

# The Dean's Column

On May 28, 2015, SKMC Dean Mark Tykocinski, MD, shared the following comments with graduates at Jefferson's 191st commencement ceremony. His remarks appear here in lieu of his usual column.

Class of 2015: Over these four years, you have been challenged to think contextually, critically and creatively — by now, all three fully ingrained. As you head off, my comments will touch on what preserving these modes of thinking means in a digital age, probing those dimensions that are uniquely human.

The long-running science-fiction series "Doctor Who" features a species of telepathic humanoids, the *Ood*, who live in the distant future, circa 42nd century. These enigmatic aliens have squid-like tentacles projecting from their lower faces and are evolutionarily equipped with two brains — first, a forebrain in their heads, and second, an umbilical cord-connected hindbrain they carry in their hands. A recent *Economist* article cleverly saw in the *Ood* a metaphor for us, for humans in the digital age. We too now carry parts of our brains externally, in the form of World Wide Web-linked smartphones — supercomputers glued to the palms of our hands.

But the *Ood* have a third brain as well — a planetary brain, via a telepathic connection to a giant *Ood* Brain on their home planet. We humans too have a third planetary brain — the World Wide Web, WiFi-connected to our handhelds.

One hot topic is the web's social effects — does it bring people together or isolate them? I pose a different question: How does this planetary brain ensnare and tunnel our thinking? Yes, incoming digital streams do feed curiosity and do spark ideas. Yet this digital input inexorably channels our thinking. We *Oods*, with necks craned over our exterior handheld brains and our minds plugged into the World Wide Web, are uncannily, and often unknowingly, ever more constrained in our degrees of thinking freedom.

Class of 2015, preserve your thinking freedom. Ensure that your brain-in-the-head remains dominant, unfettered. No equal status for your three brains. Contextual,

critical and creative thinking reside in your own cranium, as do the initiatives that flow from them. Be vigilant of the threat the planetary brain poses — to your analytics, your synthetics and your curiosity-driven imagination.

The planetary brain is especially tricky. Like the Roman god Janus, it is two-faced. On one hand it has a smiling face, which enables the free-flow of intelligence on a massive scale. It retains accumulated knowledge going back centuries, a comprehensive catalogue of bewildering proportions. It creates high-dimension collaborative opportunities that accelerate and democratize discovery and mobilize awesome creative energy by interconnecting myriad imaginations.

This Janus-like brain has a menacing face as well. Remember, the third-brain telepathy of the *Oods* was passive — they were controlled by a higher telepathic entity. Similarly, human hyper-connectedness renders us controllable. *Free think* readily succumbs to simplified *group think*.

The Internet universe, while arraying limitless viewpoints, paradoxically locks us into a rigid few. The planetary brain lures us toward simplified viewpoints and reductionist interpretations. Faced with an endless parade of information, our minds almost beg for an easy way out. We crave simplification. Searching the web, we often find it far simpler to co-opt existing tunnels than to dig our own — tunnels that filter out nuances and cloak alternatives.

Like carriage horses in Central Park, we are fitted with blinders — subtle blinders — in the form of search engines, anticipatory web links, personalized Internet ads, biased blogs, narcissistic tweets. We passive *Oods* are led through an inscrutable collage of information and misinformation toward simplistic closures.

A number of years ago, a magazine ad caught my attention: "Keep it complex, stupid." How wise — embrace complexity, that's the magic formula. Complexity equals non-linear thinking, a predicate for creativity. The brain-in-the-head is uniquely suited to this kind of thinking.

The Scottish-American naturalist John Muir stated, "The clearest way into the universe is through a forest wilderness." It

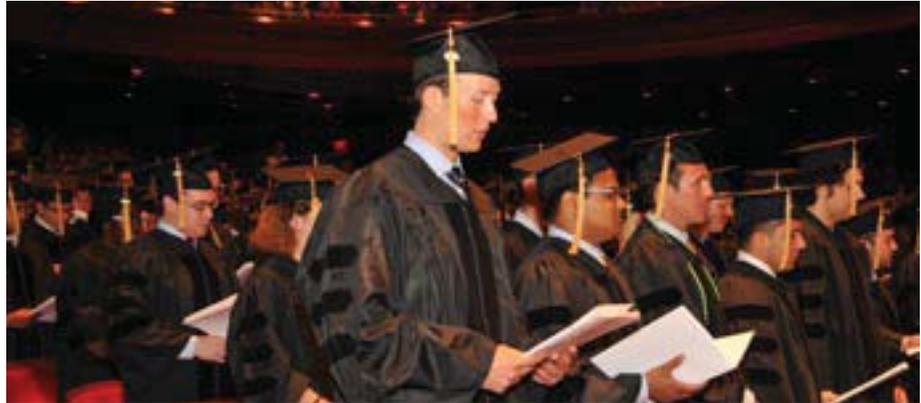
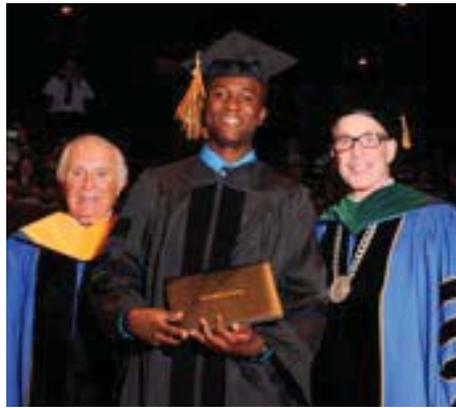
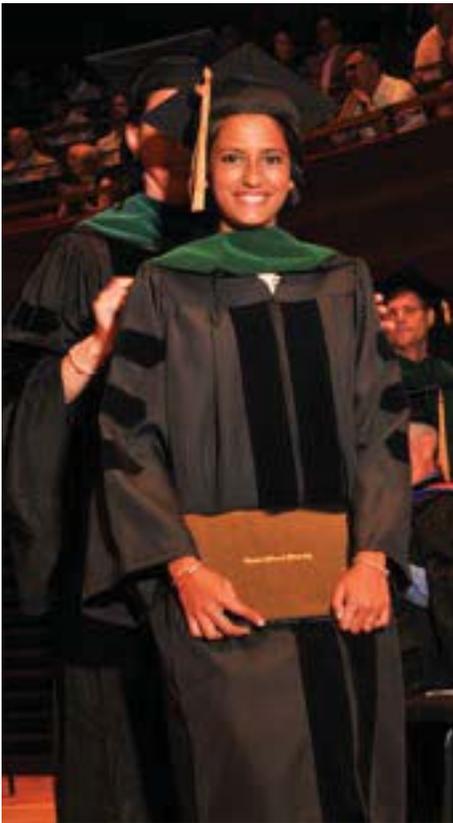
is the complexity of the forest ecosystem that fosters, and is indeed a prerequisite, for ultimate clarity. Take it all in — the squirrels clamoring up the trees, the birds chattering perched on tree branches. Be open to all worldviews, all associations. Not one tree, but the tableaux of trees, the forest tapestry. Wander through the forest wilderness; embrace its richness and complexity. Allow yourself to be tugged by curiosity, to be diverted off the main trail, to go down the circuitous path that leads to comprehension, to a *clearing in the forest*.

We are accustomed to celebrating simple, elegant, beautiful explanations. But the science of complexity is on the rise. And it is by delving into the complex, by absorbing the richness of the canvas, that you will find your way back to the simple unifying concept.

So first, resist the push of the web to oversimplify. A second piece of advice: Beware of the planetary brain's assault on the subjective — your private experience of the world; your sensations; your mental life; your inner landscape. David Gelernter, a Yale computational scientist, warns against the *nightmare of roboticism*, or *transhumanism* — the merging of men and machines predicted by Google's Ray Kurzweil. Kurzweil believes that men implanting chips in their bodies and brains, and fine-tuning their own and their children's genetic material, is simply our unavoidable future reality.

In the face of this Googleplectic assault, Gelernter champions a new subjectivist, humanist worldview: "We need science and scholarship and art and spiritual life to be fully human ... In the roboticist future, we will become what we believe ourselves to be: dogs with iPhones. The world needs a new subjectivist humanism now."

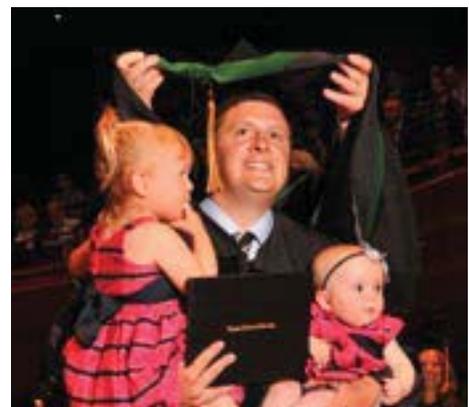
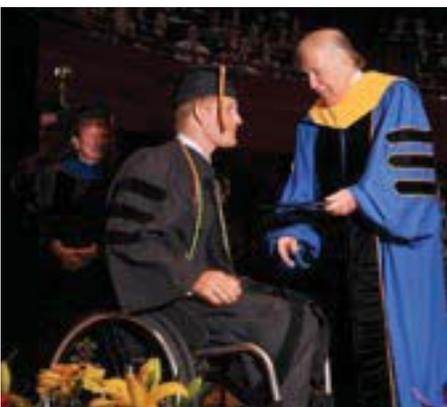
I might add: Defending the subjective requires vigilant filtering of the data bits trickling through your *Ood* plug-in to the planetary brain. While you can't decouple from it, it is you, the master controller, who plays with planetary brain information — not the planetary brain playing with your brain. Preserving subjectivity also means preserving emotivity — that is, the uniquely human ability to see the world and connect to others on an emotional level. According



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to the author of a provocative new book, *Sapiens*, it is this ability that enabled our species to triumph over its rival human species, the Neanderthal.

So embrace complexity. Cherish subjectivity. Nurture emotivity. These uniquely human skills, which inhere in your brain-in-the-head, are your bulwark against algorithmic manipulation and *group think*. They foster the freedom of thought and human judgment essential to navigate the unexpected, the counterintuitive, the shades of grey.

Trolling the scientific literature just this past year, you can find all kinds of mind-bending findings that do not fit neatly into pat textbook paradigms. Our own computational biologist, Isidore Rigoutsos, rocked the small RNA field this year, discovering a vast trove of additional human microRNAs that strikingly have no counterpart in other primates, let alone in mice. Just think for a moment what this paradigm-breaker means for the established biomedical research enterprise so pinned to mouse experimental models.

Once you allow yourself to question dogma, you open yourself up to pioneer in science-fiction mode, where the possibilities are electrifying. Within reach is the potential to rewrite an entire proteome using synthetic amino acids, making organisms virus-resistant, even perhaps us humans if mankind makes it to the 42nd century of the Oods.

I'm particularly intrigued by nature's "Faustian bargains" — a subset of counter-intuitive phenomena where bad is tolerated due to associated good. Nature seems to abound with such Faustian bargains. Good in one respect, but a price to be paid.

A dramatic example: Huntington's disease. This devastating neurological disorder is caused by a strange genetic mutation named CAG triplet-repeat expansion. This is the very same molecular mechanism that has given us our bigger brains, our neurological complexity. Too many triplet-repeats in the huntingtin gene, let's say 40 of them, and you're sure to come down with Huntington's disease. But within the normal range of triplet-repeats, let's say nine to 35 — people are healthy. The intriguing twist is that up to that limit

of 35, more is better. More repeats mean higher intelligence and better coordination of movement and thinking. An intriguing, still speculative, thought — is Huntington's disease the price humanity pays for being clever?

We humans purposefully seek out our own "Faustian bargains" as we determinedly look for opportunities to usurp the bad for the good. Right here at Jefferson, Matthias Schnell, director of our vaccine center, is using one pathogen to fight another. His team received national attention for its clever strategy toward an Ebola vaccine — specifically, piggy-backing Ebola antigens onto a vaccine-ready formulation of the rabies virus. A purposeful Faustian bargain: take one of nature's bad — rabies — and subvert it for the good.

A most controversial Faustian bargain I've saved for last, lifting it out of the headlines — targeted genome editing. Bacteria, including bad ones, chew up their viral enemies using enzymatic machinery that goes by the obscure name of CRISPR-Cas9. In a remarkable twist, scientists have subverted this bacterial immunity to create a powerful genetic engineering technology, which, coincidentally, was introduced the very year you started medical school. Using CRISPR-Cas9, we can now edit genes, inside of cells, in real time. Think of it. We have the ability to cure sickle cell anemia by editing out the sickle mutation in the marrow stem cells that generate a patient's blood cells.

Take it a step further. One could theoretically edit out this mutation from sperm, eggs or embryos of sickle cell patients — and now, you will have eliminated this genetic defect forever from that family's genetic lineage. What are the ethical quagmires of that? And if genome editing should be applied to correcting disease genes, would it be warranted to enhance non-disease characteristics — say, height or basal ganglia size, beauty or intelligence? Should we take control of our genetic destiny, and if so, should there be limits? And then how far is that from Kurzweil's *transhumanism* — Googleplectic robotizing us with implantable electronics?

Targeted gene editing — at once, a blessing and a peril for humanity — part

of the complexity that we will need to face and embrace as we move into a hyper-tech future. Dealing with grey zones and Faustian bargains requires very human judgments, facilitated by unplugging from the planetary brain and applying human judgment. The challenge in so doing is captured in paired slogans of the existentialist Jean-Paul Sartre, spray-painted on Paris walls at the height of the student upheavals of May 1968: "Power to the imagination" and "Everyone is condemned to be free."

Willingness to imagine and resistance to external mind control are what power our existential freedom. They might lead us to uncomfortable places in our mental spaces, as we part paths, at some peril, with prevailing *group think*. An embrace of freedom fueled by imagination may come at a personal cost, and so it is in this sense that we are condemned to such freedom.

In closing, my messages to you, Class of 2015:

- Decouple from the web from time to time — don't be automatons glued to networks, Oods telepathically controlled by the giant Ood Brain of the Internet. Resist being *things* in the *Internet of Things*.
- Think freely, untethered from electronic webs. Consciously combat digital tunneling and the *de facto* mind control and *group think* that goes with it.
- Embrace those things that make you uniquely human: complexity, subjectivity, emotivity — these are the foundations of independent thought and clear human judgment — providing you with the means to reach clearings in the forest.
- Be open to shades of grey, prefer iridescence to simple colors, embrace a kaleidoscope of prime movers and causes and possibilities.
- Value the counter-intuitive, and be prepared to make Faustian bargains as you grapple with the medical ethical dilemmas of the digital age. Only non-Oods, freed from external electronic control, can guide man's electronic and genetic evolution.

Class of 2015, Thomas Jefferson spoke of "generational revolutions" — you are living

through one now in this *third machine age of the Internet*, with its existential threat of algorithmic manipulation by neural networks and advanced artificial intelligence. Times of change demand independent thinking. Be willing to frame new possibilities, new mindsets, by thinking freely.

You are the first class to graduate under the banner of the Sidney Kimmel Medical College. Sidney Kimmel has been a visionary — first reimagining women’s retail, then naming two cancer centers to help craft a new future for combatting cancer and now endowing a medical school to pave the way for 21st-century

paradigms in medical training, discovery and care. He epitomizes the free thinking and resistance to dogma that I’ve showcased today.

As you now take the sacred Oath of Hippocrates, hear the profession’s ancient call to service, heed its admonitions and affirm your commitment to others, in the most professional and altruistic ways. And permit yourselves to think freely, decoupled from the narrowness of *group think*.

We salute all those who brought you to this point in life — your parents and family who nurtured and supported your passion for service and inquiry. As you cross this stage, it is indeed the dreams of all of us

here today that accompany you. You enter a long tradition that dates from Hippocrates, to McClellan and Gross, through Gibbon and now to you. It is your turn to join, to continue and to enhance Jefferson’s legacy of service, and to perpetuate that desire to make a difference that brought you to Jefferson four years ago.

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