WRITING FOR STEM

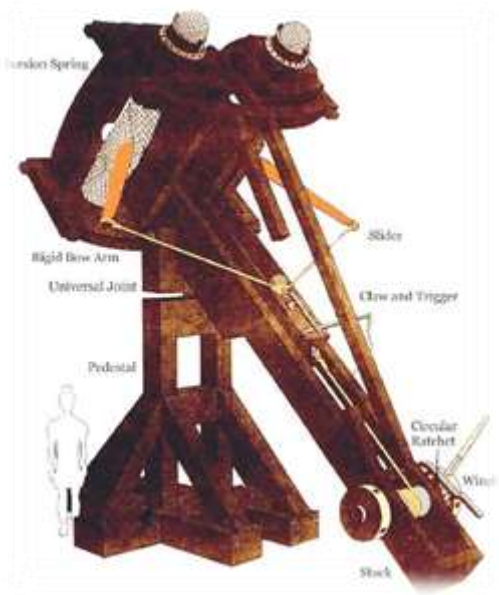
ENGLISH COMPOSITION

Andrew Rusnak

How to think for this class …

In this class we will NOT be looking for answers. Our quest will be for the next important question. During our class discussions, I'll ask you from time-to-time, "What is the next question?" as it relates to our discussion.

Is it science vs. the humanities? Do you, as students, sometimes divide your fellow students or yourselves up into “artsy” types and “science/math types?



VS.?

Science and Technology Content for English Composition Courses

The Questions in the context of the "either/or" dichotomy-driven media culture.

Conventional/Popular View of Science =

deductive reasoning, reductionism, positivism/empirical evidence, objectivity, 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.

Vs.

Creative "Humanistic" view of science =

inductive reasoning, subjectivity, abstract, 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.

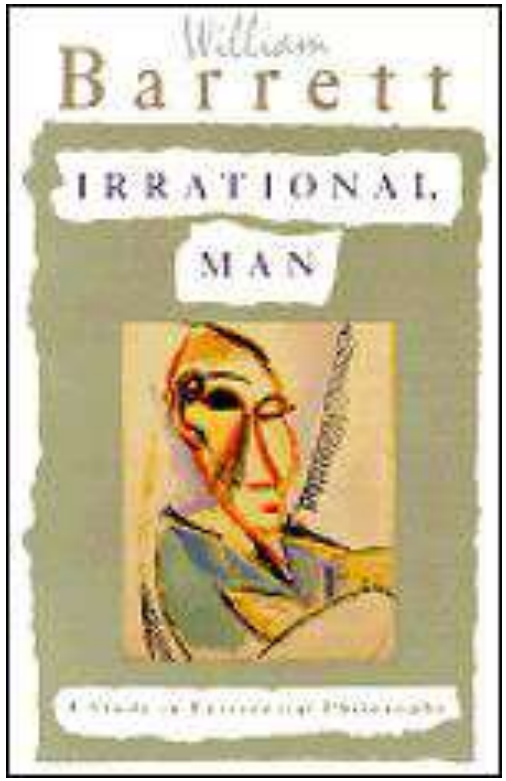
Should these two types of thinking be mutually exclusive when it comes to training, educating the next generation of scientists, engineers, and health professionals to write? This

The Questions???

Has the battle for specialized training in education won out? At the expense of humanities? Are the questions the humanities asks outdated?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*



The Questions???

Science seems to have an “everything is empirical, everything can be reduced” image problem with many in the humanities and the humanities seem to have a “we will never know everything there is to know about any one thing, let’s party with subjectivity, and, yes, emotions matter” image problem with those in the sciences.

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?

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

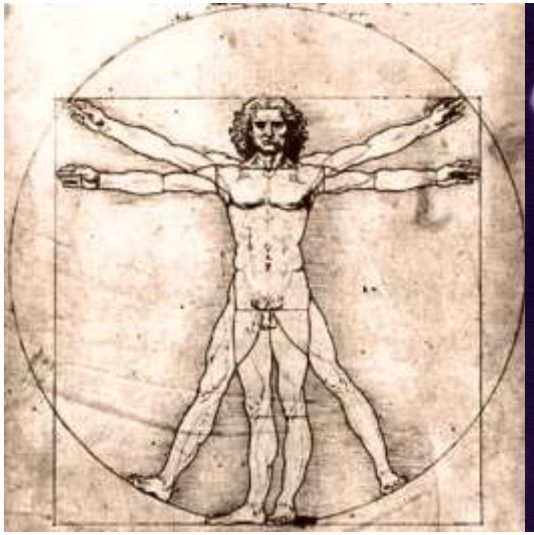
"An analysis of the history of technology shows that technological change is exponential, contrary to the common-sense 'intuitive linear' view. So we won't experience 100 years of [scientific and technological] progress in the 21st century — it will be more like 20,000 years of progress (at today's rate). 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

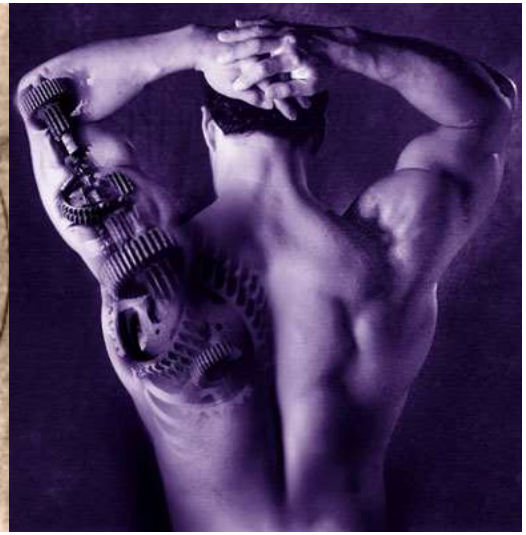
http://www.youtube.com/watch?v=EX69E-eoWVM **Ray Kurzweil: The Law of Accelerating Returns 4:00 – 7:00**

The Questions???

Previous to the 20th Century, science and technology were products of the metaphysical culture, the humanities 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, is science and technology still part of this culture? Or, because of the accelerated, exponential rate at which technological change occurs, are we proceeding at a rate that precludes the possibility of asking? Even in the 20th century, we discussed, but did not necessarily vote on: gas combustion engines, the pill, computers, etc …





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?

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"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

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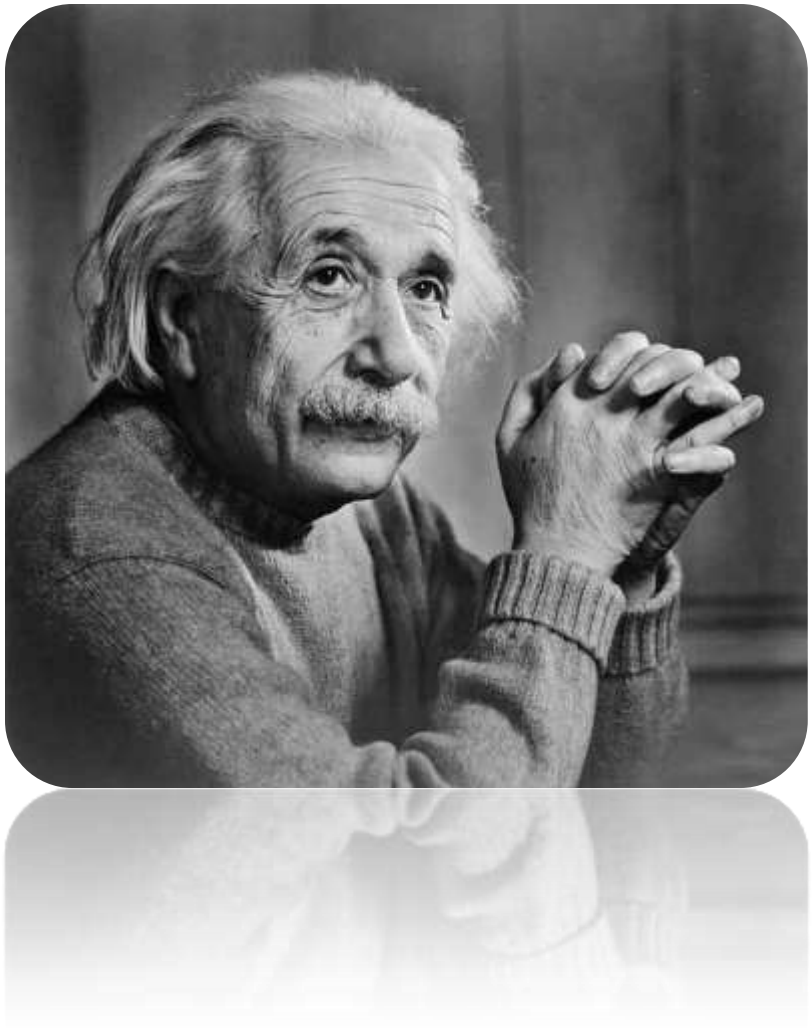
Imagination is more important than knowledge, for knowledge is limited to all we know and understand, while imagination embraces the entire world, and all there ever will be to know and understand.

−Albert Einstein



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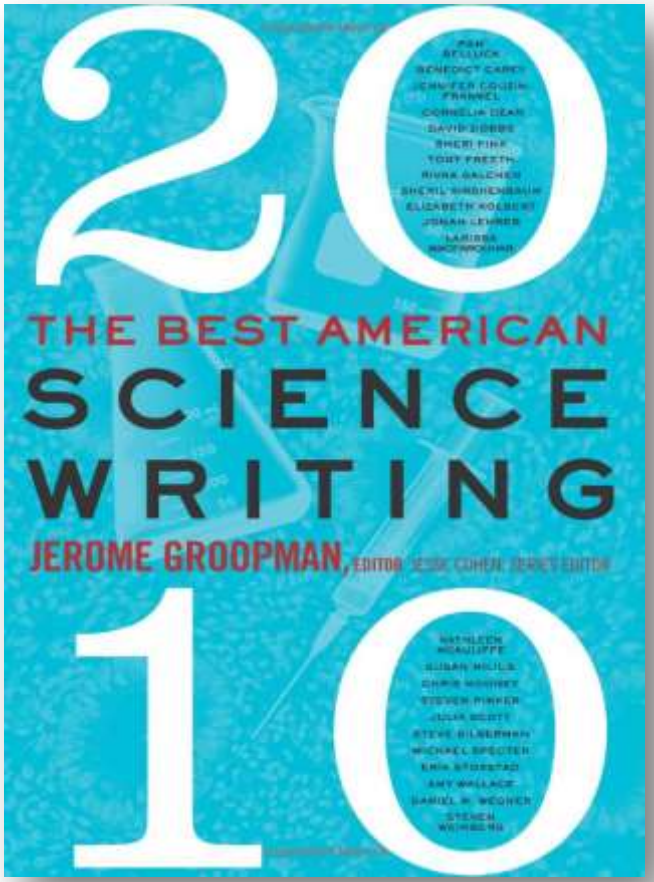


The Best Science Writing: 2010
Jerome Groopman, Ed

What's coming …

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

https://www.youtube.com/watch?v=1Ugo2KEV2XQ The coming transhuman era: Jason Sosa at TEDxGrandRapids, 15 min.

https://www.youtube.com/watch?v=D5ShvYrYnxo Future of the Mind, Michio Kaku, 13 min.

http://www.youtube.com/watch?v=ofHhzzTA6bk Dr. Michio Kaku on His New Book, "Physics of the Future: How Science Will Change Daily Life by 2100

http://www.youtube.com/watch?v=fhJoSoqtiPg - Michio Kaku on the Future of Science – 7:30

http://www.youtube.com/watch?v=dTi4v3HveqE **Michio Kaku: The Dark Side of Technology 6 min**

https://www.youtube.com/watch?v=VAh_vOWi-VY "Questions W/ Answers and Questions W/O Answers": Dr. Alan Lightman, 58:20

Method …

https://www.youtube.com/watch?v=e8-ugU0bpJs Is science value- and emotion-free? - EO Wilson, 5 min

https://www.youtube.com/watch?v=YltEym9H0x4 – Richard Feynman on knowing, 4min

https://www.youtube.com/watch?v=9kirzr6lnSs – Richard Feynman, Disrespect for Respectable, 9 min

https://www.youtube.com/watch?v=_sAfUpGmnm4 – Feynman, the way nature works, 6 min

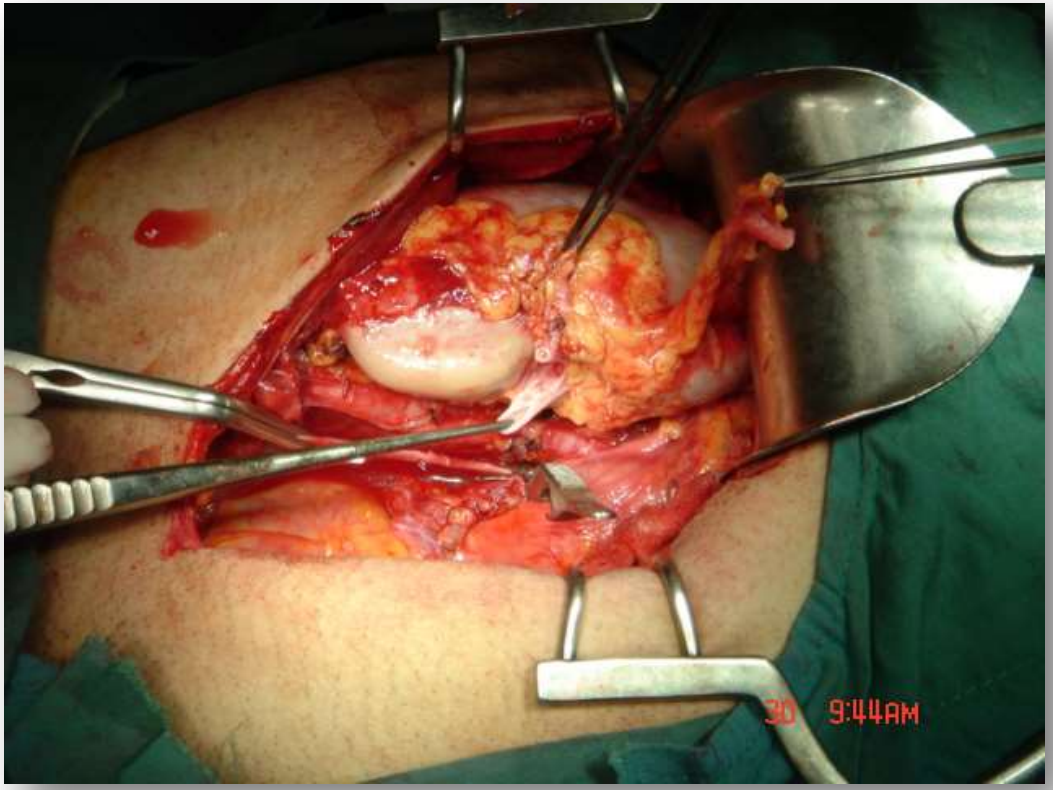
Humanity/Existence …

https://www.youtube.com/watch?v=qzQBFlFdRPk E.O. Wilson explains the meaning of human existence, in 6 min.

https://www.youtube.com/watch?v=lx26k8LTCdI E.O. Wilson: Science, Not Philosophy, Will Explain the Meaning of Existence, 9 min

https://www.youtube.com/watch?v=4Qhlp-X3EHA Dialogue: What is the Role of Science in Morality? 35 min.

The Kindest Cut, Larissa MacFarquhar. Describe all the conditions surrounding your choice to donate, or not donate, a kidney to someone. Include, if you chose to donate, would it make you a hero? Why or why not? **Option 2:** Should it be mandated that if someone suffers an accidental death and his/her organs can be used to save someone else's life, should they be extracted without any former consent? Why or why not?



http://www.youtube.com/watch?v=P8Kq-0YUvkg **Dialysis and Kidney Disease Documentary: As Time Runs Out - The Steve Lessin Story**

http://www.youtube.com/watch?v=MyWcEfT6D44&feature=related **Kidney dialysis: Matthew's story**

http://www.youtube.com/watch?v=-JEBMod52Tw **Ethics & Organ Transplant**

http://www.youtube.com/watch?v=2Mj3OxBYDwA&feature=related **"Because" - The Story of an Organ Donor**

http://www.youtube.com/watch?v=jnfA9n3OGMU **Scott Sisters Kidney Transplant Violates Donation Laws**

http://www.youtube.com/watch?v=ofiLcTs7_Ys: Tissue Engineering, 7 min

THE DAILY BEAST
READ THIS SKIP THAT

Not Just Urban Legend

Jan 9, 2009 7:00 PM EST

Organ trafficking was long considered a myth. But now mounting evidence suggests it is a real and growing problem, even in America.

By the time her work brought her back to the United States, Nancy Scheper-Hughes had spent more than a decade tracking the illegal sale of human organs across the globe. Posing as a medical doctor in some places and a would-be kidney buyer in others, she had linked gangsters, clergymen and surgeons in a trail that led from South Africa, Brazil and other developing nations all the way back to some of her own country's best medical facilities. So it was that on an icy February afternoon in 2003, the anthropologist from the University of California, Berkeley, found herself sitting across from a group of transplant surgeons in a small conference room at a big Philadelphia hospital.

By accident or by design, she believed, surgeons in their unit had been transplanting black-market kidneys from residents of the world's most impoverished slums into the failing bodies of wealthy dialysis patients from Israel, Europe and the United States. According to Scheper-Hughes, the arrangements were being negotiated by an elaborate network of criminals who kept most of the money themselves. For about $150,000 per transplant, these organ brokers would reach across continents to connect buyers and sellers, whom they then guided to "broker-friendly" hospitals here in the United States (places where Scheper-Hughes says surgeons were either complicit in the scheme or willing to turn a blind eye). The brokers themselves often posed as or hired clergy to accompany their clients into the hospital and ensure that the process went smoothly. The organ sellers typically got a few thousand dollars for their troubles, plus the chance to see an American city.

As she made her case, Scheper-Hughes, a diminutive 60-something with splashes of pink in her short, grayish-brown hair, slid a bulky document across the table—nearly 60 pages of interviews she had conducted with buyers, sellers and brokers in virtually every corner of the world. "People all over were telling me that they didn't have to go to a Third World hospital, but could get the surgery done in New York, Philadelphia or Los Angeles," she says. "At top hospitals, with top surgeons."

In interview after interview, former transplant patients had cited the Philadelphia hospital as a good place to go for brokered transplants. Two surgeons in the room had also been named repeatedly. Scheper-Hughes had no idea if those surgeons were aware that some of their patients had bought organs illegally. She had requested the meeting so that she could call the transgression to their attention, just in case.

Hospital officials told NEWSWEEK that after meeting with Scheper-Hughes, they conducted an internal review of their transplant program. While they say they found no evidence of wrongdoing on the part of their surgeons, they did tighten some regulations, to ensure better oversight of foreign donors and recipients. "But that afternoon," Scheper-Hughes says, "they basically threw me out.“

It's little wonder. The exchange of human organs for cash or any other "valuable consideration" (such as a car or a vacation) is illegal in every country except Iran. Nonetheless, international organ trafficking—mostly of kidneys, but also of half-livers, eyes, skin and blood—is flourishing; the World Health Organization estimates that one fifth of the 70,000 kidneys transplanted worldwide every year come from the black market. Most of that trade can be explained by the simple laws of supply and demand. Increasing life spans, better diagnosis of kidney failure and improved surgeries that can be safely performed on even the riskiest of patients have spurred unprecedented demand for human organs. In America, the number of people in need of a transplant has nearly tripled during the past decade, topping 100,000 for the first time last October. But despite numerous media campaigns urging more people to mark the backs of their driver's licenses, the number of traditional (deceased) organ donors has barely budged, hovering between 5,000 and 8,000 per year for the last 15 years.

In that decade and a half, a new and brutal calculus has emerged: we now know that a kidney from a living donor will keep you alive twice as long as one taken from a cadaver. And thanks to powerful antirejection drugs, that donor no longer needs to be an immediate family member (welcome news to those who would rather not risk the health of a loved one). In fact, surgeons say that a growing number of organ transplants are occurring between complete strangers. And, they acknowledge, not all those exchanges are altruistic. "Organ selling has become a global problem," says Frank Delmonico, a surgery professor at Harvard Medical School and adviser to the WHO. "And it's likely to get much worse unless we confront the challenges of policing it."

http://www.thedailybeast.com/newsweek/2009/01/09/not-just-urban-legend.html

The Placebo Problem, Steve Silberman. The placebo effect is one of the most bizarre phenomena in human nature. Placebo has a twin, the “nocebo effect,” where beliefs and negative expectations can have very harmful effects even if there is no legitimate cause.

What the mind believes to be true can be a very powerful force. Expert researchers can only explain this phenomenon up to the point of biochemical releases, “placebo-activated opioids” that relieve pain and regulate heart and perspiration. Our belief system seems to turn this process on, but it only works if we are “tricked” into believing that it will. Set up an experiment where the placebo effect works. Include a treatment group (real medication) and a control group (placebo). Invent a hypothetical problem and experiment. The results should be consistent with some of the experiments you read about in Silberman’s story. In the last 200 words or so, explain why you think the placebo effect is so powerful.

http://www.youtube.com/watch?v=v_feOG94IAs **Stuff They Don't Want You to Know - The Placebo Effect and Pharmaceutical Companies**

http://www.youtube.com/watch?v=O2hO4_UEe-4 **This Video Will Hurt, Nocebo, 6:48**

http://www.youtube.com/watch?v=LWQfe__fNbs **Mind Heal the Body? Lissa Rankin, 18:50**

Surgery for Mental Ills Offers Both Hope and Risk, Benedict Carey. Would you recommend surgery for obsessive-compulsive disorder for someone you loved and care about? Why or why not?

http://www.youtube.com/watch?v=1Izmyru5T_w **Early Treatment of Mental Disorders**

http://www.youtube.com/watch?v=tpr7bq2dV-8&feature=related **Mental : A History of the Mad House (PART 1)**

http://www.youtube.com/watch?v=hQh9LBIhjyM **Documentary on Sigmund Freud (Part 1 of 3)**

http://www.youtube.com/watch?v=RzjlfA-oPQo&feature=related **Freud Documentary p. 2**

http://www.youtube.com/watch?v=aBKSOxqu7CQ&feature=related **A Case Study in Schizophrenia**

National Alliance on Mental Illness

What is Mental Illness: Mental Illness Facts

Mental illnesses are medical conditions that disrupt a person's thinking, feeling, mood, ability to relate to others and daily functioning. Just as diabetes is a disorder of the pancreas, mental illnesses are medical conditions that often result in a diminished capacity for coping with the ordinary demands of life.

Serious mental illnesses include major depression, schizophrenia, bipolar disorder, obsessive compulsive disorder (OCD), panic disorder, post traumatic stress disorder (PTSD) and borderline personality disorder. The good news about mental illness is that recovery is possible.

Mental illnesses can affect persons of any age, race, religion, or income. Mental illnesses are not the result of personal weakness, lack of character or poor upbringing. Mental illnesses are treatable. Most people diagnosed with a serious mental illness can experience relief from their symptoms by actively participating in an individual treatment plan.

In addition to medication treatment, psychosocial treatment such as cognitive behavioral therapy, interpersonal therapy, peer support groups and other community services can also be components of a treatment plan and that assist with recovery. The availability of transportation, diet, exercise, sleep, friends and meaningful paid or volunteer activities contribute to overall health and wellness, including mental illness recovery.

From Scientific American: DSM-5 Ignores Biology of Mental Illness

The latest edition of psychiatry's standard guidebook neglects the biology of mental illness. New research may change that. By Ferris Jabr

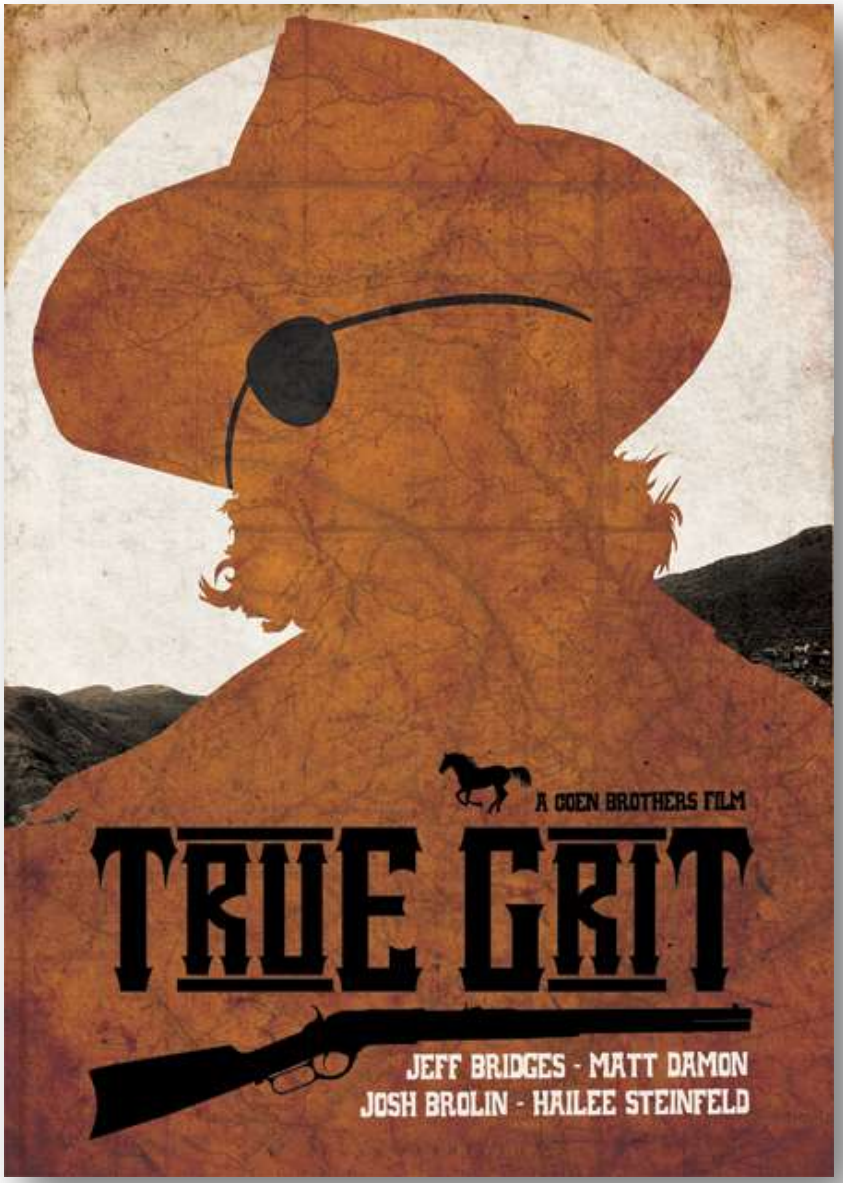
This month the American Psychiatric Association (APA) will publish the fifth edition of its guidebook for clinicians, the *Diagnostic and Statistical Manual of Mental Disorders*, or *DSM-5*. Researchers around the world have eagerly anticipated the new manual, which, in typical fashion, took around 14 years to revise. The *DSM* describes the symptoms of more than 300 officially recognized mental illnesses—depression, bipolar disorder, schizophrenia and others—helping counselors, psychiatrists and general care practitioners diagnose their patients. Yet it has a fundamental flaw: it says nothing about the biological underpinnings of mental disorders. In the past, that shortcoming reflected the science. For most of the *DSM*'s history, investigators have not had a detailed understanding of what causes mental illness.

That excuse is no longer valid. Neuroscientists now understand some of the ways that brain circuits for memory, emotion and attention malfunction in various mental disorders. Since 2009 clinical psychologist Bruce Cuthbert and his team at the National Institute of Mental Health have been constructing a classification system based on recent research, which is revealing how the structure and activity of a mentally ill brain differs from that of a healthy one. The new framework will not replace the *DSM*, which is too important to discard, Cuthbert says. Rather he and his colleagues hope that future versions of the guide will incorporate information about the biology of mental illness to better distinguish one disorder from another.

Cuthbert, whose project may receive additional funding from the Obama administration's planned Brain Activity Map initiative, is encouraging researchers to study basic cognitive and biological processes implicated in many types of mental illness. Some scientists might explore how and why the neural circuits that detect threats and store fearful memories sometimes behave in unusual ways after traumatic events—the kinds of changes that are partially responsible for post-traumatic stress disorder. Others may investigate the neurobiology of hallucinations, disruptions in circadian rhythms, or precisely how drug addiction rewires the brain.

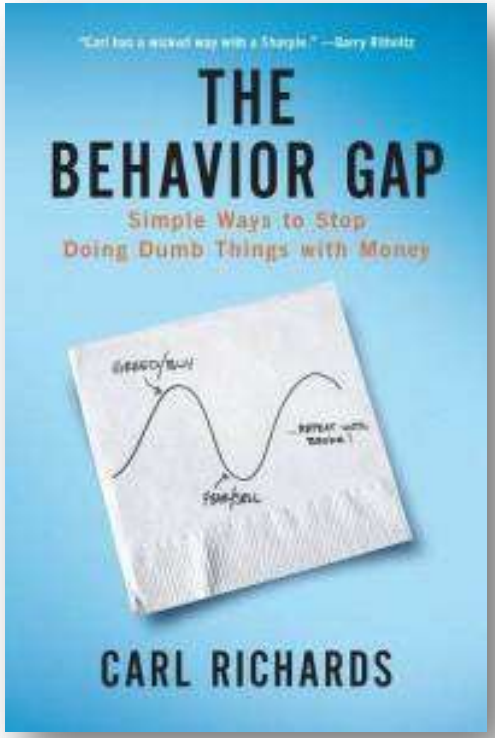
The ultimate goal is to provide new biological targets for medication. “We understand so much more about the brain than we used to,” Cuthbert says. “We are really in the middle of a big shift.”

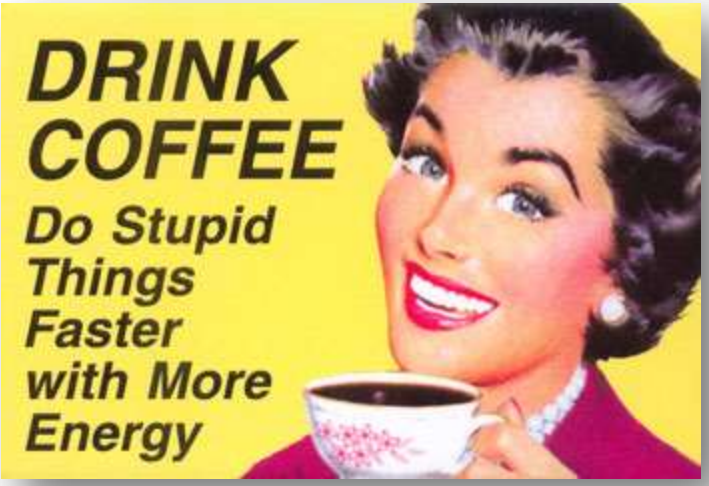
The Truth About Grit, Jonah Lehrer. It is fast becoming no secret that very successful people are only slightly more intelligent than average, but have high levels of persistence and grit. Put a “grit plan” together for your own education. Be detailed. List five ways how you will learn how to be grittier or more persistent? To what tasks or processes will you apply your grit to most?



http://www.youtube.com/watch?v=kXjPa2c7YNA **HOW *FAILURE IN LIFE* WILL MAKE YOU SUCCEED!**

How to Think, Say, or Do Precisely the Worst Thing for Any Occasion, Daniel Wegner. Wegner asks, “Why is thought suppression so hard? … Ironic errors in attention and memory occur with identifiable brain activity and prompt recurrent unwanted thoughts: attractions to forbidden desires; expression of objectionable social prejudices; production of movement errors; and rebounds of negative experiences such as anxiety, pain, and depression.” This happens most often when we are under extreme mental loads. OK, time to fess up. Select one of the “unwanted thoughts listed in the above quote and write about why you think it is recurrent with you and could become (maybe it already has?) an “Ironic error.” In the last 200 words of your essay, speculate on why our minds are built like this? Why do the thoughts we don’t want to have, that may even cause great emotional pain, that we work hard to suppress, so easily recur? What is the evolutionary reason for this? What makes sense? It has to, on some level, make sense, simply by the fact that we do it.





Who said that?

"Those who survived the San Francisco earthquake said, "Thank God, I'm still alive." But, of course, those who died, their lives will never be the same again." - Barbara Boxer, Senator

"I think that gay marriage is something that should be between a man and a woman." - Arnold Schwarzenegger

"Politics gives guys so much power that they tend to behave badly around women. And I hope I never get into that." - Bill Clinton, former U.S. President

"We have a firm commitment to NATO, we are a *part* of NATO. We have a firm commitment to Europe. We are a *part* of Europe." - Dan Quayle, former U.S. Vice President

"It is wonderful to be here in the great state of Chicago" - Dan Quayle, former U.S. Vice-President

"It's time for the human race to enter the solar system!" - Dan Quayle, former U.S. Vice President on the concept of a manned mission to Mars

"It isn't pollution that is hurting the environment, it's the impurities in our air and water that are doing it." - Dan Quayle, former U.S. Vice-President

"We are not ready for an unforeseen event that may or may not occur." - Dan Quayle, former U.S. Vice President

"If we don't succeed, we run the risk of failure." - Dan Quayle, former U.S. Vice President

"We are not without accomplishment. We have managed to distribute poverty equally." - Nguyen Co Thatch, Vietnamese foreign minister

"I cannot tell you how grateful I am -- I am filled with humidity." - Gib Lewis, speaker of the Texas House

"And now, will y'all stand and be recognized." - Gib Lewis, Texas Speaker of the House, to a group of people in wheelchairs on Disability Day

"China is a big country, inhabited by many Chinese." - Charles De Gaulle, former French President

"I'm someone who has a deep emotional attachment to Starsky and Hutch." - Bill Clinton, former U.S. President

"Sure, it's going to kill a lot of people, but they may be dying of something else anyway." - Othal Brand, member of a Texas pesticide review board, on chlordane.

"I didn't realize I was in a Buddhist temple." - Al Gore, former U.S. Vice President when asked about his illegal fundraising activities that took place in a Buddhist temple.

"Fiction writing is great, you can make up almost anything." - Ivana Trump, on finishing her first novel

"I do not like this word "bomb." It is not a bomb. It is a device that is exploding." - Jacques le Blanc, French ambassador on nuclear weapons

"Traditionally, most of Australia's imports come from overseas." - Former Australian cabinet minister Keppel Enderbery

"If you're living in an area with a bad school, move to a place where there's a better school." - Lamar Alexander, former Secretary of Education, explaining his ideas on what parents of children who attend poorly funded urban or rural schools should do to solve the problem.

"I've always thought that underpopulated countries in Africa are vastly under-polluted." - Lawrence Summers, chief economist of the World Bank, explaining why we should export toxic wastes to Third World countries.

"If you take out the killings, Washington actually has a very low crime rate." - Marion Barry, mayor of Washington, D.C.

"After finding no qualified candidates for the position of principal, the school board is extremely pleased to announce the appointment of David Steele to the post." - Philip Streifer, Superintendent of Schools, Barrington, Rhode Island

Friendship as a Health Factor, Jennifer Couzin-Frankel. The question posed by the editors at the beginning of this piece, “Can it really be true that, as some studies indicate and has been reported widely in the media, the health of people you don’t even know, but who are connected to you through other friends or relatives in your social network, can have an effect on your own health?” has profound implications. Think hard about the possibility that your immediate family of which you have a lot of contact, and your extended social network up to “friends of friends” or friends or associates of relatives you do not know, share some common trait. Interview informally three friends of friends or friends of relatives you do not know. See if there are any commonalities beyond the obvious that you share. **Option 2:** Look hard into your online social work. Speculate on whether or not you believe this theory of friendship applies to online communities as well.

Friendships: Enrich your life and improve your health

Friendships can be good for you. Find out about the connection between your health and friendship, and how to promote and maintain healthy friendships.

By Mayo Clinic staff

Friendships can have a major impact on your health and well-being, but it's not always easy to build or maintain friendships. Understand the importance of friendships in your life and what you can do to develop and nurture friendships.

What are the benefits of friendships?

Good friends are good for your health. Friends can help you celebrate good times and provide support during bad times. Friends prevent loneliness and give you a chance to offer needed companionship, too. Friends can also: Increase your sense of belonging and purpose; Boost your happiness; Reduce stress; Improve your self-worth; Help you cope with traumas, such as divorce, serious illness, job loss or the death of a loved one; Encourage you to change or avoid unhealthy lifestyle habits, such as excessive drinking or lack of exercise

Why is it sometimes hard to make friends or maintain friendships?

Many adults find it hard to develop new friendships or keep up existing friendships. Friendships may take a back seat to other priorities, such as work or caring for children or aging parents. You and your friends may have grown apart due to changes in your lives or interests. Or maybe you've moved to a new community and haven't yet found a way to meet people. Developing and maintaining good friendships takes effort. The enjoyment and comfort friendship can provide, however, makes the investment worthwhile.

What's a healthy number of friends?

There's no need to aim for a specific number of friends. Some people benefit from a large and diverse network of friends, while others prefer a smaller circle of friends and acquaintances. There are also different types of friendship. You may have a few close friends you turn to for deeply personal conversations, and more casual friends with whom you see movies, play basketball or share backyard cookouts. Consider what works for you. Overall, the quality of your relationships is more important than the specific number of friends you have.

What are some ways to meet new people?
You can take steps to meet people and develop friendships. For example:
Take your child — or pet — for a walk. Chat with neighbors who are also out and about or head to a popular park and strike up conversations there.
Work out. Take a class at a local gym, senior center or community fitness facility. Start a lunchtime walking group at work.
Do lunch. Invite an acquaintance to join you for coffee or a meal.
Accept invites. When you're invited to a social gathering, say yes. Contact someone who recently invited you to an activity and return the favor.
Volunteer. Offer your time or talents at a hospital, place of worship, museum, community center, charitable group or other organization. You can form strong connections when you work with people who have mutual interests.
Attend community events. Get together with a group of people working toward a goal you believe in, such as an election or the cleanup of a natural area. Find a group with similar interests in an activity, such as auto racing, gardening, reading or making crafts.
Go to school. Take a college or community education course to meet people who have similar interests.
Join a faith community. Take advantage of special activities and get-to-know-you events for new members.

Above all, stay positive. You may not become friends with everyone you meet, but maintaining a friendly attitude and demeanor can help you improve the relationships in your life and sow the seeds of friendship with new acquaintances.

How does social media affect friendships?
Joining a chat group or online community might help you make or maintain connections and relieve loneliness. However, research suggests that use of social networking sites doesn't necessarily translate to a larger offline network or closer offline relationships with network members. In addition, remember to exercise caution when sharing personal information or arranging an activity with someone you've only met online.

How can I nurture my friendships?
Developing and maintaining healthy friendships involves give-and-take. Sometimes you're the one giving support, and other times you're on the receiving end. Letting friends know you care about them and appreciate them can help strengthen your bond. It's as important for you to be a good friend as it is to surround yourself with good friends.

To nurture your friendships:
Go easy. Don't overwhelm friends with phone calls, texts, instant messages or emails. Respect your friends' boundaries.
Don't compete. Don't let friendships turn into a battle over who makes the most money or who has the nicest home.
Adopt a healthy, realistic self-image. Work on building your self-esteem by taking care of yourself — eat a healthy diet and include physical activity in your daily routine. Vanity and constant self-criticism can be turnoffs to potential friends.
Avoid relentless complaining. Nonstop complaining can put a strain on your friendships. Talk to your friends about how you can change the parts of your life that make you unhappy.
Adopt a positive outlook. Try to find the humor in things. Laughter is infectious and appealing.
Listen up. Ask what's going on in your friends' lives. Avoid talking about your own problems all the time. Try to only give advice when your friends ask for it.
Don't judge. Give your friends space to change, grow and make mistakes. Encourage your friends to freely express their emotions.
Respect privacy. Keep confidential any personal information that your friends share with you. Try not to ask questions that make your friends uncomfortable.
Remember, it's never too late to build new friendships or reconnect with old friends. Investing time in making friends and strengthening your friendships can pay off in better health and a brighter outlook for years to come.

How does social media really affect friendships?

The New York Times

April 21, 2012
The Flight From Conversation, By SHERRY TURKLE

WE live in a technological universe in which we are always communicating. And yet we have sacrificed conversation for mere connection.

At home, families sit together, texting and reading e-mail. At work executives text during board meetings. We text (and shop and go on Facebook) during classes and when we're on dates. My students tell me about an important new skill: it involves maintaining eye contact with someone while you text someone else; it's hard, but it can be done.

http://www.nytimes.com/2012/04/22/opinion/sunday/the-flight-from-conversation.html?pagewanted=all

How are we different as a result of digital technology? Read the **article "Is Google Making us Stupid" by Nicholas CRR published by *The Atlantic* and the piece, "The Reading Brain in the Digital Age: The Science of Paper vs. Screens" by Ferris Jabr, that appeared in *Scientific American.*** Select one of these texts, take two examples (quotes) from whatever narrative you choose, create a thesis statement based on not just if you agree or disagree with what the author is saying, but why or why not. Defend your thesis. (These texts are on the website: www.writingforstem.com

the Atlantic

Is Google Making Us Stupid?

What the Internet is doing to our brains

By Nicholas Carr

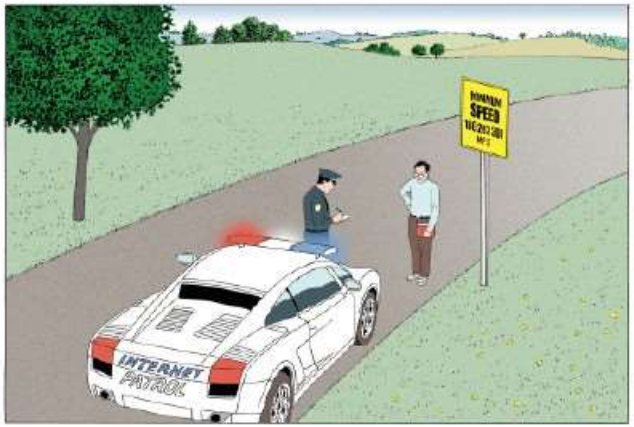


Illustration by Guy Billout

"Dave, stop. Stop, will you? Stop, Dave. Will you stop, Dave?" So the supercomputer HAL pleads with the implacable astronaut Dave Bowman in a famous and weirdly poignant scene toward the end of Stanley Kubrick's *2001: A Space Odyssey*. Bowman, having nearly been sent to a deep-space death by the malfunctioning machine, is calmly, coldly disconnecting the memory circuits that control its artificial " brain. "Dave, my mind is going," HAL says, forlornly. "I can feel it. I can feel it."

I can feel it, too. Over the past few years I've had an uncomfortable sense that someone, or something, has been tinkering with my brain, remapping the neural circuitry, reprogramming the memory. My mind isn't going—so far as I can tell—but it's changing. I'm not thinking the way I used to think. I can feel it most strongly when I'm reading. Immersing myself in a book or a lengthy article used to be easy. My mind would get caught up in the narrative or the turns of the argument, and I'd spend hours strolling through long stretches of prose. That's rarely the case anymore. Now my concentration often starts to drift after two or three pages. I get fidgety, lose the thread, begin looking for something else to do. I feel as if I'm always dragging my wayward brain back to the text. The deep reading that used to come naturally has become a struggle.

I think I know what's going on. For more than a decade now, I've been spending a lot of time online, searching and surfing and sometimes adding to the great databases of the Internet. The Web has been a godsend to me as a writer. Research that once required days in the stacks or periodical rooms of libraries can now be done in minutes. A few Google searches, some quick clicks on hyperlinks, and I've got the telltale fact or pithy quote I was after. Even when I'm not working, I'm as likely as not to be foraging in the Web's info-thickets'reading and writing e-mails, scanning headlines and blog posts, watching videos and listening to podcasts, or just tripping from link to link to link. (Unlike footnotes, to which they're sometimes likened, hyperlinks don't merely point to related works; they propel you toward them.)

http://www.youtube.com/watch?v=W86P_FX6PdI **Nicholas Carr: The Internet Weakens Deep Thinking, 5 min interview**

http://www.edge.org/video/the-age-of-the-informavore **THE AGE OF THE INFORMAVORE, Edge.org, 30 min**

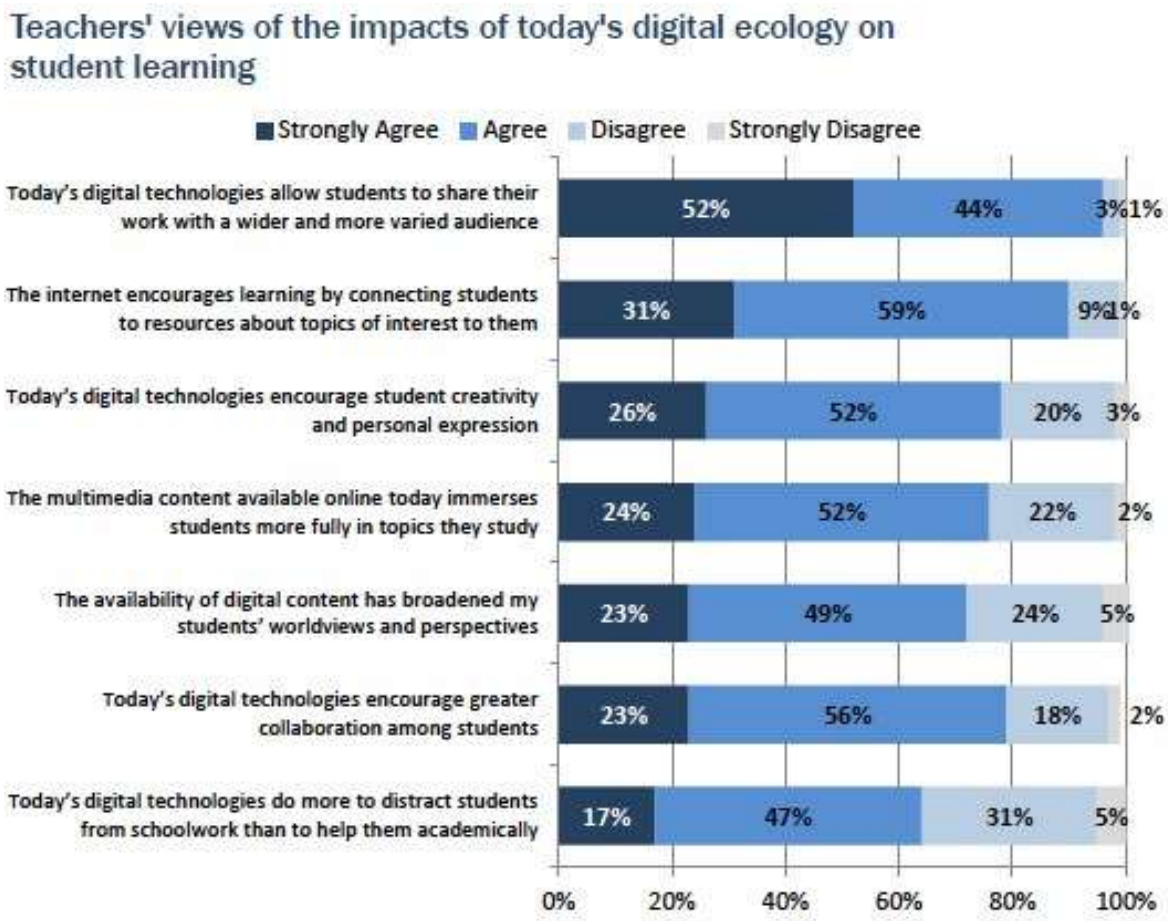
https://www.youtube.com/watch?v=MtLVCpZIiNs **Sherry Turkle Alone Together, 16.5 Min**

http://www.theatlantic.com/magazine/archive/2008/07/is-google-making-us-stupid/6868/

FORA.tv CONFERENCE AND EVENT VIDEO

A Pew Research Center survey found that nearly 90 percent of teachers believe that digital technologies were creating an easily distracted generation with short attention spans. About 60 percent said it hindered students' ability to write and communicate face to face, and almost half said it hurt critical thinking and their ability to do homework. Also, 76 percent of teachers believed students are being conditioned by the internet to find quick answers, leading to a loss of concentration…

For many, technology has become a catalyst for distraction and off task behavior with students, tweeting, or prowling through Youtube when they're supposed to be listening to the teacher or doing classwork promotes a lack of focus. Too many rapid shifts in attention, has been blamed for a loss in the ability to handle complex and challenging tasks.



Source: The Pew Research Center's Internet & American Life Project Online Survey of Teachers, March 7 to April 23, 2012, n=2,462 middle and high school teachers.

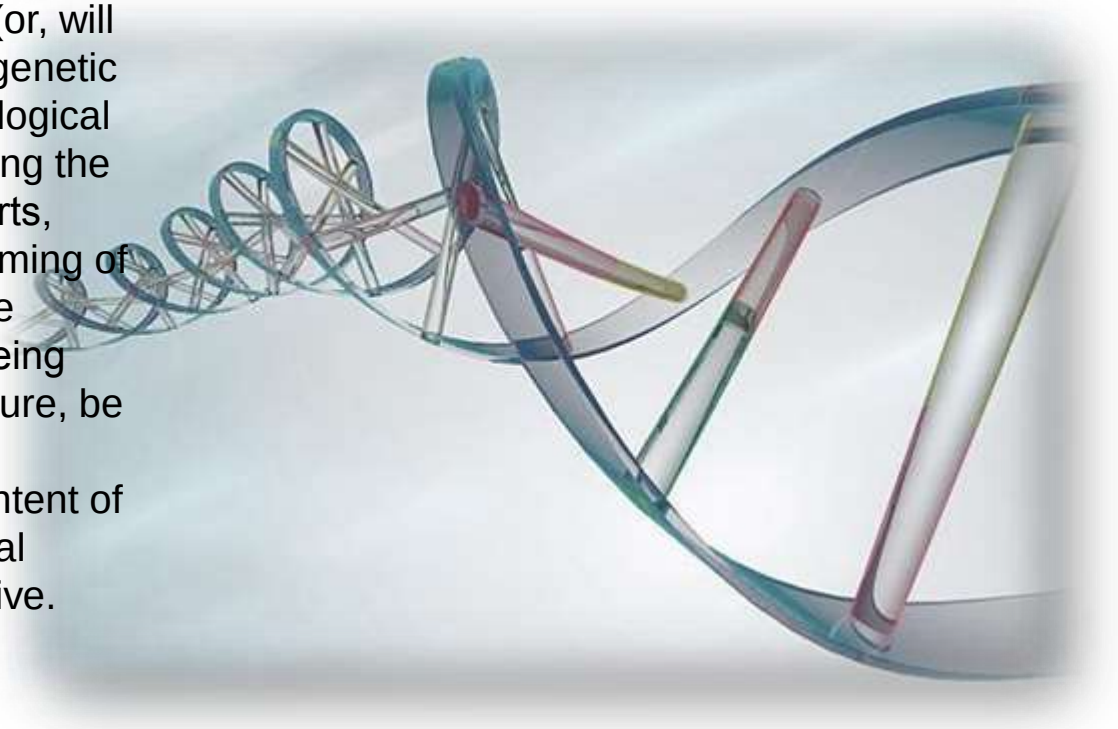
Quick access to information can lead to a lack of critical thinking about sources and quality of information, as well as an inability to “mine for data” many students will likely click one or two pages into a Website, but no further. This means that in addition to creating concentration problems, students who multitask too much develop a tendency toward skimming rather than in-depth reading and analysis. This, more than anything, will hurt grades and the development of the intellect.

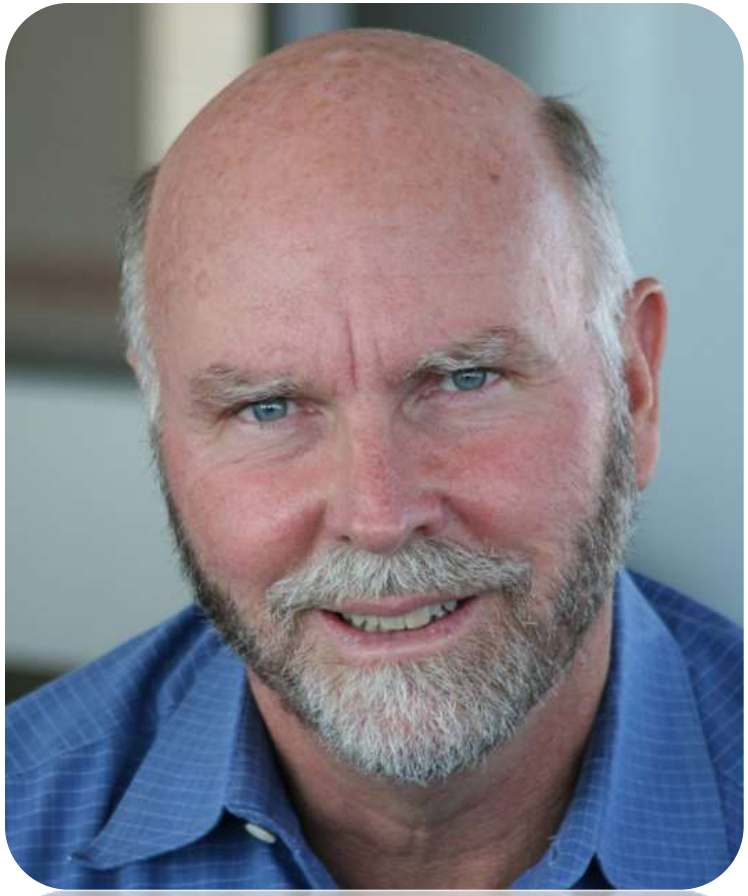
Commonly referred to by educators as the “Wikipedia problem” technology can create an expectation of easy access to information and instantaneous answers. Today students’ idea of learning about a topic is to believe what they read in online. Alas, Wikipedia has become the modern day concept of research and is considered acceptable by too many educators. Teacher reported that students are distracted constantly. Their memory is highly disorganized. Recent assignments suggest a worsening at analytic reasoning. Further, they wonder if we are creating people who are unable to think well and clearly.<<

I had my students read "Is Google Making Us Stupid?" at the start of the school year for the past couple of years. Across the board, they say that Carr is selling their generation short. They feel that they can do both deep reading and the shorter, connective bursts of reading online – the two aren't mutually exclusive. To use Carr's analogy, they like to jet ski and scuba dive. Like Joel's students, mine can be absorbed in digital composition or the free reading of actual books for up to (and over) an hour. Actually the length of their attention spans in my classroom often correlates to those times when the conditions for sustained learning aren't present (e.g. the day before Christmas vacation, the days when teacher doesn't have his act together, emergency preparedness drill days). So I disagree with this and see it as an attention-span awareness issue. – National Writing Project teacher

http://www.pewinternet.org/Reports/2012/Student-Research/Main-Report/Part-1.aspx PEW Report

A Life of its Own, Michael Specter. This article conveys profound implications for “life as we know it” in the near and not-too-distant future. Specter writes, “For the first four billion years, life on Earth was shaped entirely by nature.” Propelled by the forces of selection and chance, the most efficient genes survived, and evolution insured that they would thrive. … [B]y the beginning of the 21st century, our ability to modify the smallest components of life through molecular biology had endowed humans with a power that even those who exercise it most proficiently cannot claim to fully understand.” Man is now playing “God,” in that he can manipulate the outcomes of what nature has determined for millennia. Can life be built from scratch? is the question. Consider this question: If humankind can now (or, will soon be able to) manipulate the genetic outcomes of plants and other biological products for its own good, including the “manufacture” of replacement parts, should this practice, the programming of life, the conscious choice to make “improvements” as opposed to being shaped by the blind whims of nature, be considered natural or unnatural? Remember that it is the highest intent of every species and every individual member of every species to survive.





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.
In 2001, Craig Venter made headlines for sequencing the human genome. In 2003, he started mapping the ocean's biodiversity. And now he's created the first synthetic lifeforms -- microorganisms that can produce alternative fuels.

TED Ideas worth spreading

http://www.ted.com/talks/craig_venter_unveils_synthetic_life.html **Craig Venter unveils "synthetic life"**

In this prophetic 2003 talk -- just days before Dolly the sheep was stuffed -- biotech ethicist Gregory Stock looked forward to new, more meaningful (and controversial) technologies, like customizable babies, whose adoption might drive human evolution. Dr. Gregory Stock's levelheaded look at the hotpoints where tech and ethics connect (or short circuit) have made him a popular guest on TV and radio. He directs the Program on Science, Technology, and Society at UCLA

Cambridge researcher Aubrey de Grey argues that aging is merely a disease -- and a curable one at that. Humans age in seven basic ways, he says, all of which can be averted. Aubrey de Grey, British researcher on aging, claims he has drawn a roadmap to defeat biological aging. He provocatively proposes that the first human beings who will live to 1,000 years old have already been born.

http://www.ted.com/talks/gregory_stock_to_upgrade_is_human.html **Gregory Stock: To upgrade is human**

http://www.ted.com/talks/aubrey_de_grey_says_we_can_avoid_aging.html **Aubrey de Grey says we can avoid aging**

The Orchid Children, David Dobbs. This essay has profound implications for the study of how evolution maintains a diverse genetic predisposition, that genes are not necessarily our destiny, and that what we now perceive as negative traits in certain individuals, might in fact, be crucial to our survival at different times. In your first 500 words, describe the differences between “dandelion children: and “orchid children.” Keep this response concise and make sure you include the relevance of the terms “dandelion” and “orchid” to biology and evolution. Include in your description/definition an explanation of why this genetic diversity is critical to our survival. In the remainder of the essay, describe what you think you are, a dandelion or an orchid. Why did you select what you did?

THE GLOBE AND MAIL
CANADA'S NATIONAL NEWSPAPER • FOUNDED 1844

Parenting

How to raise an 'orchid child' to blossom

ANNE McILROY

Dec. 31, 2010 updated Jan. 01, 2011

A brown van with a small laboratory in the back pulls up at Connie Low's home in Vancouver and a research assistant welcomes the nine-year-old inside. Soon, she is playing a frustrating computer game while machines monitor changes in her heart rate and breathing and assess other signs of stress.

The questions and tests are designed to identify "orchid children," the 15 to 20 per cent of youngsters who are highly sensitive to their environments and very reactive to stress. This makes them more vulnerable to health and behaviour problems if they live in stressful conditions, preliminary studies have found. But with careful attention and nurturing, they can thrive and excel.

It is a new theory, a revolution in thinking that recasts genetic vulnerabilities as potential strengths. The University of British Columbia's Tom Boyce, Anthony Herdman and their colleagues want to learn what is different about the genes and brains of orchid children, as well as the factors in their lives that help them do well.

Are mentors, for example, important? What about feeling like being part of a school community or playing a sport? One day, the work could lead to new screening tools, programs or teaching approaches designed to spot orchid children and help them bloom.

So far, the scientists have assessed 200 eight- to 10-year-old volunteers from a wide range of socioeconomic backgrounds. They plan to do 200 more by the end of the school year. They collect DNA samples and measure each child's response to stress. Connie is asked to prepare and deliver a five-minute speech about herself, both good things and bad, and to imagine she is speaking to her class rather than to research assistants and technicians. The research assistant also asks her to count backwards, by 3, from 200.

"There will be some who aren't responsive at all, some who are exceedingly responsive and a whole bunch in the middle," says Dr. Boyce, who is also part of B.C's Child & Family Research Institute. The exceedingly responsive ones are the orchid children.

The children are also asked to perform a number of tasks designed to allow researchers to learn about their brains. The video game, called flanker fish, is used to assess how well they can focus their attention. Some of the children, although not Connie, are asked to perform other tasks on the computer while a machine measures the electrical activity of their brains.

Dr. Boyce and his colleagues are focused on children, but American psychologist Elaine Aron studies adults who were very likely orchid children in their youth. She started the work two decades ago when she asked for student volunteers who were introverted and easily overwhelmed by stimulation, like being in a noisy place.

She found these individuals, up 15 to 20 per cent of the population, had much in common: They startled easily, were sensitive to pain, deeply moved by art and sensitive to bright lights, strong smells and coarse fabrics.
Since then, Dr. Aron, who works at Stony Brook University in New York, has written a number of books about highly sensitive people.

She now calls the trait sensory-processing sensitivity and says something similar is found in other animals, including fruit flies, dogs, cats and horses. Individuals with it are more likely to watch and observe a situation before plunging in.

In humans, highly sensitive individuals tend to notice more about the people around them and their physical environment, she says, but they are also easily overwhelmed. They are often seen as shy, but that is learned behaviour, she says, not part of the trait. She has also found that they are not always introverts.

She and her colleagues, including Canadian Jadzia Jagiellowicz, have started to use brain imaging to probe how highly sensitive adults process the information their eyes, ears and other senses bring in to the brain compared to control groups.

Although Dr. Aron's experiments have been exclusively with adults, she says anecdotal evidence suggests that highly sensitive children learn better from a gentle correction than a strong punishment. "They know when they have done something wrong," she says.
She has also come up with a questionnaire that parents can use to assess their children.

Dr. Boyce says Dr. Aron's work has gone a long way toward helping highly sensitive adults understand themselves, but that there is not yet a lot of evidence on how to help children. He is also a pediatrician and recommends that his highly sensitive young patients have a set of daily routines.

"They do better when they know what is going to happen," he says. "As well, being highly nurturing and caring with these kids is a highly important part of parenting."

But he is hoping the study now underway will provide doctors, teachers and parents with more information to help orchid children succeed.

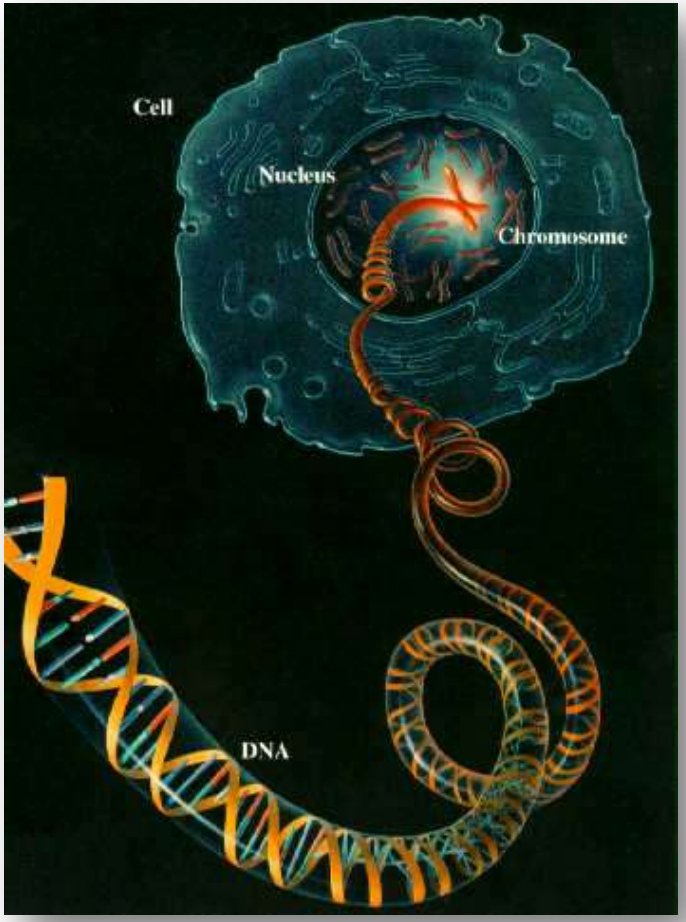
Evidence suggests that when they grow up in families and communities high in stress and adversity, they are more prone to health problems, including respiratory illnesses, and are more likely to show symptoms of depression and anxiety or have problems controlling their behaviour. But if they grow up in a protective and nurturing environment, they have lower rates of illness than less reactive children.
http://www.youtube.com/watch?v=BjjvimJRevQ
According to the theory, the genes that make them so reactive to stress also make them responsive to positive influences and sensitive to social and emotional cues. So their higher risk of illness and behaviour problems is coupled with enormous potential. “They can really blossom into extraordinary people,” says Dr. Boyce.

Parents' watch list
American psychologist Elaine Aron has developed a check list to assess whether children are highly sensitive to their environments.
Does you child…
Notice the slightest unusual odour?
Prefer quiet play?
Complain about scratching clothing, tags in clothes or seams in socks?
Startle easy?
Perform best when strangers aren't around?
Feel things deeply?
Notice when others are in distress?
Have trouble falling asleep after an exciting day?
Is your child…
Sensitive to pain?
A perfectionist?
Bothered by noisy places?

http://abcnews.go.com/video/playerIndex?id=4437413 **Genes Linked To Stress Response?**
Redford Williams, M.D., Duke University

http://www.youtube.com/watch?v=BjjvimJRevQ **Epigenetics**

My Genome, My Self, Steven Pinker. Pinker writes, “Like the early days of the Internet, the dawn of personal genomics promises benefits and pitfalls that no one can foresee. It could usher in an era of personalized medicine, in which drug regimens are customized for a patient’s biochemistry rather than juggled through trial and error, and screening and prevention measures are aimed at those who are at most risk. It [also could] open(s) a niche for bottom-feeding companies to terrify hypochondriacs by turning dubious probabilities into Genes of Doom.” He goes on to point out that era of personalized medicine based on genetic profiles could create a national healthcare system in that it would not allow anyone to be discriminated on based on their genetic predispositions, which are not guarantees of manifestation. It could also create a situation where insurance companies cherry pick those they ant to cover. There are many more implications. Read this essay very carefully, especially the conclusion, Pinker’s advocacy of what can be described as the truth about genes, that they are not destiny. Given that essential truth, write a response to the question: Do you think it is a good idea for society if we analyze everyone for their genome sequence? Why or why not?



http://www.bing.com/videos/search?q=National+Geographic+Genome+Project&view=detail&mid=A8340D58C292042C717CA8340D58C292042C717C&first=0 The Genographic Project: Our history within

http://www.youtube.com/watch?v=lkexKLCak5M&list=PLD8E09BDA2899D14D&index=4&feature=plpp_video The Human Family Tree, Nat Geo, Coordinate with film: The Human Family Tree

BUT, as we are all connected, we are all different. Keep everything you read in Pinker's piece as you read **Are We Still Evolving?** By Kathleen McAuliffe (below). It's very critical to, not just your STEM education, but your overall education, in the tradition of the liberal arts and humanities, that you establish what the German's refer to as weltanschauung or world view, a big picture perspective. Being able to distinguish where and how various ideas split apart and where they synthesize is important to making good decisions, how and why we come up with the ideas we do, how and why we defend them, and how all this contextualizes our existence.

Test Subjects Who Call the Scientist Mom or Dad, Pam Belluck. This one is relatively easy. Put an essay together on whether or not, if you were a career researcher in either the hard or social sciences, you would use your children as test subjects. Why or why not?

http://www.nowpublic.com/health/scientists-use-their-own-children-test-subjects
http://www.nowpublic.com/health/scientists-use-their-own-children-test-subjects

The Famine Fighter's Last Battle, Erik Stokstad. This story depicts a "beautiful" albeit frustrating example of the complexity of nature in flux. Even though mankind has figured out how to manipulate the genetic material of plants to withstand various climates and bacterial or fungicidal invaders, the game is still on and even somewhat accelerated, with the invaders winning sometimes. In a sense, no matter how much knowledge we gain from genetic manipulation, no matter how much we are able to design resistance in the lab and program the results of human reproduction accordingly, this is only a temporary solution. Eventually, all organisms adjust. What do you think is the true ethical fallout of mankind's genetic work in the lab toward the goal of accelerating natural selection and making us all healthier, more resistant to threat, and more acclimated to climate extremes?

http://video.pbs.org/video/2065771003/ PBS **Famine in Somalia**

Pesticides Indicted in Bee Deaths, Julia Scott. The implication in Scott's piece is that the Environmental Protection Agency (EPA) failed to do its job to prohibit use by agribusiness of Bayer CropScience Inc.'s insecticide, imidacloprid, which has been linked by researchers to bee colony collapse. Acts of pollination bees perform are critical to ecology and plant life world-wide. The EPA usually gets criticized by private industry for being too stringent with its regulatory practices. In 500 words, research and describe the process of bee pollination and what would happen if this process stopped. In the balance of your essay, offer two examples where businesses are criticizing the EPA for being too austere in protecting the environment and not allowing business to thrive, and two examples (one of which may be the imidacloprid example) where the EPA appears to be favoring business too much and not protecting the environment. This will require some research.

SCIENTIFIC AMERICAN™

Remember this story when we get to the essay on mass extinction.

By Sarah Fecht | May 8, 2012 |

Hive and Seek: Domestic Honeybees Keep Disappearing, but Are Their Wild Cousins in Trouble, Too?

Is colony collapse disorder just the visible part of a "global pollinator crisis"? The answer is surprisingly murky. To help answer the question, scientists have created an inexpensive, nationwide wild bee monitoring program.

Bees are making headlines these days, and not in a positive way. Colony collapse disorder has cut through honeybee populations, with some beekeepers reportedly losing up to 90 percent of their stock in recent years. European bee populations are also declining, and so are some species of North American bumblebee. That data is often interpreted to mean that all of the world's 20,000 bee species are in danger, and that we may be in the midst of a "global pollinator crisis." But there's little data to back up those claims, scientists say.

"When you look at what's out there in the public press, the implication is that pollinators are all under threat, that there's some kind of mysterious decline across the board," says Sam Droege, a biologist at U.S. Geological Survey's (USGS) Patuxent Wildlife Research Center. "The problem is, there's really no data to show that either way."

A new paper, published in the *Journal of the Kansas Entomological Society*, offers a ray of hope for native bee species. In this research, Droege and his colleagues compiled a list of 770 species that are historically native to the eastern U.S. They sent this list to a network of bee experts, asking them to note which species they had found within the past 20 years. The survey revealed that 95 percent of the bee species that lived 150 years ago have not gone extinct. Thirty-seven species were nowhere to be found, but the researchers pointed out that those bees had been rare to begin with and were often subject to taxonomic confusion. The paper offers "a clarification to the 'all pollinators are going to hell' point of view," Droege says.

http://www.youtube.com/watch?v=1XhAt7mNkhw **Honey Bee colony collapse disorder (CCD)**

http://www.youtube.com/watch?v=iNvXDAkRzUw&feature=related **Colony Collapse Disorder: It's Pesticides**

http://www.scientificamerican.com/slideshow.cfm?id=hive-and-seek-domestic-honeybees-keep-disappearing

It is important to understand the health of our native pollinators, because "in the absence of pollination, whole communities could collapse," says USGS ecologist Ralph Grundel. "If plants can't reproduce, you lose the primary producers, and then the species that depend on them." It is also estimated that bees pollinate about a third of the food that we eat, at a value of about $15 billion per year. Grundel, who was not involved in the research, said that the paper is a good starting point. "It's useful because they've put together this information on what was out there historically, and what still is out there. But the fact that they're not finding mass extinctions is not the equivalent of knowing whether species are declining or in jeopardy.“ Droege, too, said that the conclusions are weaker than he'd like. "We'd love to make statements more detailed than, 'Yup, we found 'em!' But if we didn't do this paper, we basically wouldn't know anything at all," he says.

John Ascher, an invertebrate zoologist at the American Museum of Natural History (AMNH), agreed. He wrote in an e-mail that "we don't even know *what* native bees exist, as many remain undescribed or unidentifiable. Nor do we know *where* they live, as even state lists remain highly incomplete despite our best efforts…. As to *how* the bees are doing—we know even less."

In order to really understand the health of native bees, scientists need to document species' distribution and abundance as well as monitor how those numbers change over time. That's why Droege and several colleagues are working with the U.S. Forest Service to set up a nationwide bee-monitoring program. He recruited 11 experimental forest stations from places as far-flung as Maine, Colorado and Puerto Rico, and has created a standardized, almost foolproof collection strategy.

"It's fantastic that someone is doing this," says Rutgers University entomologist Rachael Winfree. "There are no long-term bee monitoring programs in North America, except for bumblebees. This is not a new idea, it's just no one is doing it.“

Part of the reason there hasn't been a long-term, wide-scale bee monitoring program is because there wasn't an efficient way to collect the bees. Using nets takes time, and results vary depending on who swings them. Bowls of soapy water catch bees effectively, but the water evaporates quickly—meaning scientists have to check the traps frequently. "Figuring out how much and when to sample is tricky" with this method, Droege says. A third option uses malaise traps, which are large tent-like nets that funnel insects into jars of alcohol or propylene glycol, but these traps can cost up to $250 apiece. Droege and his colleagues spent years cooking up a solution. They developed a trap made from painted plastic beer cups, soap and glycol. The paint colors attracts the bees, the soap kills them and the glycol preserves them. (Propylene glycol is "generally recognized as safe" by the U.S. Food and Drug Administration.) The foresters at each site set out the traps, collect the captured bees every two weeks and mail them to Droege for identification.

The program is in its third year of data collection, but doesn't yet have a name or funding. And so far they haven't needed it; most of the participating sites report that maintaining the traps requires very little money or effort. Henry McNab, a research forester at the Bent Creek Experimental Forest in North Carolina, estimates that on average the bee collections required 15 minutes per week and about $30 per year. Some sites have collected more than 1,400 bees in one summer. They've found several rare bees, and discovered species in places that would typically be considered outside of their normal range or habitat—for example, scientists at the Maine site collected a squash bee (Peponapis pruinosa), a species that is most common in the U.S. Southwest and rarely found north of southern New England.

The two-year analysis is also uncovering hints at population trends, although several years' more data are needed to determine whether these hints are significant. "The main goal is to look at change over time," Droege says. "If we can foresee declines, we can intervene before it's too late."

By making the monitoring project simple and inexpensive, Droege has made it easy for the experimental sites to continue participating for a very long time. Michael Ryan, a research ecologist at the Manitou Experimental Forest in Colorado, said in an email that "As long as the Forest Service can afford to keep a site manager at Manitou, we'll continue. And even if the site manager goes away [due to budget cuts]," he added, "I'll work somehow to get it done."

The simplicity of the program could come at a slight cost. For now, foresters participating in the monitoring program set up the traps in an area of their own choosing, typically in an area that is most convenient. But bees respond strongly to local habitat changes, such as weeds flowering in a nearby field or a freshly mowed lawn, Winfree says. She suggested that by standardizing and controlling the environments around the traps it will be easier to detect large-scale changes in bee populations, rather than the effects of local changes.

As the project is still in its infancy, Droege continues to work out the kinks. After he has proved that the experimental design works, he says he'll ask for federal funding in hopes of scaling up the project and increasing data resolution. At the moment Droege alone is tasked with identifying the thousands of bees collected, so he only has time to categorize them down to the genus level. "To some extent, the really interesting and important questions are at the species level," Winfree says. "The problem with having genus-level data is that, say one species is increasing and one went extinct, you wouldn't even detect it," because the total number of bees would stay the same, she says. AMNH's Ascher also pointed out that this monitoring project alone won't to tell us everything we need to know about the bees' status. He said that it should be paired with diverse types of sampling that are better able to detect rare bees, and bees that occupy specialized habitats.

Nevertheless, it's a start. And whether or not the project receives funding, entomologists say that the project is a first and is already turning up important data about the U.S.'s native bees. "It shows how much research can be done on a shoestring budget," Bent Creek's McNab says. "And it's something that we can't afford not to do."

Disaster Aversion, Rivka Galchen. This is a beautifully written essay that blends well on several layers: Psychoanalytical; Philosophical; and Scientific. Thematically, the philosophical inquiries work into the scientific and psychological aspects. There is the story on the current research on hurricane mitigation and the story, like so many stories in good in literature, about the meaning of Galchen's relationship with her father, a famous meteorologist who died at a young age. This assignment is broken down into three possibilities:

- Write an essay, using three examples from the text, on how the two themes mentioned above relate to each other. In other words, how is Galchen's apparent need to recall a lack of fulfillment, or, the awareness of being stuck in a kind of adolescent overdrive as it relates to the premature death of her father, a man she cared deeply about, but could not quite fully assess, how does this figure into the story she is working on, interviewing oceanographers and meteorologists on hurricane mitigation strategies?

- Write an essay on the quote on p. 184: "Chaos is commonly misunderstood as randomness, whereas what is characteristic of chaos is that very small changes in a chaotic system can lead to enormous changes in a system's future." Do you agree or not? Why or why not?

- Someone once said that in order to be a good engineer, one must be a good poet. And in order to be a good poet, one must be a good engineer. Write an essay on why it's important to integrate the arts and sciences, as exemplified in the following quote from p. 187 of Galchen's essay: "These grand weather-control ideas, charted in mathematical detail, are works of scientific imagination. I myself think of these as poems. They are constrained not be meter or rhyme or genre but by the stuff of our real world. We're used to thinking of constraints as a way to enhance the artistic imagination; we're just not used to these particular constraints, the laws of our universe as we understand them. When we treat certain scientific imaginings as pragmatic undertakings rather than as a kind of art, we end up with bumbling disasters, occasionally profound evil, and now and again something like a smallpox vaccine and affordable clean-water resources for millions of people."

http://www.youtube.com/watch?v=WpxxPJv6vQs **Extreme Weather & Climate Change**

The Sixth Extinction? Elizabeth Kolbert. To think and feel that we could be in the process of a mass extinction, most likely because, as Kolbert suggests, humans have radically altered, or, perhaps, accelerated the natural rise of carbon dioxide in the atmosphere, accelerated what used to take tens if not hundreds of thousands of years into a single century, threatening the existence of the human race is a very frightening proposition. This places what we are now going through into what Kolbert defines as the "catastrophic" discontinuation of life as we know it. This question, on its surface, is accessible but when explored in depth requires much thought. Compare the idea of your own death with the thought of mass extinction, which includes the dying out of human beings. Remember, most species that have existed on the planet are already gone. It could be claimed very easily that, in the long run, nothing survives. Is your own death more frightening or consequential than the idea of the extinction of humans? How and why are these two concepts different?

The extinction vortex, 25 08 2008

First coined by Gilpin & Soulé in 1986, the extinction vortex is the term used to describe the process that declining populations undergo when "*a mutual reinforcement occurs among biotic and abiotic processes that drives population size downward to extinction.*"

http://www.youtube.com/watch?v=hDbz2dpebhQ **The Permian Mass Extinction**

http://www.youtube.com/watch?v=y6ig6zKiNTc&feature=related **Nova: Permian Extinction**

http://www.youtube.com/watch?v=cZiykaGgB4M **The Next Mass Extinction Event**

More than 90 percent of all organisms that have ever lived on Earth are extinct. As new species evolve to fit ever changing ecological niches, older species fade away. But the rate of extinction is far from constant. At least a handful of times in the last 500 million years, 50 to more than 90 percent of all species on Earth have disappeared in a geological blink of the eye.

Though these mass extinctions are deadly events, they open up the planet for new life-forms to emerge. Dinosaurs appeared after one of the biggest mass extinction events on Earth, the Permian-Triassic extinction about 250 million years ago. The most studied mass extinction, between the Cretaceous and Paleogene periods about 65 million years ago, killed off the dinosaurs and made room for mammals to rapidly diversify and evolve.

The causes of these mass extinction events are **unsolved mysteries**, though volcanic eruptions and the impacts of large asteroids or comets are prime suspects in many of the cases. Both would eject tons of debris into the atmosphere, darkening the skies for at least months on end. Starved of sunlight, plants and plant-eating creatures would quickly die. Space rocks and volcanoes could also unleash toxic and heat-trapping gases that—once the dust settled—enable runaway global warming. An extraterrestrial impact is most closely linked to the **Cretaceous extinction event**. A huge crater off Mexico's Yucatán Peninsula is dated to about 65 million years ago, coinciding with the extinction. Global warming fueled by volcanic eruptions at the Deccan Flats in India may also have aggravated the event. Whatever the cause, dinosaurs, as well as about half of all species on the planet, went extinct.

Massive floods of lava erupting from the central Atlantic magmatic province about 200 million years ago may explain the **Triassic-Jurassic extinction**. About 20 percent of all marine families went extinct, as well as most mammal-like creatures, many large amphibians, and all non-dinosaur archosaurs. An asteroid impact is another possible cause of the extinction, though a telltale crater has yet to be found.

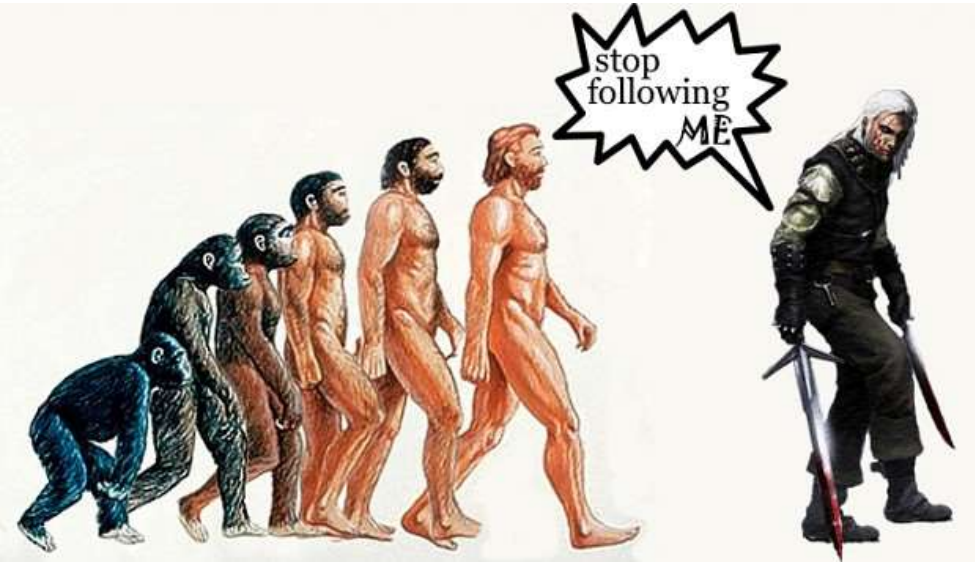
Largest Ever Die-Off
The **Permian-Triassic extinction event** about 250 million years ago was the deadliest: More than 90 percent of all species perished. Many scientists believe an asteroid or comet triggered the massive die-off, but, again, no crater has been found. Another strong contender is flood volcanism from the Siberian Traps, a large igneous province in Russia. Impact-triggered volcanism is yet another possibility.

Starting about 360 million years ago, a drawn-out event eliminated about 70 percent of all marine species from Earth over a span of perhaps 20 million years. Pulses, each lasting 100,000 to 300,000 years, are noted within the larger late **Devonian extinction**. Insects, plants, and the first proto-amphibians were on land by then, though the extinctions dealt landlubbers a severe setback.

The **Ordovician-Silurian extinction**, about 440 million years ago, involved massive glaciations that locked up much of the world's water as ice and caused sea levels to drop precipitously. The event took its hardest toll on marine organisms such as shelled brachiopods, eel-like conodonts, and the trilobites.

Happening Now?
Today, many scientists think the evidence indicates a **sixth mass extinction** is under way. The blame for this one, perhaps the fastest in Earth's history, falls firmly on the shoulders of humans. By the year 2100, human activities such as pollution, land clearing, and overfishing may have driven more than half of the world's marine and land species to extinction.

Are We Still Evolving? Kathleen, McAuliffe. Early in this essay, reflecting the view that is highly suspicious of recent, accelerated mutations in the human genome, McAuliffe writes that, “Some scientists are alarmed by claims of [physical] ethnic differences in temperament and intelligence fearing that they will inflame racial sensitivities.” Later, towards the end of the piece, she goes back to report, “In some circles, Moyzis says, to suggest that natural selection is acting on the human brain is tantamount to heresy—an incredible hypothesis that demands extraordinary proof.” And towards the end of the essay, one of the main researchers she interviews says, “Whatever we find, it would never be justification for abandoning the egalitarian value that all individuals , regardless of their ethnicity, are deserving of the same rights and opportunities. [I]t would be boring if all the races were fundamentally the same.” Write an essay that explores the following idea. It’s not hard to see how if it were proven that ethnic groups are actually different (not just culturally) this could ignite a fierce outrage even among intelligent, “educated” people. Some ideas are just hard to live with. But why does being different automatically equate to being better or worse? If ethnic groups are smart because their environment, through natural selection, made them that way, and all ethnic groups can be said to be “smart to their environment,: which means they are all different, why is there such a fear that so many would turn this idea into an excuse for racial hatred and practices of discrimination, prejudice, hegemony?



http://www.youtube.com/watch?v=NxcKNBmIYqM&feature=related **The great mysteries of the human brain 1.1 - Charlie Rose: The brain series**

http://www.youtube.com/watch?v=z1Esj2dOGj0&feature=relmfu **Consciousness (series 2, ep. 2) - Charlie Rose: The brain series 2**

http://www.youtube.com/watch?v=lUUOHBk5qDM&feature=relmfu **The Creative Brain (ep. 12) - Charlie Rose: The Brain Series**

The Accidental Mind is a book by David J. Linden. It seeks to explain how brain evolution has given rise to those qualities that most profoundly shape our human experience.
http://accidentalmind.org/free_chapters/

Neurons have hardly changed from those of prehistoric jellyfish. "Slow, leaky, unreliable," as Linden calls them, they tend to drop the ball: at connections between neurons, signals have a 70 percent chance of sputtering out. To make sure enough signals do get through, the brain needs to be massively interconnected, its 100 billion neurons forming an estimated 500 trillion synapses.

Just as the mouse brain is a lizard brain "with some extra stuff thrown on top," Linden writes, the human brain is essentially a mouse brain with extra toppings. That's how we wound up with two vision systems. In amphibians, signals from the eye are processed in a region called the midbrain, which, for instance, guides a frog's tongue to insects in midair and enables us to duck as an errant fastball bears down on us. Our kludgy brain retains this primitive visual structure even though most signals from the eye are processed in the visual cortex, a newer addition. If the latter is damaged, patients typically say they cannot see a thing. Yet if asked to reach for an object, many of them can grab it on the first try. And if asked to judge the emotional expression on a face, they get it right more often than chance would predict especially if that expression is anger. The brain stem is the oldest and smallest region in the evolving human brain. It evolved hundreds of millions of years ago and is more like the entire brain of present-day reptiles. For this reason, it is often called the 'reptilian brain'. Various clumps of cells in the brain stem determine the brain's general level of alertness and regulate the vegetative processes of the body such as breathing and heartbeat.

It's similar to the brain possessed by the hardy reptiles that preceded mammals, roughly 200 million years ago. It's 'preverbal', but controls life functions such as autonomic brain, breathing, heart rate and the fight or flight mechanism. Lacking language, its impulses are instinctual and ritualistic. It's concerned with fundamental needs such as survival, physical maintenance, hoarding, dominance, preening and mating. It is also found in lower life forms such as lizards, crocodiles and birds. It is at the base of your skull emerging from your spinal column. The basic ruling emotions of love, hate, fear, lust, and contentment emanate from this first stage of the brain. Over millions of years of evolution, layers of more sophisticated reasoning have been added upon this foundation.

What are the real differences between races and ethnicities and how should we think about them?

How do the following areas/disciplines describe differences between races/ethnicities:

- **Biology/Technology?**
- **History?**
- **Modern Society/Culture?**

- Are there distinct differences that are considered factual or biological?
- Do you think the evaluation methods by which we measure intelligence could be biased? How?
- Do factual differences between how biology interprets race and intelligence point to social consequences? How and, more importantly, why?

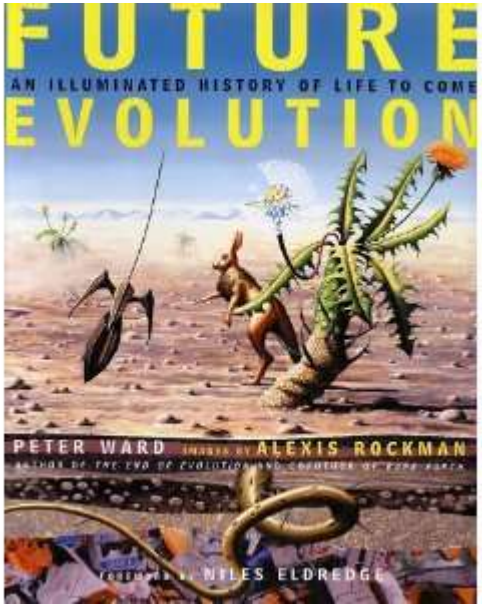
http://www.youtube.com/watch?v=7tz1GDvZAiw&feature=related **Differences between the races (Historical Cartoon)**

http://www.youtube.com/watch?v=-P5NLcem7P4 **Jared Taylor, Biology and Race**

http://www.youtube.com/watch?v=d6kD64iS5Ow&feature=related **Race & Intelligence: Is There A Link?**

How are we evolving?

- **Are genetics destiny?**
- **How are we changing the way human beings will evolve?**
- **What ethical implications does the future of evolution create?**
- **What are the prospects for research in:**
  - **Genetics;**
  - **Nanotechnology; and**
  - **Robotics/Artificial Intelligence.**



http://www.youtube.com/watch?v=4-14mZgPfxM&feature=related **THE INTELLIGENCE REVOLUTION - Visions Of The Future – BBC**
In the opening instalment, Kaku explains how artificial intelligence will revolutionise homes, workplaces and lifestyles, and how virtual worlds will become so realistic that they will rival the physical world. Robots with human-level intelligence may finally become a reality, and in the ultimate stage of mastery, we'll even be able to merge our minds with machine intelligence.
Describe three challenges Kaku says humans will face in the coming century

http://www.youtube.com/watch?v=QwiL0wEl8gA **ZEITGEIST MOVING FORWARD 2.5hrs**
Are there any new ideas in this film that counter what you saw in "The Intelligence Revolution?" What are they and how are they different?

SCIENTIFIC AMERICAN™

The Future of Man--How Will Evolution Change Humans? Contrary to popular belief, humans continue to evolve. Our bodies and brains are not the same as our ancestors' were—or as our descendants' will be

By Peter Ward

http://integral-options.blogspot.com/2008/12/future-of-man-how-will-evolution-change.html

Key Concepts

- People commonly assume that our species has evolved very little since prehistoric times. Yet new studies using genetic information from populations around the globe suggest that the pace of human evolution increased with the advent of agriculture and cities.
- If we are still evolving, what might our species look like in a millennium should we survive whatever environmental and social surprises are in store for us? Speculation ranges from the hopeful to the dystopian.

When you ask for opinions about what future humans might look like, you typically get one of two answers. Some people trot out the old science-fiction vision of a big-brained human with a high forehead and higher intellect. Others say humans are no longer evolving physically—that technology has put an end to the brutal logic of natural selection and that evolution is now purely cultural.

The big-brain vision has no real scientific basis. The fossil record of skull sizes over the past several thousand generations shows that our days of rapid increase in brain size are long over. Accordingly, most scientists a few years ago would have taken the view that human physical evolution has ceased. But DNA techniques, which probe genomes both present and past, have unleashed a revolution in studying evolution; they tell a different story. Not only has *Homo sapiens* been doing some major genetic reshuffling since our species formed, but the rate of human evolution may, if anything, have increased. In common with other organisms, we underwent the most dramatic changes to our body shape when our species first appeared, but we continue to show genetically induced changes to our physiology and perhaps to our behavior as well. Until fairly recently in our history, human races in various parts of the world were becoming more rather than less distinct. Even today the conditions of modern life could be driving changes to genes for certain behavioral traits.

A Most Private Evolution, Susan Milius. The writer brings up a very interesting point, in that not all of our genetically manifested traits seem to have been selected for survival. There is such a thing as sexual selection. Select three, human, genetic traits, that lend themselves to sexual selection and not necessarily to biological survival. Explain why each is more appropriate for sexual partnering than it is for actual survival.

An important feature of most sexually reproducing species is that males are more brightly coloured than their female counterparts; the classic example of this it the peacock's tail. One would expect such disadvantageous traits not to be naturally selected - unless they enhance reproductive success in some way. To explain this, Darwin (1874) came up with his theory of sexual selection, describing two processes through which it took place.

Intrasexual selection (mate competition) - Members of one sex compete with each other for members of he opposite sex. The victors are able to mate and so pass on their genes, whereas the losers do not. Whatever traits lead to success in these same-sex contests will be passed on to the next generation.

Intersexual selection (mate choice) - Involves the preferences of one sex for members of the opposite sex who possess certain qualities, e.g. if females prefer tall males, over time there would be an increase in the number of tall mates in the population. The preferences of one sex, therefore, determine the areas in which the other sex must compete. This may be in terms of plumage, or economic resources. These indicators reveal traits that could be passed on to offspring, as well as information about the chances of being able to give good protection and support to offspring.

http://www.youtube.com/watch?v=JakdRczkmNo **Evolution Episode 5 - The sexual selection, 55min**

Unpopular Science, Chris Mooney & Sheril Kirshenbaum. We are certainly witnessing, are in the midst of, are participants in, one of the greatest revolutions in the history of mankind. We have already seen how digital communication and social media change the ways we think and interact. Explain the difference between a society with traditionally published newspapers and magazines and the kind of content (articles) one would find in them and a society with only online media and the kinds of information and the ways it is packaged. What's the difference in how we receive and digest our information? Is memory affected in any way?

Is the era of the printed newspaper nearly over? Online newspapers are becoming increasingly popular. However, the following comparison of the pros and cons of the print newspaper versus online newspapers indicates that neither is mutually exclusive. Rather, one form of news may appeal over another based on a particular reader's lifestyle. *We can expect to see both forms of news coexisting into the future, serving slightly different purposes.*

Print Newspapers: ADVANTAGES

- **Local information** (e.g. local news, new zoning and construction, movies/entertainment, local sports, other events in your area, coupons and advertisements for stores having sales)
- **Read it anywhere** (almost! - it's not restricted to a laptop or other internet-enabled digital device)
- **Level of importance of each story is made more obvious** by use of different sized headline fonts
- **Easy-to-find comic and puzzle section** (in most major print newspapers)

DISADVANTAGES

- **A subscription to a print newspaper costs money**, in contrast many online newspapers offer free access to most content
- Full text of all the content **requires you to scan more carefully than online newspapers to find content** of interest of you. (Your eyes are your 'search' button!)
- **Adds to the household recycling basket**

Online Newspapers: ADVANTAGES

Based on the story you are reading, **an online newspaper may suggest other recent stories of interest to you**, personalizing the experience and saving you time in finding content of interest.

Can quickly and easily source the same article from many different online newspapers on the web (e.g. via Google news), allowing you to read the same thing from different perspectives to decrease the possibility of bias.

Online news can be updated more frequently than the once a day print newspapers

Content is usually free for basic news of the day (although there is an increasing trend for charging for certain types of content, such as archived material).

DISADVANTAGES

Requires you to use a digital internet-enabled device; not so compatible with a cup of morning coffee!

Digital **advertisements can be more distracting** than print advertisements

Frequently needing to scroll up and down

Conclusion: While online news and print newspapers overlap a lot in terms of content, each may have a very different appeal based on the reader's personality and lifestyle. For example, a property developer is much more likely to benefit from an in-print newspaper than online news to find out what is happening locally such as new zoning laws and road construction. On the other hand, someone who is accustomed to being online frequently may simply find it more efficient to simply get their news there. Print newspapers lend themselves better to browsing while online is more effective for searching. Lastly, it's important to remember that both print and online news may appeal to the same person under different circumstances (e.g. reading the print newspaper over breakfast and coffee, versus later in the day checking online for updates on stories of interest).

http://gisellemaine.hubpages.com/hub/print-newspaper-vs-online-news

My FACTS Account

An Epidemic of Fear, Amy Wallace. We live in an age when it is easy to “produce your own truth,” to manipulate facts in a way that they fit what you believe. It’s not like you are even deceiving yourself, you are simply shoehorning factual information into an underlying ideology that you believe. For instance, research points out that most people do not vote according to the issues but on how closely the “image” of the issue or of who is promoting it, fits with their specific cultural beliefs. What has resulted is a political system and a culture where nothing can be agreed to, that it’s more important to defend your ideology at all costs than to look for any compromise. Answer why this is dangerous for society? In your answer address the particulars, the specifics on how to avoid this? Can it be avoided?

http://www.youtube.com/watch?v=4TpRItKtamw&feature=relmfu **The Psychology of the Political Left & Right - Part 1**

http://www.youtube.com/watch?v=wCinmE0cUPA&feature=related **The Psychology of the Political Left & Right - Part 2**

http://www.youtube.com/watch?v=tJr7ejEzdiA&feature=relmfu **The Psychology of the Political Left & Right - Part 3**

The Missions of Astronomy, Steven Weinberg. Beyond what is mentioned in this essay, the study of astronomy and physics and technology could very well be critical to the survival of however we come to define the human race in the probably near future. Explain three ways that the survival of the human race can depend on the study of the universe?

http://www.youtube.com/watch?v=Kvalg9kBA9Y **A New Era of Space Exploration**

http://www.youtube.com/watch?v=_XieRkM5asw&feature=related **The Future of Space Travel**

http://www.youtube.com/watch?v=YzMrNFd4oOk&feature=related **Stephen Hawking - Rocket to the Future**

http://www.youtube.com/watch?v=xe7PpfCiwAI **Colonizing Space - www.documentaryz.com**

Decoding an Ancient Computer, Tony Freeth. Freeth concludes his essay with this quote from Price's essay in *Scientific American:* "It's as bit frightening to know that just before the fall of their great civilization the ancient Greeks had come so close to our age, not only in their thought, but also in their scientific technology." There are many who feel, beyond the commercial exploitation of Mayan calendars and other such media-driven frenzies, that we are approaching our own end times. (Remember the piece on mass extinction.) There are many variables that could accumulate and push this notion. We are seeing an abundance of apocalyptic literature and film these day. Answer the question: Do you think the human race will soon end? How and why?

http://www.youtube.com/watch?v=BoTExQEyblU **Apocalypse 1/9(History Ch)**

http://www.youtube.com/watch?v=NnYID6Kc-VE&feature=relmfu **Apocalypse 2/9 (History Ch)**

http://www.youtube.com/watch?v=2lwq8E4ypXQ&feature=relmfu **Apocalypse 3/9 (History Ch)**

http://www.youtube.com/watch?v=Ym87fbo7RdE&feature=relmfu **Apocalypse 4/9 (History Ch)**

http://www.youtube.com/watch?v=_2pmhO47YTM&feature=relmfu **Apocalypse 5/9 (History Ch)**

The Deadly Choices at memorial, Sheri Fink**:** In Sheri Fink's piece, *The Deadly Choices at Memorial,* write an essay on whether or not you believe that the medical staff (especially Dr. Anna Pou, who was indicted by the state's attorney) is or is not guilty of practicing euthanasia in the aftermath of Katrina. Make sure you construct a strong, working thesis statement and that this thesis is supported by at least three direct quotations from the text. Include in your answer whether you believe, as Pou does, that the dynamics of managing healthcare during a natural disaster changes the ways critical care patients are evaluated, and that healthcare workers should be exempt from civil and/or criminal liabilities.

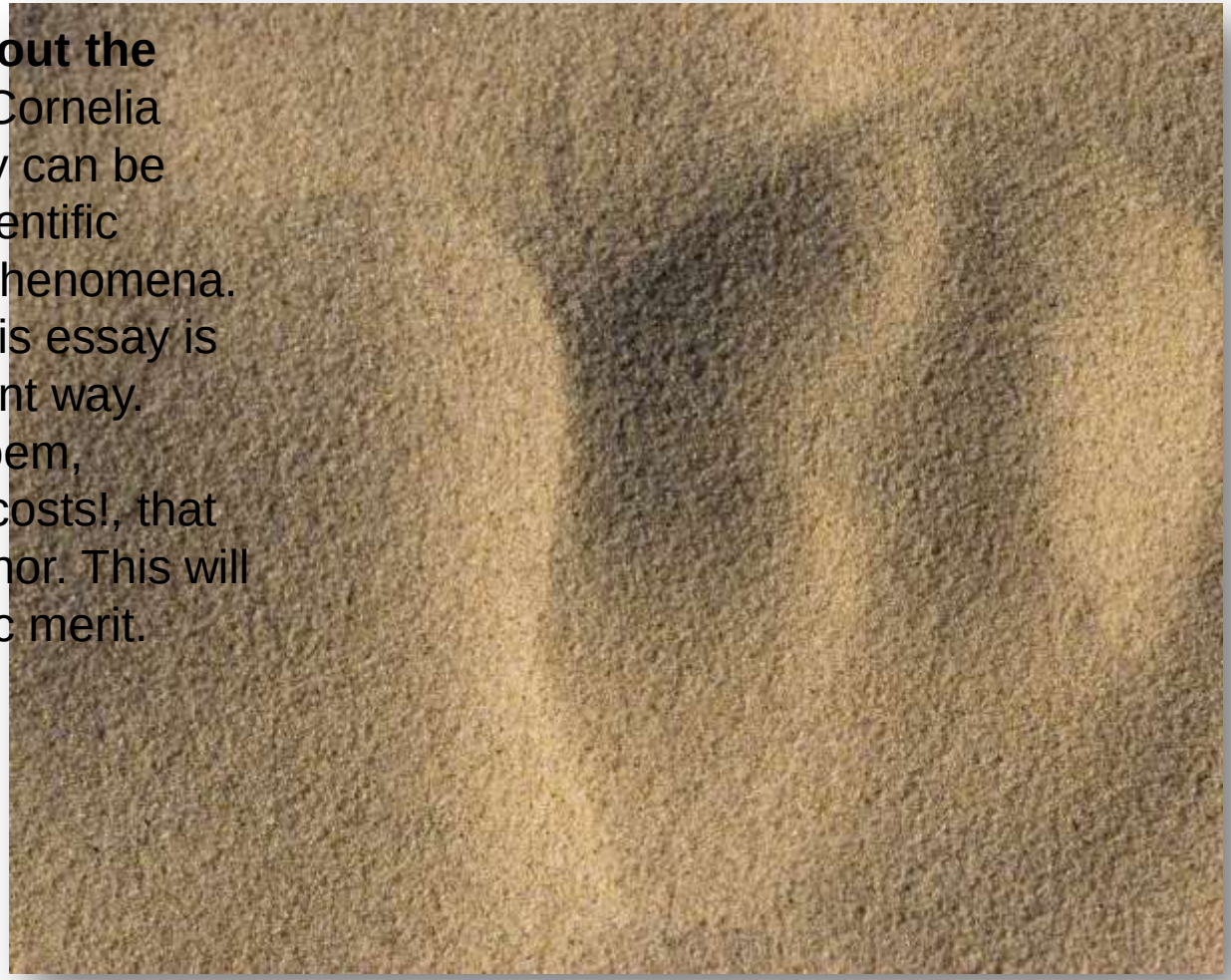
http://www.youtube.com/watch?v=KuPQ924ZhUM Katrina damage

http://www.youtube.com/watch?v=vOwKrmR3HPQ **Dr. Pou 60 Minutes Interview**

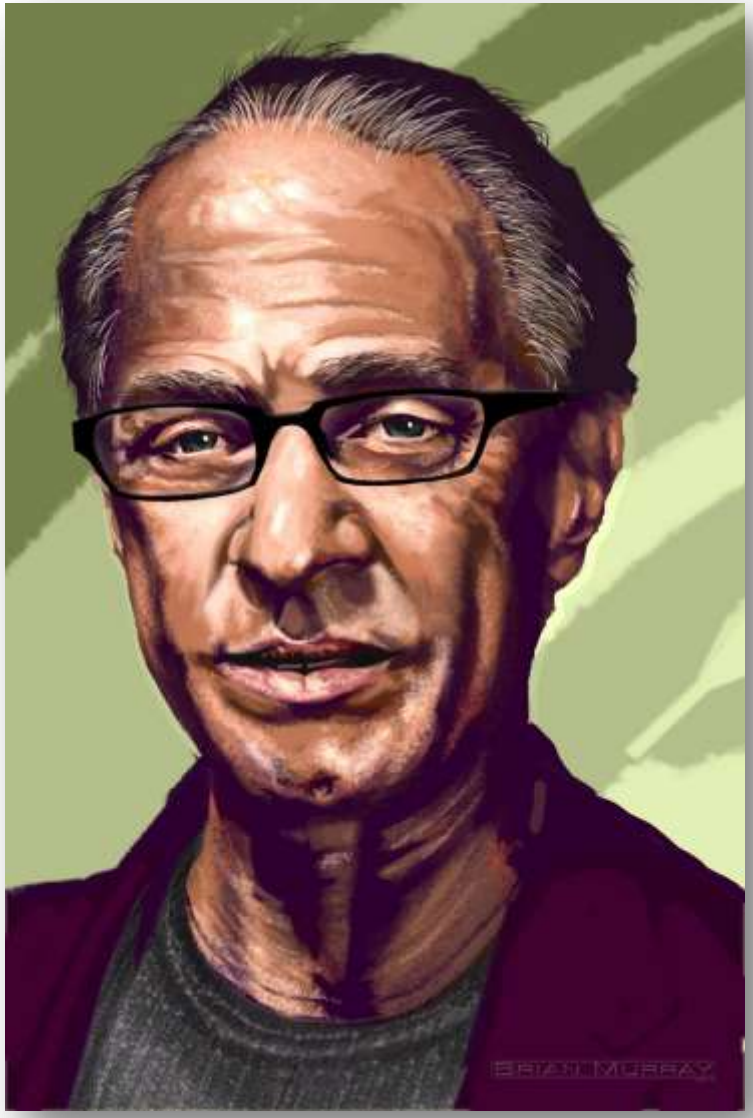
http://www.youtube.com/watch?v=DmLY6K7gAUk&feature=related Sheri Fink

Extra Credit Only! (This assignment only counts for extra credit.)

So Much to Learn About the Oceans From Sand, Cornelia Dean. This short essay can be looked at as a very scientific explanation of poetic phenomena. Your assignment for this essay is challenging in a different way. Write a 1,500-word poem, avoiding clichés at all costs!, that uses sand as a metaphor. This will be graded on its artistic merit.



Film #1: ***Transcendent Man: The Life and Ideas of Ray Kurzweil.*** This film draws on the concept of immortality as well. In many ways humankind's search for immortality has pervaded our history, art, and mythology. And now, our science. One hundred years ago, the average lifespan of men and women was mid-40s. Now, it's mid-70s. In just a short one hundred years, with the discovery of hygiene and bacteria and viruses and how germs work, we have been able to almost double our lifespans. Isn't it the purview of modern medicine to extend life as long as possible? Now science is looking deeply into the aging process, how it works on a cellular level, how it can be slowed, stopped, even reversed? Other scientists are looking at how technology will extend our lives, how our biology and technology will merge to make something other than what we have come to define as human. This is not the stuff of science fiction anymore. It is real and it is being researched and explored with all the seriousness of legitimate scientists and researchers, not snake oil salesmen. Some of these adventurous scientists are imagining extended our lives 1,000, even 5,000 years, with the first wave of research extending our lives a mere 50-75 years. Alas, we are approaching the end of aging and postponing death to unheard of periods of time. What will happen to our culture? Our art? How we think about, well, just about everything? For this paper come up with words on what it would be like to live for 500 years. You will need to focus on a particular angle: cognitive development, over population, relationships, art, how and where we would live. This is about using your imagination. Cite two examples from the film.



Film #2: *The Human Family Tree, Nat Geo.* Given that DNA and anthropological evidence indicate that all human beings started in Africa and migrated in various patterns to various locations around the globe where specific races took on certain traits shaped by nature and culture, write an essay that uses the evidence offered in this study by the National Geographic Society as context for modern concepts such as prejudice and discrimination. In other words, how much of a difference does it make in the way we evaluate "those" who are not like "us," or, the "other," if we all have the same origins? Use two ideas from the film to support your thesis.
http://www.youtube.com/watch?v=lkexKLCak5M&list=PLD8E09BDA2899D14D&index=4&feature=plpp_video

BBC News

The idea that there were several different human species walking the Earth two million years ago has been dealt a blow.
Instead, scientists say early human fossils found in Africa and Eurasia may have been part of the same species. Writing in the journal Science, the team says that *Homo habilis*, *Homo rudolfensis* and *Homo erectus* are all part of a single evolving lineage that led to modern humans.

But others in the field reject this.

A team looked at the most complete hominid skull ever found, which was uncovered in Dmanisi, Georgia.
It had a small braincase, large teeth and a long face, characteristics it shares with *H. habilis.* But many features from the braincase were also "unique" to *H. erectus.*

The 1.8-million-year old skull comes from a site that has given up the biggest collection of well-preserved early-human remains known anywhere in the world.

The skull had a very small braincase

The Dmanisi collection also represents the earliest evidence of primitive humans outside Africa, a group that emerged soon after early *Homo* diverged from Australopithecus, or "Lucy".

"We now have the best evidence for what early *Homo* really is," said lead author David Lordkipanidze from the Georgian National Museum in Tbilisi, Georgia.

"One of the most important things is that we have such a remarkable collection; it's very rare that you have that from one site."

The fossil remains showed a lot of variation that had previously puzzled researchers, but Prof Lordkipanidze said it was clear that these features were all from one population.

"When we looked at this variability and compared it with modern humans, you can see this is a normal range of variation," Prof Lordkipanidze told BBC News.

The skull was uncovered eight years ago and since then the team has compared it to other *Homo* fossils found in Africa from as early as 2.4 million years ago.

The comparative analysis of the hominid cranium revealed enough similarities for the team to consider the earliest *Homo* fossils as the same species as the Dmanisi hominids.

- The Georgian hominids lived about 1.8 million years ago and represent an early expansion of human ancestors outside Africa
- They are the most complete collection of a *Homo* species from any site older than 300,000 years old
- They had human-like spines and lower limbs that would have been well suited for long distance travel
- The male of the species was much larger than the female
- They also had relatively small brains and primitive upper limbs, traits which they shared with the earlier *H. habilis,* and even with the more primitive Australopithecus