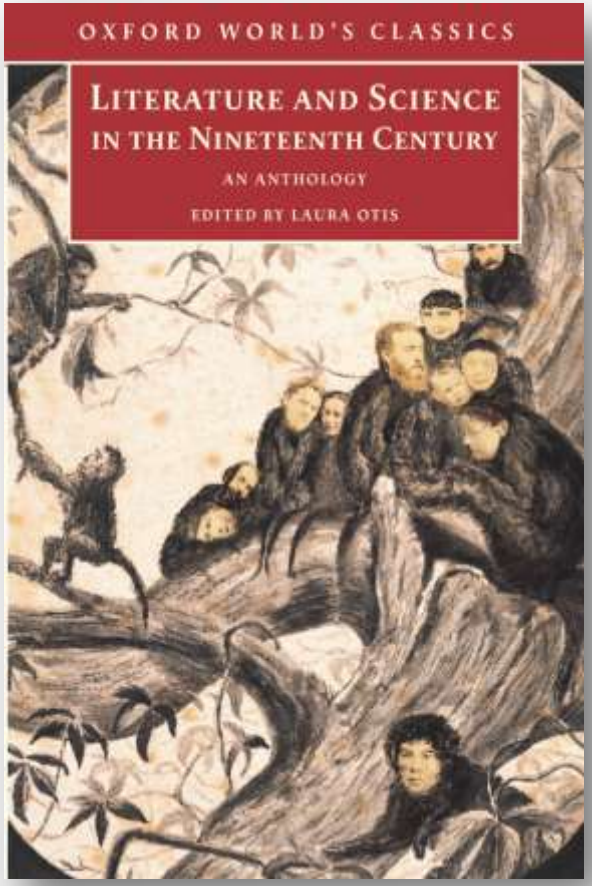
- **Arithmetic** -- Number in itself
- **Geometry** -- Number in space
- **Music, Harmonics, or Tuning Theory** -- Number in time
- **Astronomy or Cosmology** -- Number in space and time

Apollo was the god of both poetry AND medicine

Art and Technology share a common ancestor, *techne'* the Greek word for art, skill, craft.

From: Daniel C. Dennett's essay, "The Evolution of Culture."

History, how we got here:

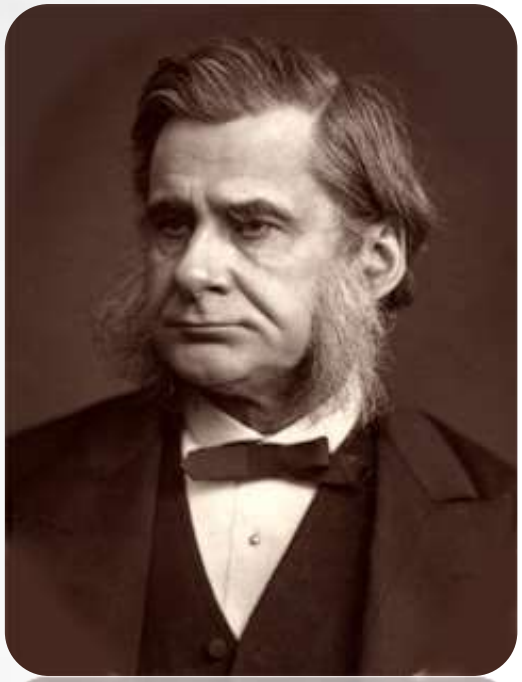


"Although we are used to thinking of science and the humanities as separate disciplines, in the nineteenth century this division was not recognized. As the scientist John Tyndall pointed out, not only were science and literature both striving to better "man's estate", they shared a common language and cultural heritage. The quest for "origins", the nature of the relationship between society and the individual, and what it meant to be human were subjects that occupied both the writing of scientists and novelists."

—Laura Otis, *Literature and Science in the Nineteenth Century*

Why—in the 20th century, a time when empirical evidence began to dominate the epistemological landscape—did the academic world fully split along scientific and literary (Humanities) lines? Why did a conflict develop between two competing views of what passes for knowledge?

vs.?



Whose the science person and whose the literature person?

Thomas Huxley, 1825-1895, biologist, "Darwin's Bulldog," advocated natural selection, wrote *Evidence on Man's Place in Nature,* and "founded a remarkable dynasty of English scientists and thinkers."

Mathew Arnold, 1822-1888, English poet, literary and social critic. According to the Academy of American Poets, "Meditative and rhetorical, Arnold's poetry often wrestles with problems of psychological isolation." Author of Literature and Science (1882)."

Science and Technology Content for English Composition Courses

- In *Literature and Science* Arnold seeks to rebuke Huxley's call for the predominance of education to "pass from letters to science," to transition from "mere literary instruction and education" to "sound, extensive and practical scientific knowledge."

- Advocates of the natural/physical sciences proposed to make it the "main part of education" and push literature, or, the classics, into the background.

- Arnold's claim was that "all knowledge is interesting" but that "when we set ourselves to enumerate the powers which go to the building up of human life, and say that they are the power of conduct, intellect and knowledge, beauty, and social life and manners, he (Huxley) can hardly deny this scheme, though not pretending to be scientific."

Literature and Science
by Matthew Arnold (1882)[1]

Practical people talk with a smile of Plato and of his absolute ideas; and it is impossible to deny that Plato's ideas do often seem unpractical and impracticable, and especially when one views them in connection with the life of a great work-a-day world like the United States. The necessary staple of the life of such a world Plato regards with disdain; handicraft and trade and the working professions he regards with disdain; but what becomes of the life of an industrial modern community if you take handicraft and trade and the working professions out of it? The base mechanic arts and handicrafts, says Plato, bring about a natural weakness in the principle of excellence in a man, so that he cannot govern the ignoble growths in him, but nurses them, and cannot understand fostering any other. Those who exercise such arts and trades, as they have their bodies, he says, marred by their vulgar businesses, so they have their souls, too, bowed and broken by them. And if one of these uncomely people has a mind to seek self and philosophy, Plato compares him to a bald little tinker, who has scraped together money, and has got his release from service, and has had a bath, and bought a new coat, and is rigged out like a bridegroom about to marry the daughter of his master who has fallen into poor and helpless estate.

Nor do the working professions fare any better than trade at the hands of Plato. He draws for us an inimitable picture of the working lawyer, and of his life of bondage; he shows how this bondage from his youth up has stunted and warped him, and made him small and crooked of soul, encompassing him with difficulties which he is not man enough to rely on justice and truth as means to encounter, but has recourse, for help out of them, to falsehood and wrong. And so, says Plato, this poor creature is bent and broken, and grows up from boy to man without a particle of soundness in him, although exceedingly smart and clever in his own esteem.
One cannot refuse to admire the artist who draws these pictures. But we say to ourselves that his ideas show the influence of a primitive and obsolete order of things, when the warrior caste and the priestly caste were alone in honour, and the humble work of the world was done by slaves. We have now changed all that; the modern majesty consists in work, as Emerson declares; and in work, we may add, principally of such plain and dusty kind as the work of cultivators of the ground,, handicraftsmen, men of trade and business, men of the working professions. Above all is this hue in a great industrious community such as that of the United States.

Now education, many people go on to say, is still mainly governed by the ideas of men like Plato, who lived when the warrior caste and the priestly or philosophical class were alone in honour, and the really useful part of the community were slaves. It is an education fitted for persons of leisure in such a community. This education passed from Greece and Rome to the feudal communities of Europe, where also the warrior caste and the priestly caste were alone held in honour, and where the really useful and working part of the community, though not nominally slaves as in the pagan world, were practically not much better off than slaves, and not more seriously regarded. And how absurd it is, people end by saying, to inflict this education upon an industrious modern community, where very few indeed are persons of leisure, and the mass to be considered has not leisure, but is bound, for its own great good, and for the great good of the world at large, to plain labour and to industrial pursuits, and the education in question tends necessarily to make men dissatisfied with these pursuits and unfitted for them!

Many thinkers in the 18th and 19th were not like like Huxley …

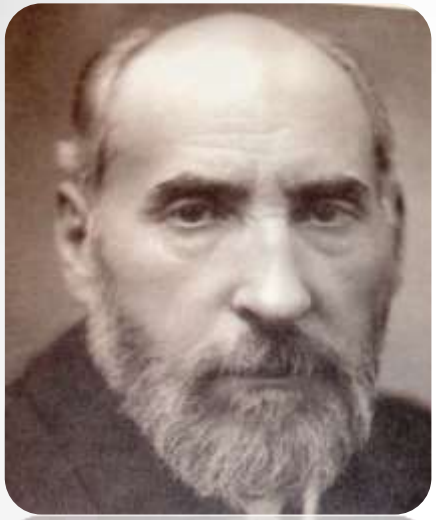
…[T]he first scientist to recognize a correlation between scientific talent and non-scientific pursuits was Jacobus Henricus van't Hoff, a Dutch Scientist who won the first Nobel in chemistry. In his essay "Imagination in Science," he argued that the greatest scientists almost invariably display their imagination in non-scientific fields as well.

Examples include Galileo, also an artist, craftsman, musician, and writer.

van't Hoff also was a talented flautist who wrote poetry in four languages

From: "Nurturing creativity in science takes breath of training" March 23, 2009, Michelle & Robert Root-Bernstein, *Imagine That*

Many thinkers in the 18th and 19th were not like like Huxley …



Spanish pathologist, Ramon y Cajal, one of the founders of neuroanatomy and an early Nobel winner (1906) practiced gymnastics, produced the first color photographs in Spain, painted, and wrote science fiction. When it came to recruiting students he rejected those focused solely on their science.

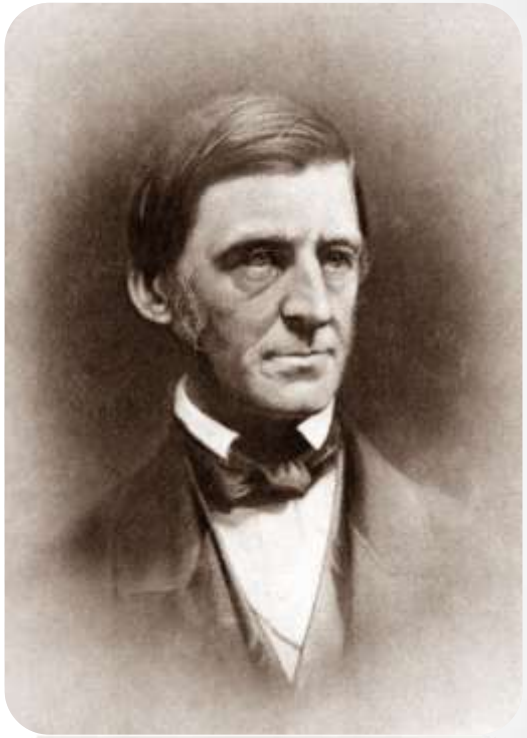
"The far sighted teacher," he once wrote, "will prefer those students who are somewhat headstrong, contemptuous of first place, insensible to the inducements of vanity, and who, being endowed with an abundance of restless imagination, spend their energy in the pursuit of literature, art, philosophy …. To him [or her] who observes them from afar, it appears as though they are scattering and dissipating their energies, while in reality, they are channeling and strengthening them … "

From: "Nurturing creativity in science takes breath of training"
March 23, 2009, Michelle & Robert Root-Bernstein, *Imagine That*

Many thinkers in the 18th and 19th were not like like Huxley …

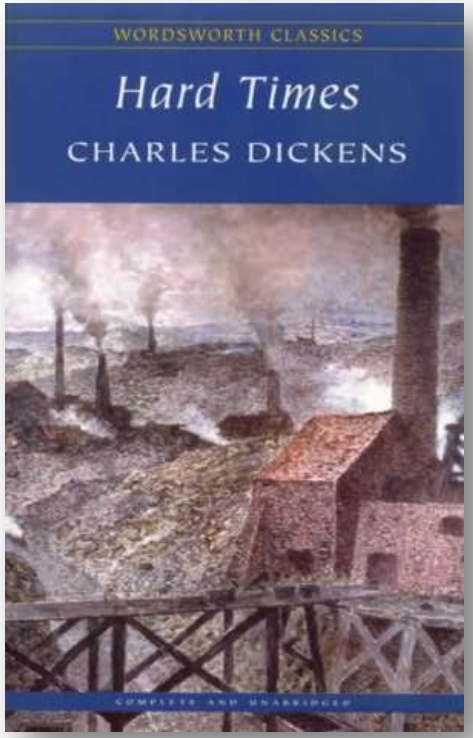
"Man is thus metamorphosed into a thing, into many things. The planter, who is Man sent out into the field to gather food, is seldom cheered by any idea of the true dignity of his ministry. He sees his bushel and his cart, and nothing beyond, and sinks into the farmer, instead of Man on the farm.

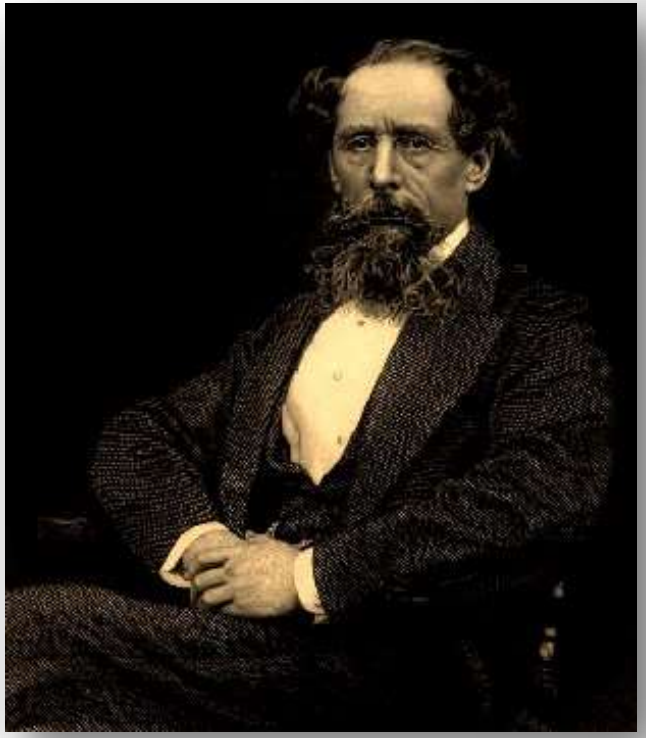
In this distribution of functions, the scholar is the delegated intellect. In the right state, he/she is, *Man/Woman Thinking*. In the degenerate state, when the victim of society, he/she tends to become a mere thinker, or, still worse, the parrot of other men's/women's thinking."



Ralph Waldo Emerson, *The American Scholar*

Many thinkers in the 18th and 19th were not like like Huxley …





From: Alice Jenkins, "Literature: Wonders and Ologies," February 2, 2012 *Nature*

- Science, in Dickens view, does immense good—moral, social, and intellectual—but only when it works hand-in-hand with imagination and reverence.
- Dickens' objection in *Hard Times* was not to science itself, but to the reductionist principle that imposes stultifying order and leaves no room for emotion or imagination.
- "The facts of science are at least as full of poetry as the most poetical fancies," Dickens wrote in an 1848 review of Robert Hunt's, *The Poetry of Science.*

Can you pick out the poets? The Physicians?

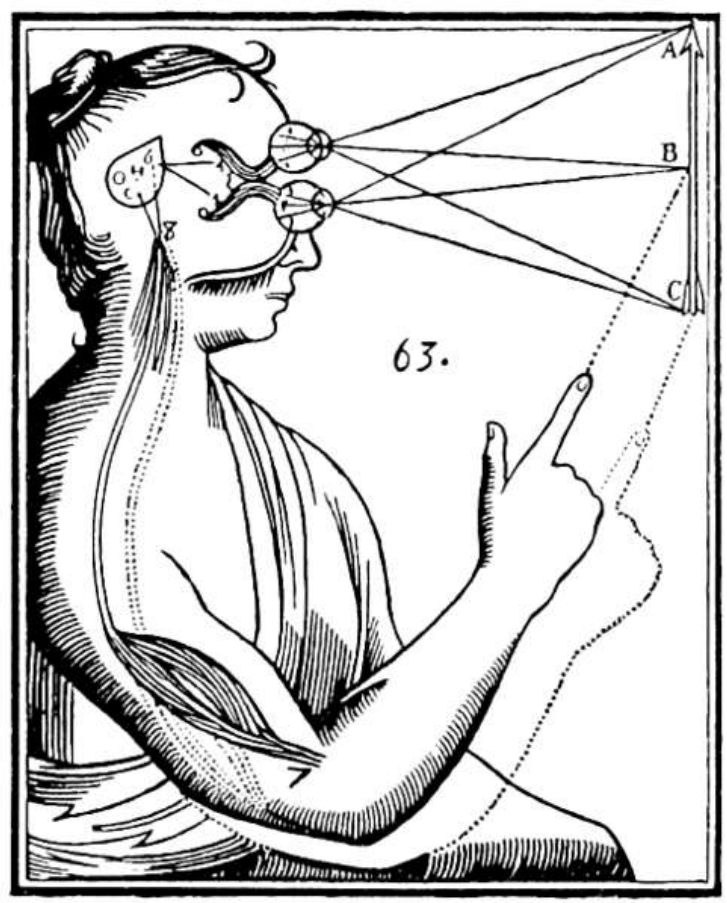
Writer Anton Chekhov

Poet William Carlos Williams

Poet John Keats

Were all physicians

Science and Technology Content for English Composition Courses



The debate continues to this day on the value of a liberal vs. technical education. As we are wont to do, instead of seeking synthesis, we have, generally, crafted an either/or proposition, a one-side-or-the-other argument, which often results in a de-emphasis of humanities (even a stigmatization) when it comes to choosing a major in college.

We expect students and employees to learn imagination, creativity, innovation, inductive thinking, subjectivity, maybe through osmosis, these critical thinking skills that are mostly taught in the humanities and fine arts and now seem to be sacrificed to *specialization* and job training.

The future: questions, themes, challenges.

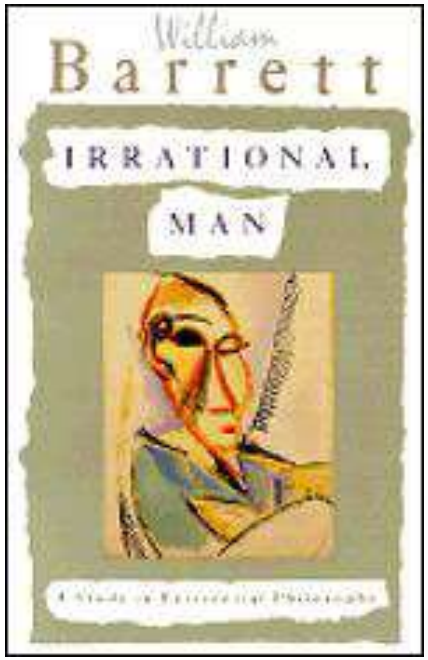
A

The questions …

Has the battle for specialized training in education won out? At the expense of humanities or interdisciplinary approaches? Are the questions the humanities asks outdated? Or needed now more than ever?

> "Specialization is the price we pay for the advancement of knowledge. A price, because the path of specialization leads away from the ordinary and concrete acts of understanding the terms of which man actually lives his day-to-day life."

—William Barrett, *Irrational Man*



Will math help determine the Illiad's historic accuracy? Image credit: G. V. Tischbein, public domain, Wikimedia Commons

The questions …

Is our responsibility to teach future STEM professionals austere methods in writing that only lend themselves to analytical organization, linear sequencing, and reductionist rhetorical strategies? Or, should we also explore the iconic humanities question when we develop our curricula/assignments—What does it mean to be human?—a question that lends itself to imagination, creativity, mystery in various contexts? Today, is there a better context than science and technology in which to ask this question?

The questions …

We are here

The inescapable context of the "either/or" dichotomy-driven media culture?

Conventional/Popular View of Science =

deductive reasoning, reductionism, abstractions, positivism/empirical evidence, overwhelming objectivity, abstractionism, either/or, black and white, finite, cause and effect, concrete, left brain, "all the answers," consciousness is a byproduct of neural activity, a human being is no more than a highly sophisticated computer, science is not relativistic, the immediate end to the "animating principle."

Vs.

Creative "Humanistic" view of science =

inductive reasoning, subjectivity, exploration, innovation, imagination, creativity, gray matter, infinite, entrepreneurial, art, "mystery embraced," right brain, "answers are always and forever suspect and susceptible to reinterpretation," consciousness is a synthesis of brain, body, and environment that is always in flux, science is not value free, Feyerabend's *Against Method*, Kuhn's *The* [Real] *Structure of Scientific Revolutions* .

Should these two types of thinking be mutually exclusive when it comes to training, educating the next generation of scientists, engineers, and health professionals to think and write?

Today's themes: The culture of science and technology and why we need humanistic thinking.

Previous to the 20th Century, science and technology were products of the metaphysical culture, a humanities, interdisciplinary tradition that—within political, economic, and social contexts—inspired critical and imaginative thought, argumentation, exploration into the pervasive question, **What does it mean to be human today compared to yesteryear? Today, is science and technology still part of this culture?**

Today's themes:

How did worlds used to end?
(A Humanities Favorite)

T.S. Elliot's poem, *The Hollow Men*
Perhaps, the way worlds used to end

This is the way the world ends
This is the way the world ends
This is the way the world ends
Not with a bang but a whimper.

How do they end now? Today?

Philosopher Daniel Dennett short introduction in *This Will Change Everything?*

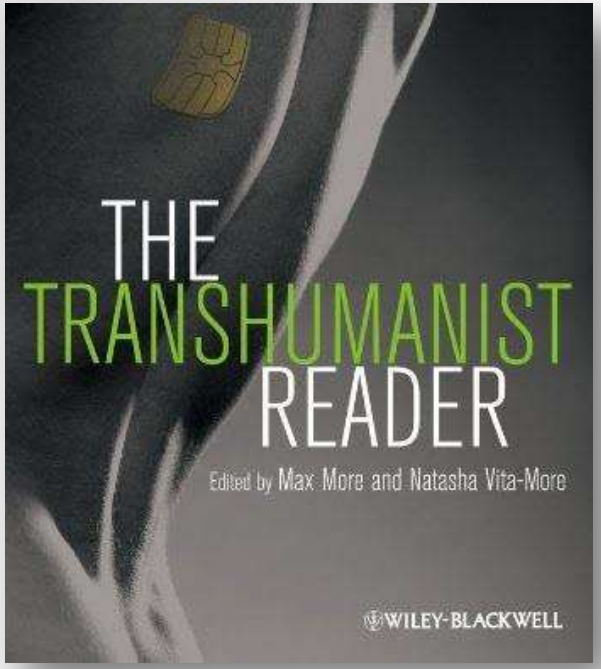
Extinction can happen overnight in some cases … Reflective scientific investigation of everything is going to change everything … when we look closely at looking closely, when we increase our investment in techniques … for increasing our investment in techniques, we create **nonlinearities that amplify uncertainties** … allowing phenomena that have heretofore been orderly and relatively predictable to escape our control. Will the result be utopia or dystopia?

Cultural Transformation ?

Everything seems to keep coming at us at an accelerated, non-linear rate …

"An analysis of the history of technology shows that technological change is exponential, contrary to the common-sense 'intuitive linear' view. So we won't experience 100 years of [scientific and technological] progress in the 21st century — it will be more like 20,000 years of progress (at today's rate). The "returns," such as chip speed and cost-effectiveness, also increase exponentially. There's even exponential growth in the rate of exponential growth." --Ray Kurweil

http://www.youtube.com/watch?v=EX69E-eoWVM **Ray Kurzweil: The Law of Accelerating Returns 4:00 – 7:00**



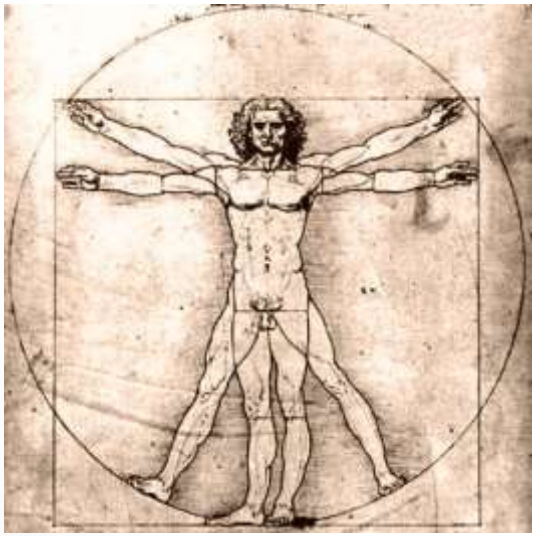
As a result, perhaps now more than ever in the history of the human race, we need to ask the questions that drove the humanities, especially Why? To use what many consider to be fading cognitive faculties (Is Google really making us stupid?) like sustained speculative and imaginative focus applied in a historical context to create realistic perspectives.

Are we approaching the era of "the last question of the humanities?" Are we being defined out of humanism into the "transhuman" or "posthuman?" A place where culture and education are replaced by science and technology as the primary means of "advancement" for the human race?

Why ask this "still human" question?

Because science fiction isn't in Kansas anymore …

Our biological bodies are inadequate, antiquated, dysfunctional, inappropriate for the challenges of any progress we can now readily conceive. We need technical updates, new ways to define health and advancement. It's only through science and technology that this can happen. Will we leave the old ideas of what it means to be human behind?



No kidding Dorothy …

SCIENTIFIC AMERICAN™

Efforts to Resuscitate Extinct Species May Spawn a New Era of the Hybrid

What does de-extinction mean for biology and the environment? By David Biello

http://www.youtube.com/watch?v=XKc9MJDeqj0 **Stewart Brand: The dawn of de-extinction. Are you ready? 3:30- 5:00**

http://news.nationalgeographic.com/news/2013/03/130305-science-animals-extinct-species-revival-deextinction-debate-tedx/

Still not kidding …

At a press conference in Washington, DC, (2010) Craig Venter and team make a historic announcement: they've created the first fully functioning, reproducing cell controlled by synthetic DNA. He explains how they did it and why the achievement marks the beginning of a new era for science.

"The first synthetic cell, a cell made starting with the digital code in the computer, building the chromosome from four bottles of chemicals, assembling the chromosome in yeast, transplanting it into a recipient bacterial cell, transforming that cell into a new bacterial species. This is the first self-replicating species we've had on the planet whose parent is a computer."

http://blog.ted.com/2010/05/21/unveiling_synth/ **Venter on creating Synthetic Life – 18 min.**

Beyond not kidding …

In Sherri Turkle's short essay The Robotic Moment," she writes about what will happen when robots become "smarter" than humans, or, in this case, emotionally relatable. "Sociable technologies," Turkle writes, "come onstage as toys, but in the future they will be presented as potential nannies, teachers, therapists, life coaches, and caretakers for the elderly." A small extension it seems before robots also become friends and lovers.

Recognize this man?

http://www.dailymotion.com/video/xhg0jt_ultra-realistic-human-looking-robot-revealed_news **Zoom.in United Kingdom, 2 min**

http://www.youtube.com/watch?v=UIWWLg4wLEY **AI robot, 3 min.**

http://www.youtube.com/watch?v=IhVu2hxm07E **realistic robot can hold conversations and answer questions 2min**

And in a galaxy not so far, far away…

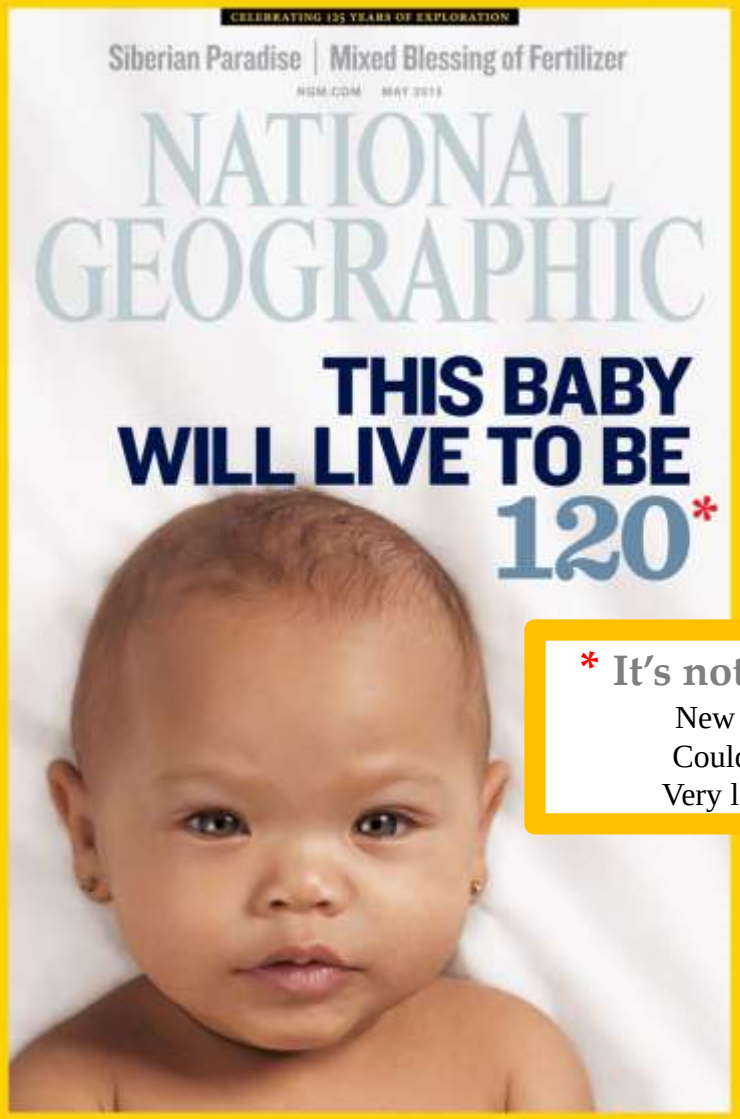
Nanotect/Nanobots

Basic nanomachines are already in use. *Nanobots* will be the next generation of nanomachines. Advanced nanobots will be able to sense and adapt to environmental stimuli such as heat, light, sounds, surface textures, and chemicals; perform complex calculations; move, communicate, and work together; conduct molecular assembly; and, to some extent, repair or even replicate themselves. Nanobot.info is an informational site that provides information on both recent developments and future applications at the intersection of nanotechnology and robotics. Nanotechnology is the science and application of creating objects on a level smaller than 100 nanometers. The extreme concept of nanotechnology is the "bottom up" creation of virtually any material or object by assembling one atom at a time. Although nanotech processes occur at the scale of nanometers, the materials and objects that result from these processes can be much larger. Large-scale results happen when nanotechnology involves massive parallelism in which many simultaneous and synergistic nanoscale processes combine to produce a large-scale result.

What I'm saying now is [when it comes to genetic engineering, stem cell replacement therapy, nanotechnology, and artificial intelligence] we are as gods and have to get good at it—Stewart brand http://edge.org/conversation/we-are-as-gods-and-have-to-get-good-at-it

http://www.youtube.com/watch?v=7wuujmiqD-w **Dean of Invention- Nanobots Fight Cancer and Kill Tumors 3 min**

http://www.youtube.com/watch?v=mEH6tDLKcVU **Power of Nanotechnology first minute**



* It's not just hype
New Science
Could lead to
Very long lives

- Life extension
- Genetic Engineering
- Tissue Engineering
- Transhumanism

*Average lifespan in 1900 = 45

http://www.youtube.com/watch?v=8eprl7c0rks **Designing Humanity - Genetic Engineering, 3 min**

The Challenges; Why it is critical in today's civic and economic world to integrate science and technology with humanities and arts.

"Technical (STEM) writing should not be so heavily mortgaged to pragmatism that it lacks cohesiveness and moral purpose."

—Russell Rutter's 1991 essay, "History, Rhetoric, and Humanism"

What happens in science and technology when there is a failure of imagination? A failure of culture? A failure of "person" and "man [and woman] thinking (Emerson)?" What happens when writing becomes too heavily mortgaged to pragmatism and lacks cohesiveness and moral purpose? When STEM becomes too monolithic and devoted to formulaic thinking?

Can questions get any bigger?

"[Researchers] Winsor and Pace show several managers and engineers knew the type of O-rings used in the Challenger had already cracked under test conditions and thus might crack during launching. Memorandums were written … a conference was held involving managers and engineers at which … O-ring failure was discussed.

—Russell Rutter's 1991 essay, "History, Rhetoric, and Humanism"

"…[T]he decision was taken to launch the Challenger. 'Why,' Winsor asks, did those who knew of the problem with the shuttle's solid rocket boosters not convince those in power to stop the launch?'"

—Russell Rutter's 1991 essay, "History, Rhetoric, and Humanism"

And who can forget?

"For Pace, the Challenger disaster illustrates in graphic terms how human the process of communication is,' and he urges that technical communication scholars [writers] and decision makers 'broaden their perspectives of communication to include the human values inherent in the process.'"

—Russell Rutter's 1991 essay, "History, Rhetoric, and Humanism"

http://www.youtube.com/watch?v=ljPYmSdyVZc **Challenger Explosion**

This image?

The orbiter itself did not explode, but broke apart on ascent (65,000 ft., 73 seconds into the flight). The crew cabin tore off and in less than three minutes hit the surface of the water at about 200 MPH. It could not be determined by examining the remains of crew was dead before they hit the water.

—Russell Rutter's 1991 essay, "History, Rhetoric, and Humanism"

Another example of the failure of imagination?

On July 22nd, 2011, this full-page ad ran in USA Today:

US AIRWAYS' UNWRITTEN POLICY:

Revenues First, Safety Second?

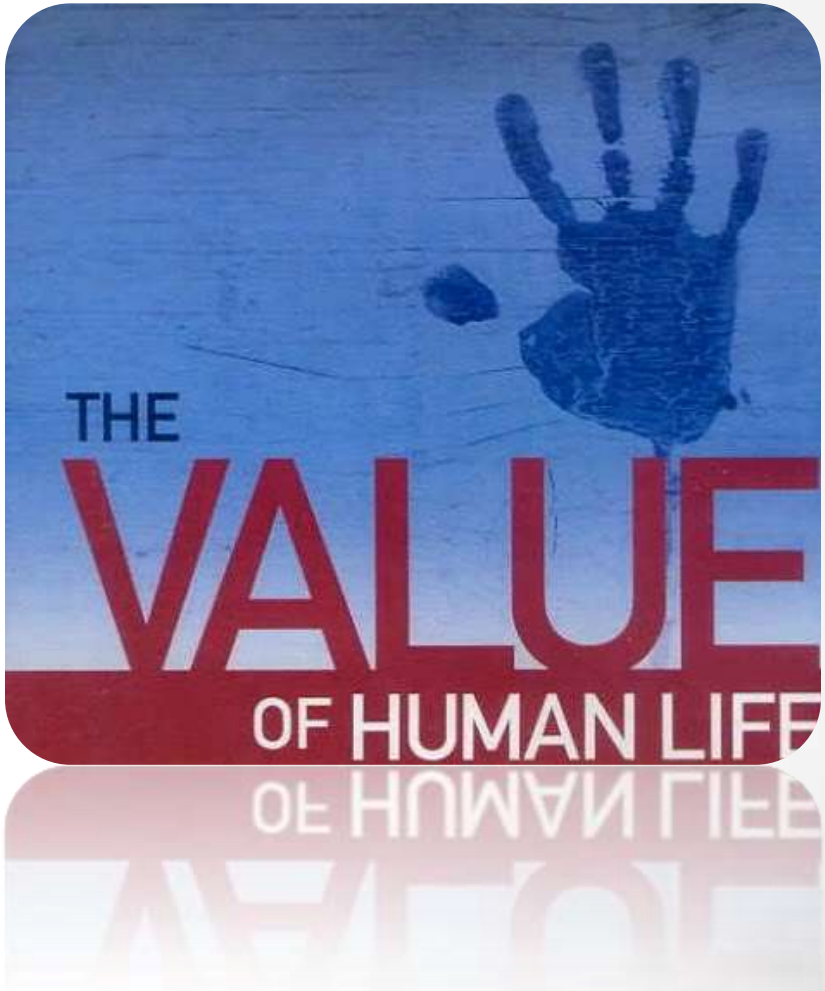
We know this is going to sound unbelievable, but please read on.

On July 16, 2011, a US Airways Captain with 30 years of experience stopped her flight from departing. Something was wrong with the airplane. She was deeply concerned about a balky power component that, should it continue to fail, might have eliminated all electrical power to her trans-Atlantic flight.

Despite her valid concerns, US Airways' management pressured her to fly the airplane, over the ocean, at night. When she refused to jeopardize the safety of her passengers, US Airways' security escorted her out of the airport, and threatened to arrest her crew should they not cooperate. Before she was removed from the aircraft, two other US Airways pilots also refused to fly the aircraft. After she was removed from the airport, three more US Airways pilots refused to fly the aircraft, citing their own concerns about the fitness of the plane. It turned out the pilots were right: the power component was faulty and the plane was removed from service and, finally, fixed. Eventually, a third crew operated the flight, hours later.

USA TODAY

These are not failures of technology so much as they are failures of imagination, failures of "person thinking," [Emerson] failures to include the "human values inherent in the process," failures to ask the questions inherent to humanities.



The humanities and arts can and should provide a foundation for all pursuits in science and technology.

G

Let's add it all up, If:

- As Einstein said, "Imagination is more important than knowledge";
- Nobel laureates in hard sciences are far more inclined to practice art, music, poetry, than "regular scientists";
- Innovation is our greatest commodity and entrepreneurial thinking will be required for all employees in the future economy;
- It is imperative that for employees of the future to be "value added" they need to bring their ideas to the table to increase efficiency, improve processes, and generate improvements;
- It is the responsibility of higher ed. to prepare students for active citizenship in a culture ever more dominated by technology and its ethical implications;
- As I suspect, your students can't wait for this class to be over so they can reach for their smart phones and thumb off the next text:

Then what elements are critical to the methods and content, the pedagogy, of teaching STEM students to think and write?

Science and Technology Content for English Composition Courses

"…[I]f science and technology are rigid, monolithic, and devoted to formulaic thinking and nothing but pure objectivity, the language used to write about them should resemble them. This point is radically false, with regard to both science and technology and to writing, and when stated this bluntly … seems false to most people."

"There is more [much, much more] to technical writing [writing for science, technology, engineering, math, and the health professions] than proficiency in writing, more even than knowing facts. Technical [STEM] writing should not be so heavily mortgaged to pragmatism that it lacks cohesiveness and moral purpose. Technical [STEM] communication belongs to a tradition that asserts the primacy of knowing and being over willing and doing. It insists that the "person thinking" is more important than the tools used or the system acted upon."

—Russell Rutter's 1991 essay, "History, Rhetoric, and Humanism"

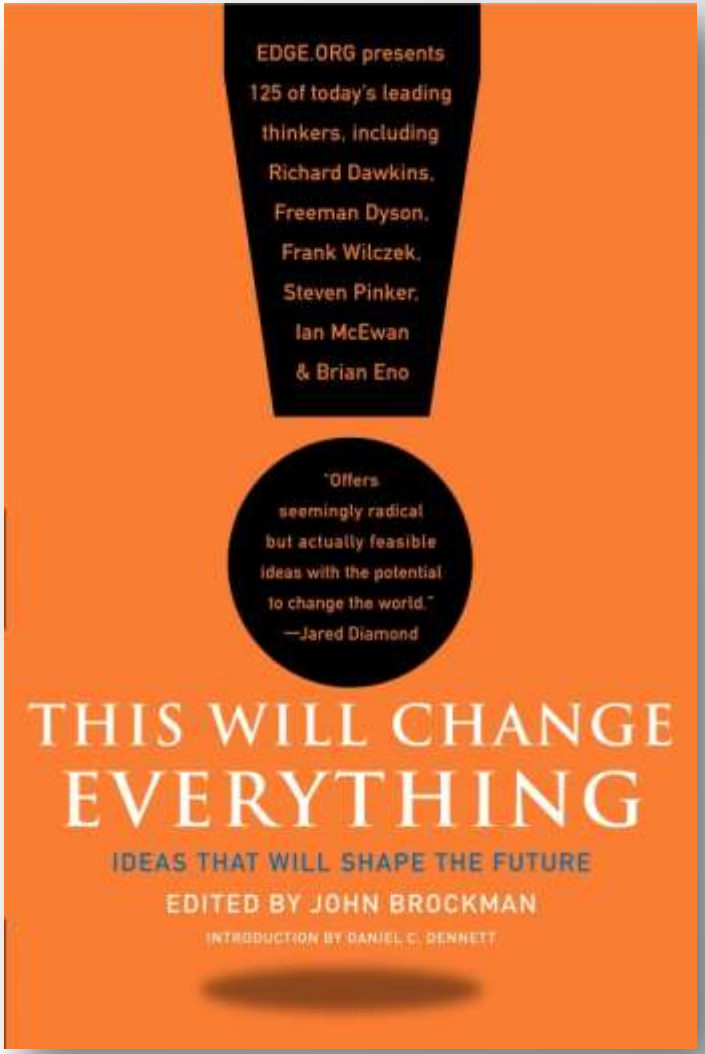
Science and Technology Content for English Composition Courses

"We are on the cusp of a twenty-first-century scientific renaissance. Science is driving our culture and conversation unlike ever before, transforming the social, political, economic, aesthetic, and intellectual landscape of our time. Today, science is culture. As global issues—like energy and health—become increasingly interconnected, and as our curiosities—like how the mind works or why the universe is expanding—become more complex, we need a new way [or a return to the 19th century] of looking at the world that blurs the lines between scientific disciplines and the borders between the sciences and the arts and humanities."

Adam Bly
Science is Culture

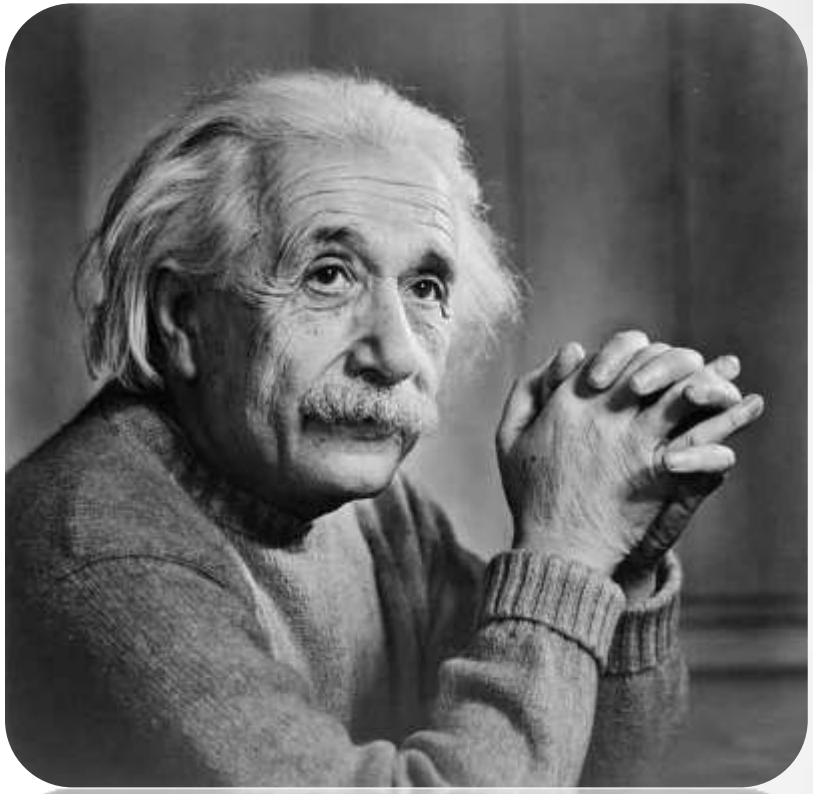
Science and Technology Content for English Composition Courses

Preface: John Brockman: Brockman writes, "In 1991, I suggested the idea of a third world culture which consists of those scientists and other thinkers in the empirical world who, through their work and expository writing, are taking the place of the 'traditional intellectual' in rendering visible the deeper meanings of our lives, redefining who and what we are. And, that they do so with the understanding that they are to be challenged."

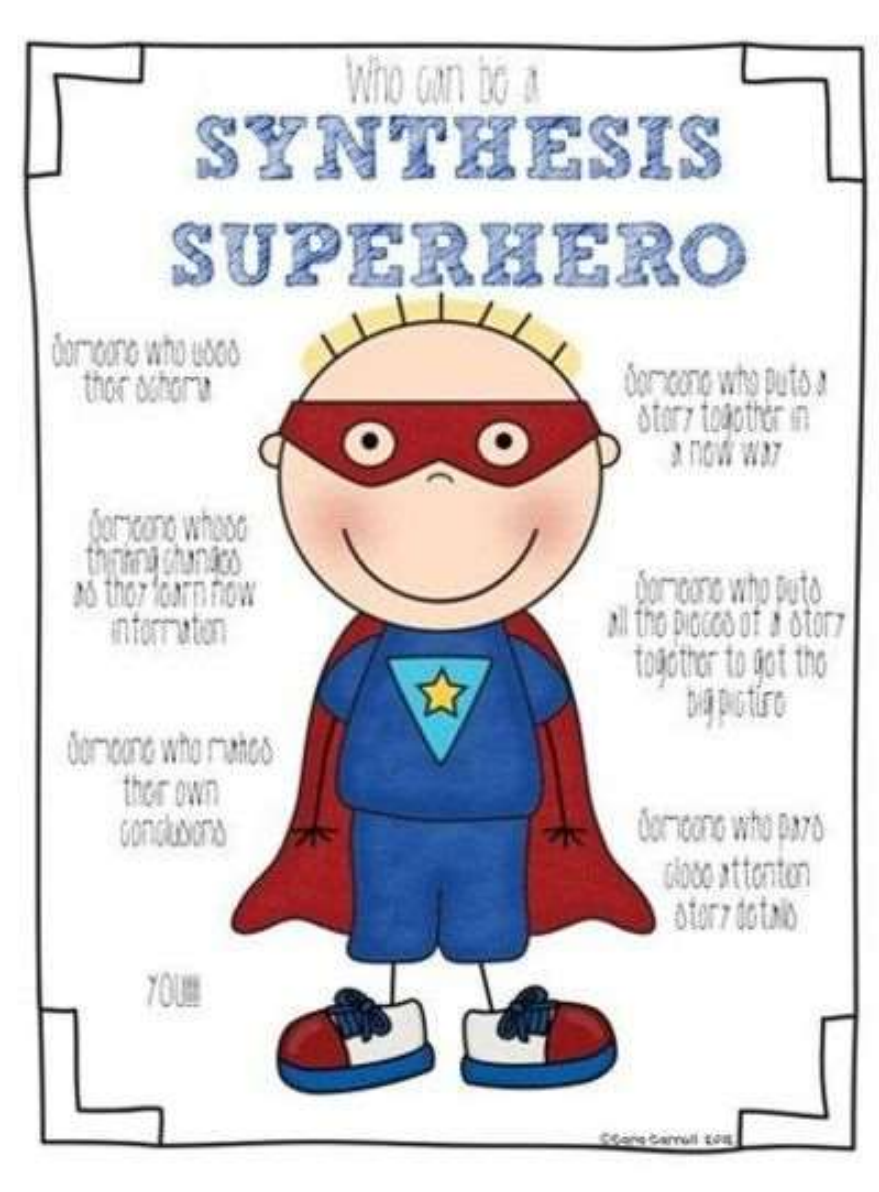


Imagination is more important than knowledge, for knowledge is limited to all we know and understand, while imagination embraces the entire world, and all there ever will be to know and understand.

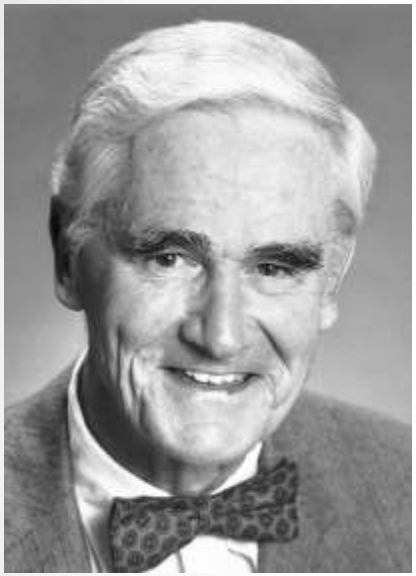
–Albert Einstein



Be a synthesis superhero!

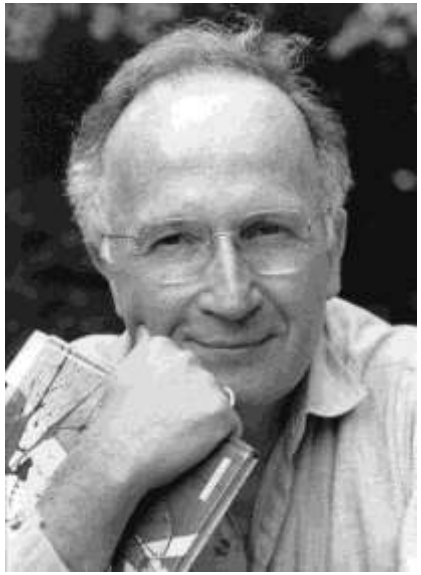


Toward synthesis superheroes …



Donald Cram, 1987 Nobel Prize, Chemistry. Artist, poet & musician.

Peter Mitchell, 1978 Nobel Prize, Chemistry. Philosopher & artist.



Roald Hoffman, 1981 Nobel Prize, Chemistry. Two collections of poetry.

William D. Phillips, 1997 Nobel, Physics, Writer & science communication.

From: "Nurturing creativity in science takes breath of training"
March 23, 2009, Michelle & Robert Root-Bernstein, *Imagine That*

Nobel prize winners are rarely the best academic students. They do not have high IQs that are any higher than those of scientists overall. They don't test higher on other standardized tests.

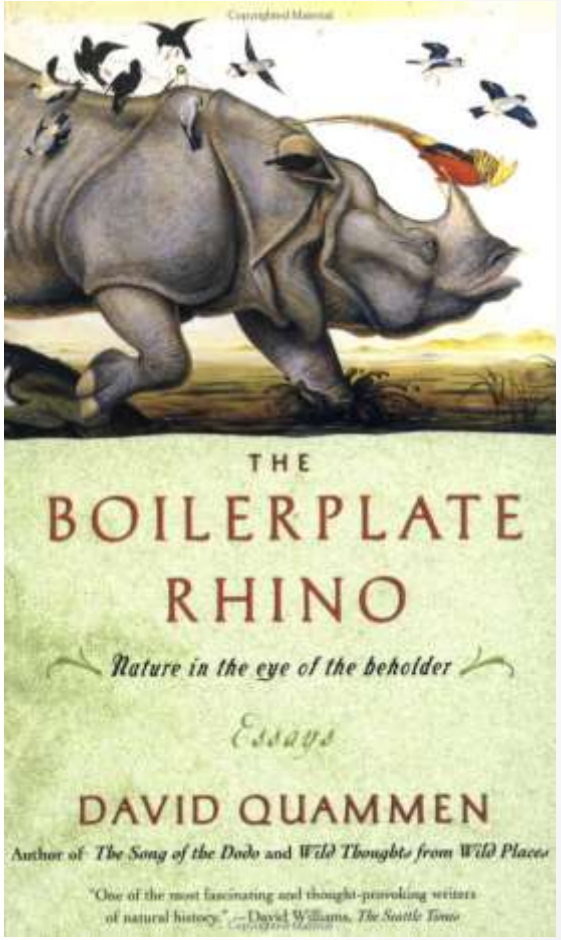
They DO bring a much wider range of skills, knowledge, talents, and methods to their work. So, instead of looking for scientific and mathematical prodigies and funneling them into early scientific specialization, we should be doing the opposite.

From: "Nurturing creativity in science takes breath of training"
March 23, 2009, Michelle & Robert Root-Bernstein, *Imagine That*

Toward synthesis superheroes …

"… I've seen that science itself is a fallible human activity, not a conceptual machine-tool, and that while accuracy and precision can be easily achieved, validity and meaning cannot.

The imperfections and constraints vitiating scientific knowledge stand as a warning about the limits of other sorts of knowledge—even shakier sorts—including that based on eyewitness experience."



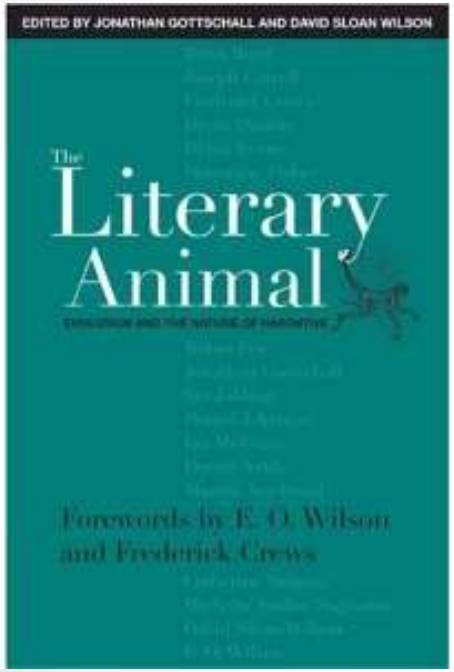
Toward synthesis superheroes …

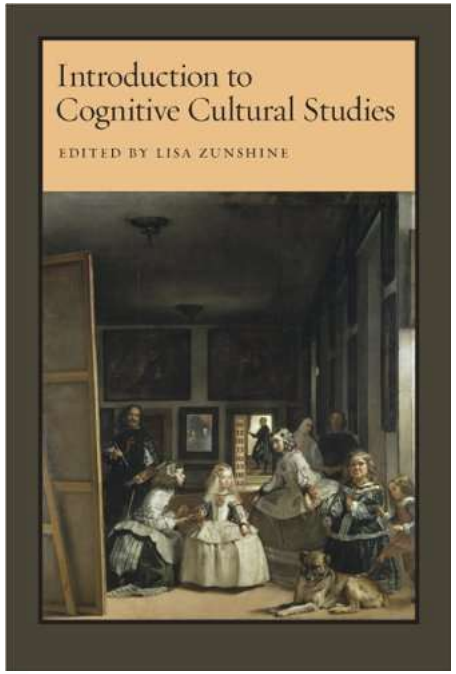
"That which binds us, our common nature, is what literature has always, knowingly and helplessly, given voice to. And it is this universality which the biological sciences, now entering another exhilarating phase, are set to explore further "

—British Novelist Ian McEwan, *Literature, Science, and Human Nature*

Toward synthesis superheroes …

Integration, evolutionary themes, the science of literature, lit. crit. based on evolutionary context does not mean the "absolute," or even devalue deconstruction, post modernism, post structuralism, constructivism, or cultural approaches to literature.





"When science does flourish, it validates and extends as much as it overturns the uncertain knowledge derived by other means. …[L]iterature does not diminish in value, when approached from a scientific perspective. The relationship between the two bodies of wisdom should be mutually reinforcing."

Toward synthesis superheroes …

In order to be a great poet one must be a good engineer, in order to be a great engineer, one must be a good poet.

Want to attract more students to STEM? Embrace arts and humanities.

All STEM majors should take fine arts courses.

http://venturebeat.com/2013/05/13/steam-carnival/ **Lasers, robots, and electricity help make STEM education into STEAM**

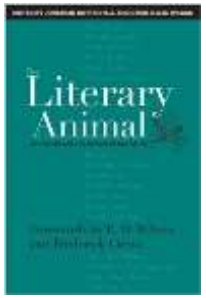
Recommended Reads

The Transhumanist Reader: Classical and Contemporary Essays on the Science, Technology, and Philosophy of the Human Future, Eds. Max Moore, Natasha Vita Moore

Material Culture and Technology in Everyday Life: Ethnographic Approaches (Intersections in Communications and Culture: Global Approaches and Transdisciplinary Perspectives), Ed. Phillip Vaninni

Technology and Society: Building our Sociotechnical Future, Eds. Deborah G. Johnson & James M. Wetmore

The Literary Animal: Evolution and the Nature of Narrative (Rethinking Theory) Eds. David Sloan Wilson & E.O. Wilson



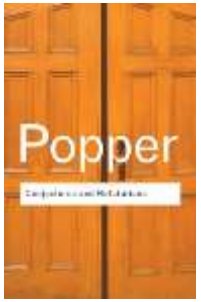
Introduction to Cognitive Cultural Studies, Ed. Lisa Zunshine

Novelist and Physicist C.P. Snow reified the debate for modern times.

This Will Change Everything: Ideas That Will Shape the Future, Ed. John Brockman

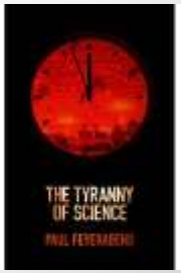
Literature & Science in the Nineteenth Century, Ed. Laura Otis

The Structure of Scientific Revolutions, and *The Road since Structure: Philosophical Essays, 1970-1993, with an Autobiographical Interview*, Thomas Kuhn



Carl Popper, *Conjectures and Refutations.*

Against Method and *The Tyranny of Science*, Paul Feyerabend



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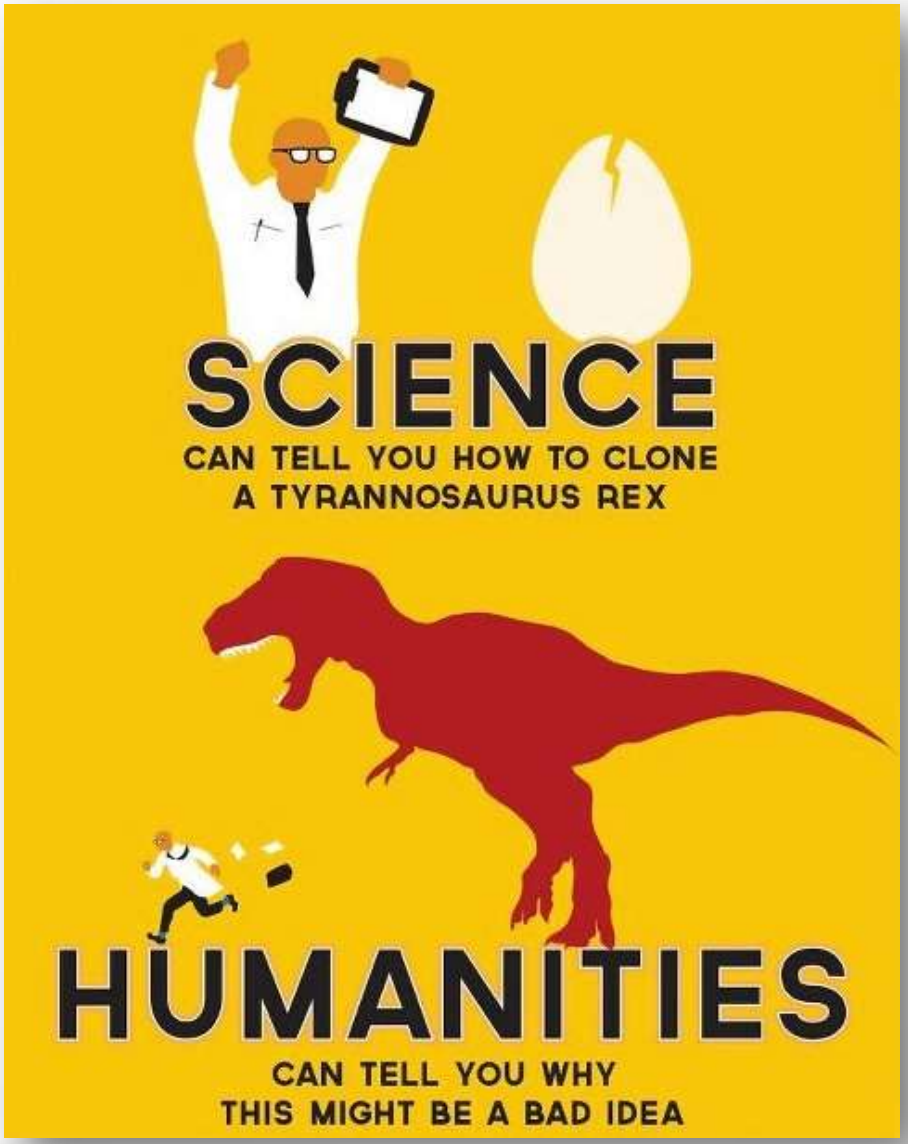
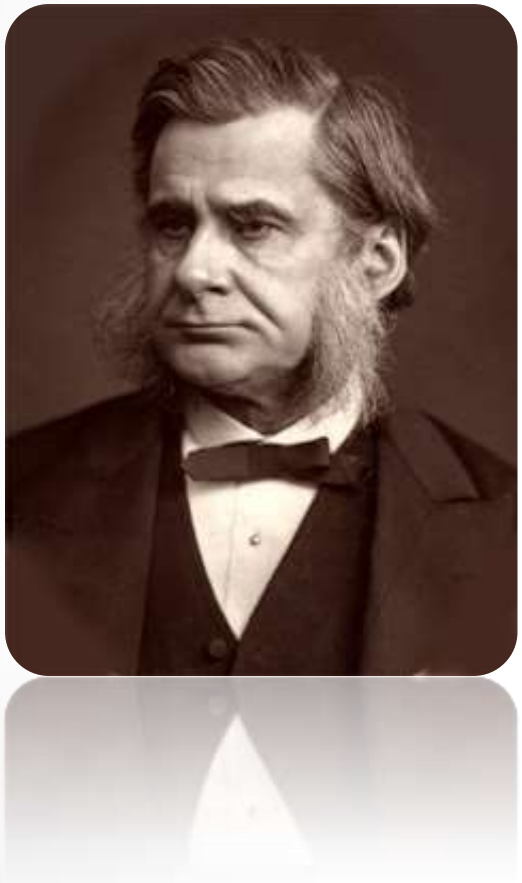


Toward synthesis superheroes …



Even Huxley recanted somewhat, believing that an education that focused totally on science was as "skewed" as one that focused solely on literature.

A word about facts. Facts:

- Are not absolute;
- Have a short shelf life and history;
- Are not value free;
- Are generally very loosely organized and not discovered or recognized as part of a cumulative, chronological sequence;
- One era's fact is another era's _____;
- One person's fact is another person's_____;
- Are at once something we have to accept as real and purposeful while at the same time understanding that they are in flux.

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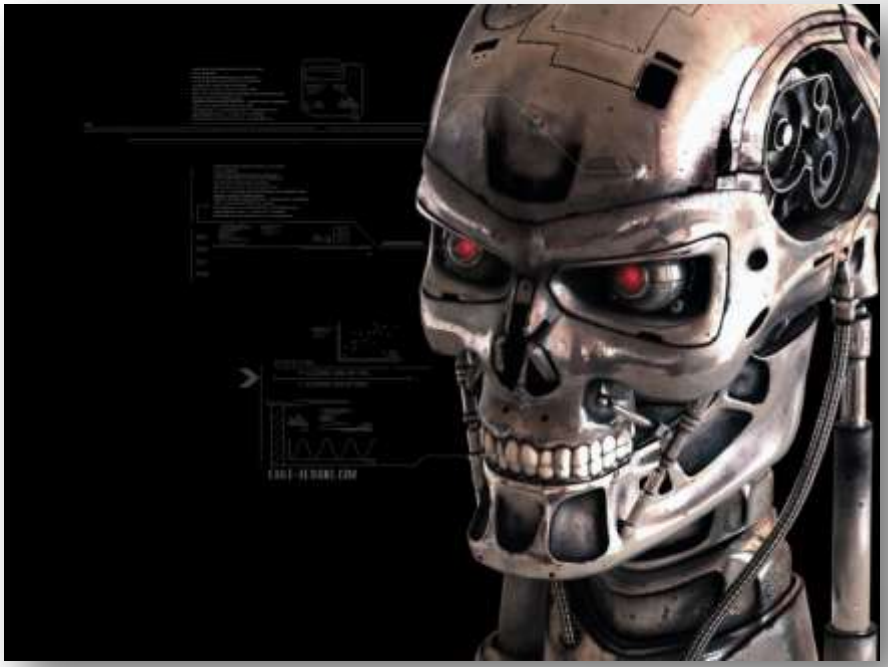
Or go to:

www.writingforstem.com

The terminator scenario!