



# Natural Selections

A NEWSLETTER OF THE ROCKEFELLER UNIVERSITY COMMUNITY

Issue 90  
July/August 2012

## Help Wanted.

PHILIP DiMAURO

The Rockefeller University Classifieds may be low-tech as social networks go, but for me—someone who has never worked in a laboratory—the steady trickle of e-mails requesting reagents, cells, tools, and technical assistance has opened a small window to the practical concerns of lab life.

Occasionally, a classified ad sparks my curiosity and leaves me wondering about its origin and outcome. So I selected a few examples and tried to find out more about them.

*"I need one or two large (~4 cm) cockroaches so I can practice an electrophysiology demo. I rarely see cockroaches on campus, but I imagine others might... I know appropriately sized cockroaches are easy to find through Carolina Biological, but I thought I'd try this first. Waste not, want not."*

Katherine Leitch, who posted this ad, was kind enough to answer a few questions.

She received several responses on the afternoon she posted. People provided advice or "conveyed their amusement," but no one turned up to offer an insect. Had Kate received any wild-caught roaches, she would have used them to test simple electrophysiology setups that high school students will use in August when they participate in the annual Summer Neuroscience Program at Rockefeller. This two-week program is coled by Kate and two other graduate students, Lindsay Bellani and Roman Corfas.

Kate never intended to use "crusty urban cockroaches" for experiments conducted by high school students. But she decided that wild-caught specimens would not pose any health risks to her, nor would they compromise the results of her initial run-throughs.

That assumption won't be tested. A dozen captive-raised Discoideid cockroaches, natives of South America, have already arrived from a commercial supplier. This species is larger than the hard-shelled, 4-cm residents that New Yorkers generally revile. Those are the so-called American cockroaches, which

originated in the Old World.

*"Wanted: Floppy disk(s)."*

Affectionately referring to them as "old timey," "outdated," and "ancient," two people posted ads looking for 3 ½ inch floppy disks. Their experiences show that while old computers may be serviceable, they also can be cranky.

John Biggins was "using a gel box with a video capture that was hooked up to an old computer." Then his flash drive stopped working. His system had no CD burner or online connection, "so the only way to get my pics was to extract my files with old floppies."

The limited storage capacity of floppy disks turned out to be a bigger problem than expected, and the process was painstakingly slow. He eventually gave up and reverted to modern technology, using his iPhone's camera to snap pictures of the images on his screen.

Daniel Gareau wanted to use his vintage laptop loaded with Windows '98 and MatLab (a technical programming language) for undergraduate students coming to Rockefeller in the summer, but he needed to clear the hard drive of "videos of my geeky electrical engineering friends and me pulling pranks in college. I wanted to use an external drive to transfer data but needed to download some USB key drivers via the good old floppy disk."

Who still keeps floppy disks around, anyway? The person who replied to Dan's ad also offered him a recorder for eight-track tapes.

*"Does anyone have one of those long-handled grabbers? We have lost something at the bottom of the liquid nitrogen tank."*

What could have slipped into the super cold abyss? Part of a costly lab instrument? A cell phone? Someone's wedding ring?

I learned that none of those objects would ever be at risk of dropping into the tank. In this case, a plastic freezer box had gotten loose and was eluding capture. Tiffany Nivare

of the Casanova laboratory told me that her e-mail immediately drew a helpful response from Chris Keogh, the University's Chief Procurement Officer, who remembered that this kind of reaching tool had been ordered by another laboratory. That lab also contacted her right away.

Even with the right tool, it took two attempts to fish out the box and its cover. The borrowers returned the grabber to its owner between tries. I like this story because it shows how the Classifieds can help to solve problems by tapping into individual memory and community goodwill.

*"...looking for octopamine and dopamine antibodies..."*

Was I the only person who didn't know about octopamine? And why was it paired with a neurotransmitter that has its own chocolate-related page on Oprah's health blog? Since I didn't give the posters of this classified much time to respond, I decided not to harass them. But I did follow up on octopamine, which took me on a meandering path to a PBS-style nature show horror (with more roaches), dubious weight loss claims, and a little bit of science history.

"'Zombie' Roaches Lose Free Will Due to Wasp Venom." This headline from *National Geographic News* (online) refers to the behavior of cockroaches parasitized by jewel wasps<sup>1</sup>. When the wasp injects venom into the brain of a cockroach, the roach stops walking, but its legs do move as the wasp leads it to a nest where it deposits an egg into the helpless animal. The live roach serves as a food source for the wasp larva. The *Nat Geo* article covered research conducted by investigators at Ben Gurion University, who said their findings suggested "the wasp venom interferes with octopaminergic modulation of walking initiation in central structures of the cockroach brain<sup>2</sup>."

"Octopamine: Eight-Legged Fat Loss!" It doesn't take much to spur the diet supple-

ment industry into action. In this case, evidence that octopamine triggers the export of fat from fat cells has spawned advertisements touting its benefits for people hoping to shrink their adipose tissue<sup>3</sup>.

This Internet pitch at least pays homage to octopamine's history. It was isolated from the salivary glands of octopi by Vittorio Erspamer, an Italian chemist/pharmacologist, in the late 1940s. Erspamer also identified a substance he called enteramine, which is now known as serotonin. But that's another story.

Thanks to everyone who helped with this

article. ☉

#### References:

1. Mati Milstein, *National Geographic News*, <http://news.nationalgeographic.com/news/2007/12/071206-roach-zombie.html>
2. Lior Ann Rosenberg, Jose Gustavo Glusman, and Frederic Libersat, "Octopamine partially restores walking in hypokinetic cockroaches stung by the parasitoid wasp *Ampulex compressa*." *J Exp Biol.* 2007 Dec;210(Pt 24):4411-7.
3. <http://www.bodybuilding.com/forum/octo.htm>

## Summer in the City

AILEEN MARSHALL

New York City has been called the "Capital of the World." There are so many exciting things to see and do here. Unfortunately, it can also be one of the most expensive cities to live in or to visit. That makes it tough for those of us in the academic sector, who do not make the salaries of the one percent. However, come the hot summer days, there is a wide range of outdoor activities that are either free or inexpensive.

Probably the most well-known are the free concerts on the Great Lawn in Central Park. The New York Philharmonic will present its usual two concerts this year on July 13 and July 16, 2012. Concerts start at 8:00 p.m. and there are fireworks afterward. These concerts are famous for people picnicking on the Great Lawn, usually with wine and cheese. One can enter the park at 79th or 85th Street and Fifth Avenue, and if you are more interested in hearing the concert, arrive early to get a place up front. The more serious picnickers are toward the south end. More information about these concerts can be found at <http://www.nyphil.org/>.

Another great Central Park event series is SummerStage at Rumsey Playfield, with a wide range of music, dance, and spoken word productions. Most events are free, but there are a few benefit concerts put on throughout the summer. Enter the park at 69th Street and Fifth Avenue and follow the path to Rumsey Playfield. For some of the more popular artists, a line forms in front of the gate well beforehand. There are bleacher seats in back, with Astroturf up front, sometimes set up with folding chairs. You can bring in food, but no glass bottles, and there are also food vendors inside. For a complete schedule, go to [www.cityparksfoundation.org/summerstage](http://www.cityparksfoundation.org/summerstage).

One of the best Central Park activities is Shakespeare in the Park. Produced by The Public Theater and presented at the Delacorte Theater in the park, this year's plays will be *As You Like It*, from June 5 through June 30, 2012, and *Into the Woods*, from July 23 through August 25, 2012. Tickets, although free, can be obtained by standing in line in front of the Delacorte Theater from 1:00 p.m., or on the website. These are very good productions that usually draw a crowd. I once saw Jimmy Smits on the stage and Tom Hanks in the audience. The complete schedule can be found at [www.shakespeareinthepark.org](http://www.shakespeareinthepark.org).

Lincoln Center hosts some very fun and inexpensive events in the summer. Lincoln Center Out of Doors presents a range of international music and dance events, with special events for children. This free series runs from July 25 through August 12, 2012. Performers run the gamut from Nile Rodgers to Tom Paxton and many others. Midsummer Night Swing is a run of dance events with everything from salsa to disco from June 6 through July 14. There are group dance lessons at 6:00 p.m. and live music at 7:30 p.m. Certain events require a \$17 ticket but others are free! Both series are on the Josie Robertson Plaza at Lincoln Center. More information can be found at [www.lincolncenter.org](http://www.lincolncenter.org).

On Monday nights, HBO sponsors a summer film series in Bryant Park. The movies this year range from *All About Eve* to *Butch Cassidy and the Sundance Kid*. Blankets and food are allowed. The lawn opens at 5:00 p.m., but there is usually a crowd gathered well in advance to get a spot. The movies begin at sunset, and they show an old Warner Brothers cartoon beforehand. People will cheer for Porky Pig's famous sign off "...That's all folks!" The complete schedule

**Natural Selections**  
Editorial Board  
**EDITORIAL BOARD**

**Lauren Brenner**  
**Carly Gelfond**  
**Melina Herman**  
**Jim Keller**  
**Aileen Marshall**  
**Engin Ozertugrul**  
**Christina Pyrgaki**  
**Tobias Reichenbach**  
**Susan Russo**

*selections.rockefeller.edu*  
*nseleditors@rockefeller.edu*

is at [www.bryantpark.org](http://www.bryantpark.org). At both the Central Park Great Lawn concerts and the Bryant Park Film Festival, it is traditional to have some members of your group arrive early to secure a spot, and have some predetermined arrangement of balloons or a flag for the rest of the group to find.

Another great summer venue is Hudson River Park. It runs for five miles along the Hudson River and hosts a plethora of summer events, all free. On Pier 84 on West 14th Street, The Moon Dance series features a live band on Sunday nights, with styles ranging from swing to tango. Dance lessons are given at 6:30 p.m. and the bands start at 7:00 p.m. The RiverRocks series, also on Pier 84, focuses on up-and-coming musicians. The River Flicks events feature two series of outdoor movies. The Wednesday night movies are held on Pier 63 from July 11 through August 23, 2012. The theme this year is "Blockbusters" including movies such as *Moneyball* and *Bridesmaids*. The Friday night movies are more family-oriented, including such fare as *Hugo* and *Back to the Future*. These are shown on Pier 46, at Charles and West Streets. Both movie series start at sunset, and free popcorn is available if you get there early. Some seating is provided, or you can bring a blanket to sit on. The RiverFlicks events are usually not as crowded as the Bryant Park movies. More information can be found at [www.hudsonriverpark.org](http://www.hudsonriverpark.org).

Two good websites to find information about these and other events in the city are: [www.newyorkled.com](http://www.newyorkled.com) and <http://newyork.citysearch.com>. The NewYorkled site also includes a complete calendar of the city's many street fairs. With all of these options available, you can have a great summer in the city without going broke. ☉

# ***Vox Clamantis in Urbe***

## **Who Cares What Other People Earn? or Income Inequality Part I**

JACOB OPPENHEIM

Over the past year, I have written a series of columns about housing regulation, transportation policy, and occupational licensing, among other topics, which address how seemingly sensible government mandates may lead to significant impoverishment, especially in urban areas. Before addressing the issue of income inequality, it is worth reviewing these ideas and linking them together to see how seemingly well-meaning mandates have amounted to a regressive transfer of wealth from the poor to the rich. In 1950, only one in twenty workers had a job that required some form of licensing; today, that number has reached one in three. Jobs that require licensing are overwhelmingly held by low- and middle-income workers. Licensing stifles competition, protects the wages of incumbents, and constitutes a highly regressive tax on the unemployed, in the form of long training periods (it takes 140 days to become a manicurist in Oregon), and expensive, useless coursework (frequently only available at for-profit institutions), and testing. A recent report from the libertarian Institute for Justice is littered with examples of the sheer ridiculousness of our licensing regime, a system that would be comical were it not for its perverse consequences.

For those who have a job, however, a thicket of overlapping rules, regulations, and mandates makes housing far more expensive than it should be. Given market competition, the price of housing should fall to equal the cost of construction, a value (\$300 per square foot) so low that decent housing could be afforded by the working poor of New York. Yet, by creating restrictions that limit where one can build and how dense one may build there, we limit the supply of housing, especially near public transportation. A brief glance comparing the area around any outer borough express subway stop with that around, for instance, 86th Street and Lexington Avenue in Manhattan, should easily convince one of the vast untapped potential for building housing within the city. Were these regulations overturned, the exceedingly long and expensive processes of community approval and environmental review would keep most potential builders from the market. After all, who has the ability, except the largest real estate firms, to continue to borrow money amid intermi-

nable delays without seeing any returns? Perhaps the greatest example of the well-off sticking a finger in the eye of the poor is historical preservation. The large tracts of land that wealthy, mostly white, members of the urban elite have cordoned off from development, to avoid having to pay the economic cost of living at low density in prime locations (mostly in Manhattan), are perhaps the clearest example of the rich “rigging the game” against the lower and middle classes.

Provided a job and housing though, there are still sclerotic and wasteful local and state bureaucracies that frequently appear to be more concerned with providing good jobs to members of the American Federation of State, County, and Municipal Employees (AFSCME) than with providing services to the public at large. I have covered the issue of corrupt transit-worker pensions and how archaic work rules force the MTA to expend far more on labor costs than it should. I intend to return to these subjects in the next year to demonstrate how even the best reform proposals cannot be implemented without a shredding of the public-sector union contracts that bind the hands of those who want to serve the populace at large.

Rather than focus on the inequality of income, we should focus on the costs of living a healthy, productive, and fulfilling life. Many of the proposals I have outlined above would work by decreasing the cost of living, mostly in the form of housing, which frequently consumes more than one-third of an individual's income. Over the past 50 years, the cost of food has dropped from 33 percent of average household income to 7 percent, mostly due to increases in agricultural efficiency. Manufacturing is a marvel of efficiency: today 80 percent of poor households have air conditioning, up from 34 percent in 1970, and three in four own a car or truck. Electronics and entertainment devices are cheap enough that two-thirds of poor households own a DVD player, and half own a personal computer. Liberalizing the housing market and the services sector by ending most forms of occupational licensing would make the money earned by the poor travel much further. Low-

er rents would allow stores and restaurants to charge dramatically lower prices. The cost of groceries and especially restaurant meals in New York City is due mostly to the extremely high commercial rents that local merchants must make up for in the cost of their goods, not the high cost of preparing quality food. A brief trip to a decent suburban restaurant is convincing in this regard. The poor deserve to be able to purchase the necessities of life with enough left over to afford some measure of luxury and savings.

Ultimately, we cannot determine the optimal level of income inequality for economic growth, social peace, and the pursuit of happiness at a societal level. It is easy enough to imagine a level of general prosperity high enough that even extreme inequality would not pose a problem: if nearly everyone makes enough money to purchase all he or she can reasonably consume, who cares if a few outliers make one hundred or one thousand times as much? Income inequality is a canard, distracting us from the true causes of societal impoverishment. On the local level, these constitute extreme regressive transfers from the poor to the rich in the form of occupational licensing, housing regulation, and an inefficient and corrupt public sector. On a national level, these are the issues that dominate the national debate: the exploding cost of healthcare and the similarly enormous rise in the cost of higher education. These are the debates we should be having, rather than wringing our hands in anguish over income inequality. In my next column, I will explore the roots of income inequality and further demonstrate how little of a threat it poses to society. ☉

### **NATURAL SELECTIONS**



**NEEDS YOU!**

Narrate your story, send us your memorabilia, share with us your interests!

Enrich us by describing your country, culture and living!

Share your experiences here and bring in your unique viewpoints!

Email: [naturalselections@rockefeller.edu](mailto:naturalselections@rockefeller.edu)

# When Things Go Wrong: An Exploration of Error at Rockefeller

JOE LUNA

As anyone at the bench knows, it's frustrating when a hypothesis doesn't pan out. Sometimes a succinct and beautifully conceived idea, carefully fashioned to predict something testable, can in an instant be rendered useless by a muddy blot, a blank gel, or an otherwise completely healthy mouse. This prospect is part of the exciting—though slightly terrifying—feeling most anyone feels at the developer or computer screen, at the moment of discovery, when the response for important experiments can be summed up with either “It worked! Let's have a drink” or “It didn't work. I need a drink.” It's little wonder the Faculty and Students Club is so well attended.

Having a hypothesis confirmed is one thing, although a refuted hypothesis is still useful since it obviously tells you what didn't work. Historians and philosophers of science have long recognized this, and they have argued that this observation says something about our ability to practice science. Philosophers of science often write of something called the “pessimistic meta-induction” (PMI), which is essentially a fancy way to describe what history can teach us about being wrong. The basic idea is this: as history is littered with many scientific models that eventually failed, it's problematic to assume that our present success rate is any different. Thus, it's likely that some fraction of currently accepted scientific models will turn out to be wrong in the future. Combined with the specter of hindsight bias—whereby we only recall those ideas that were correct to begin with—it becomes easy to overlook which scientific paradigms could face eventual questioning absent the technological improvements or nurturing environments that make such questions testable. Such a situation can be thought of as the calm before a Thomas Kuhn-style scientific revolution.

In practice, this makes a lot of sense. There's little reason for a scientist to have to know and catalog overturned scientific ideas, beyond their utility as disposable teaching tools and the occasional colorful anecdote. Somewhat counter to PMI, scientific realism offers a standard and more optimistic view. In general, since science self-corrects over time, absorbing and refining theories as new data warrants, while discarding pieces that don't agree with observation, we can be confident that a scientific theory approximates some level of truth. Or, put another way, our “success rate” at getting things right gets higher as we build upon scientific advances that have withstood the test of time. Thus, it's naïve to assert that our present success rate is the same as that of the past, when we knew much less.

There are examples in The Rockefeller University (RU) history that could be claimed by either camp. Those that would be claimed by the realists you're likely already aware of because these tend to be the stories that are celebrated with repeated visits to Stockholm. But what about those examples where Rockefeller researchers got it wrong? What happened, and how can we learn from them?

There are numerous examples from RU history, though perhaps the most famous is the story of DNA research. Contrary to what you might think, this story doesn't begin with Oswald Avery, Colin Macleod, and Maclyn McCarty, but with Phoebus A. T. Levene, a founding member of The Rockefeller Institute and well-known nucleic acid chemist. First with RNA, and later with DNA, Levene determined that both were long polymers composed of four chemical entities that he termed “nucleotides” (A, C, G, T, and U), names we can credit Levene with inventing. Over the course of the 1910s and 1920s, Levene's lab correctly characterized their individual chemistries, determined the nature of their ribose or deoxyribose backbones, and correctly determined that nucleotides

were linked via 5'-3' phosphodiester bonds. All in all, these were stunning achievements. As for the uses of these long polymers, Levene reached an impasse. Because he measured approximately equal amounts of each nucleotide in biological samples, he proposed what became known as the “tetra-nucleotide” hypothesis, where each of the nucleotides in groups of four were connected via 5'-3' bonds in stacked rings with their bases facing outwards as a structural support for proteins. There was nothing in his model that could suggest a means for information storage, let alone replication. In fact, similar to other chemists of the day, Levene considered nucleic acids to be far too chemically simple to store information. The basic gist, compared to the later Watson-Crick model, was that Levene got it completely backward. Only later could we call the idea wrong.

Being wrong is certainly not the end of the world. The problem, however, was that this work was considered to be definitive for many years. In an era when most thought that proteins carried genetic information, Levene's model was considered compelling evidence that nucleic acids (with four paltry building blocks) couldn't do the job. Surely a protein or a series of proteins, each composed of a mix of twenty amino acids, was better suited to explain the complex process of heredity.

Levene died in 1940. Thus, he never was able to grasp later work done in pneumococci by the Avery group that strongly pointed to DNA as the carrier of genetic information. Acceptance of this seismic result came slowly, as there were many holdouts of the protein-centric view, even among RU colleagues (Alfred Mirsky was one particular vocal opponent of Avery's discovery.) Consequently, Avery's result was largely overlooked in his lifetime and only later lauded as the monumental discovery we view it as today.

But what of Levene? It is unfortunate that his legacy has been overshadowed by the “tetranucleotide hypothesis,” despite the many key discoveries that make him an arguable great-grandfather of molecular biology. Though as much as Levene could be considered exhibit A for a PMI view of science—Levene needed to be wrong for Avery to be triumphant Avery—it is heartening to know that Levene was an impassioned realist. From his address, upon receiving the Gibbs award, Levene declared:

“Thus step by step, one mystery of life after another is being revealed. Whether the human mind will ever attain complete and absolute knowledge of and complete mastery of life is not essential. It is certain, however, that the revolt of the biochemist against the idea of a restriction to human curiosity will continue. Biochemistry will continue to function as if all knowledge, even that of life, were accessible to human understanding. The past has taught that the solution of some problem always opens up a new one. New discoveries in physics, in mathematics, in theoretical chemistry, furnish new tools to biochemistry, new tools for the solution of old problems and the creation of new ones. So long as life continues, the human mind will create mysteries and biochemistry will play a part in their solution.”

In one way or another, at the bench, we're all either Levenes or Averages. We're unknowingly crafting and testing incomplete hypotheses or we're slaving away, ultimately on the right track, but with little more than fanciful interpretation to explain otherwise strange data. We're either wrong or we're right, and we just don't know it. ♦

For a nuanced and intimate portrait of Levene—the person—(and the source of the above quote,) see:

Van Slyke, D.D., and Jacobs, W. (1945) *Biographical Memoir of Phoebus Aaron Theodor Levene*, Vol. 23, pp. 75–86, National Academy of Sciences, Washington D.C.



**This Month Natural Selections interviews Prerana Shrestha, Postdoctoral Associate in the Laboratory of Molecular Biology.**  
**Country of origin: Nepal**

## New York State of Mind

**1. How long have you been living in the New York area?** I have been living here for over eight years.

**2. Where do you live?** Sutton House, gladly minutes away from the Rockefeller campus.

**3. Which is your favorite neighborhood?** My favorite neighborhood has to be the Upper West Side in the 60s near Central Park. I used to live two blocks from the south entrance of Central Park when I first joined Rockefeller, and I loved the proximity to the green space and the running trails both within Central Park and Riverside Park.

**4. What do you think is the most overrated thing in the city? And underrated?** I think some of the things advertised for tourists are overrated, such as the always-overcrowded Times Square and the overpriced carriage ride in Central Park, when the park is best explored by foot. Among events, I find the Five Borough Bike Tour the most overrated, which attracts over 30,000 cyclists to pedal through the city. Due to the enormity of the event, there are long delays in the start of the event, and long queues at the finish line when boarding the ferry. I prefer the Bike MS NYC tour, which is quite under-

rated. This bike ride enjoys traffic-free access to the Holland Tunnel (it used to be the Lincoln Tunnel until last year) and is not as crowded as the Five Borough event. Also, the biking event is for a great cause (the National Multiple Sclerosis Society.) The most underrated thing about the city, I find, is just how cheap cab rides are compared to elsewhere in the country.

**5. What do you miss most when you are out of town?** The convenience of public transportation and the access to a plethora of restaurants serving authentic ethnic food.

**6. If you could change one thing about NYC, what would that be?** I would ban car honking except for emergency vehicles.

**7. Describe a perfect weekend in NYC.** I would start the day with a good breakfast and cappuccino, and then ride my road bike to Riverside Park and bike all the way past the George Washington Bridge. I would then bike back south all the way back to Battery Park. On the way back, I would stop at Cafe Himalaya in the East Village for a hot steaming plate of momos (Nepali dumplings). In the evening, I would go to Joe's Pub or The Living Room to hear some of the up-and-coming artists perform live, and



to catch up with my friends.

**8. What is the most memorable experience you have had in NYC?** When I ran the ING New York City Marathon in 2006 and raised funds for a nonprofit organization (Help Nepal Network), which I am currently involved with, to build a health post in rural Nepal.

**9. If you could live anywhere else, where would that be?** Kathmandu, San Francisco, or London.

**10. Do you think of yourself as a New Yorker?** The other day, I recommended places to visit and to avoid to a bunch of out-of-town visitors straight out of memory. That, and having lived in this city for over eight years, pretty much makes me a New Yorker. ☺

## For Your Consideration—First Half FYC Edition

JIM KELLER

Believe it or not, half of the year is behind us. We've shed off the colder months, segued into a more moderate climate (some may say unseasonably moderate) and have settled into summer heat. In New York, summer can all but suffocate us in humidity and by the time fall hits, we're gasping for that first breath of fresh air. It's also when we can look back at the first half of the year's film offerings to try and nail down some potential Oscar contenders. By this time last year, we knew Christopher Plummer would more than likely land a Best Supporting Actor nomination for his work in *Beginners*; Melissa McCarthy's Oscar-nominated *Bridesmaids* performance hit like thunder; and we had our first bona fide Best Picture contender in Woody Allen's *Midnight in Paris*. But what we didn't know was that one fateful engine that could, *The Help*, would

establish its place in the Awards race as a serious contender for numerous acting honors as well as Best Picture. So let's have a look at those films with looming possibilities, the films that have carried us through the first half of the year—the films that just might find enough support to push them into contention.

**BEST ANIMATED FEATURE:** *The Secret World of Arrietty* (director: Hiromasa Yonebayashi)

U.S. Release: January 21, 2012

**FYC:** In this Japanimation adaptation of Mary Norton's famed book, *The Borrowers*—a children's book that examines our world from a tiny perspective—comes to life in part, thanks to Hayao Miyazaki's screenplay. Norton's characters are imbued with just enough charm and whimsy to avoid

saccharine overload as we're taken along with the ever-curious, rebellious teen, Arrietty Clock (Amy Poehler), as she ventures out from beneath the floor boards into the life of sickly "human bean," Shawn (David Henrie). Miyazaki's body of work, which includes his 2003 Best Animated Feature winner, *Spirited Away*, and 2001's nominated *Howl's Moving Castle*, is comprised of traditional animation that focuses on natural human movements and is often done in watercolors. It's through this tried and true method that his work stands on its own in a sea of animators clamoring to be the next big thing—often dialing up their process to a futuristic or hypersensitive outcome that risks losing the human experience. Given that Yonebayashi is a long-time collaborator, it stands to reason that his work may follow in Miyazaki's footsteps and that his

premiere outing as a director might see similar critical acclaim.

**BEST ACTOR:** Liam Neeson (*The Grey*, directed by Joe Carnahan)

U.S. Release: January 27, 2012

**FYC:** Following a plane crash in Alaska, six oil workers led by a skilled huntsman (Liam Neeson) are unceremoniously hunted by a pack of wolves as they fight to stay alive in the wilderness. Given the subject matter, you might be hard-pressed to find a reason to support the accolades Neeson has received for his performance in the film. But, through his portrayal of Ottway, Neeson marries the tough exterior of a hardened man with the gentle soul of tender heart, which makes him a formidably accessible hero. When you are able to relate your own experience of the world through the eyes of another, a bond is made. The question is, will that bond be strong enough to push Neeson into Academy Awards contention? Of course not, but we're talking about a man, on the edge of 60, who was nominated for Best Actor in 1993 for *Schindler's List* and who has built a career around being the go-to Irish actor for action-packed thrillers (see *Batman Begins*, *Taken*, and *Unknown*, among others.) Further, according to screenrant.com, Open Road studios will re-release the film in October to remind the Academy of Neeson's performance.

**BEST ACTRESS:** Jennifer Lawrence (*The Hunger Games*, directed by Gary Ross)

U.S. Release: March 23, 2012

**FYC:** Based on Suzanne Collins' book of the same title, Jennifer Lawrence is Katniss Everdeen: a lone wolf plucked from the periphery to represent her district in a Battle Royale-style televised death match in a future world where the Capitol has absolute power over its citizens. In this role, Lawrence creates something beautiful in her character's terror, a feat not easily achieved. Ultimately, Everdeen's bravery wins out over her fear and her heart, enabling us to see what this scrappy, intelligent young woman is capable of. Standing in the midst of a \$650 million (and rising) global box office grab is nothing to sneeze at. Take this and consider Lawrence's 2010 Best Actress nomination for *Winter's Bone* and you can see why she's on many critics' lists at this early stage. Yet, it's important to realize that being at the top at the six-month mark requires a long and steady march through the latter half—one dotted with performances in films which all

but aim for Academy attention. Still, Lawrence has done this march for *Winter's Bone* and that didn't stop her, or the film, which also reaped Best Picture and Best Adapted Screenplay nominations as well as a Best Supporting Actor nomination for John Hawkes.

**BEST ACTRESS:** Rachel Weisz (*The Deep Blue Sea*, directed by Terence Davies)

U.S. Release: March 23, 2012

**FYC:** Set in the 1950s, the film version of Terrence Rattigan's play tells the story of Hester Collyer (Rachel Weisz), the younger wife of High Court judge Sir William Collyer (Simon Russell Beale). Hester has a passionate affair with Freddie Page (Tom Hiddleston), a former Royal Air Force pilot troubled by war memories, who longs for the fear and excitement of his past life. Since its inception at the Toronto Film Festival last fall, Weisz has enjoyed a steady wave of acclaim for her performance from cheery critics such as those at *The New York Times* and *The Los Angeles Times*, while the film itself was nominated that year for Best Film by the London Film Festival. In 2006, Weisz surprised many with her Best Supporting Actress win for *The Constant Gardener*—a role that helped put her on the map as a serious actress and that led her to roles such as that in the acclaimed film *The Whistleblower*, which many critics thought she deserved a nomination for. If *The Deep Blue Sea* can manage to stay in the Academy's consciousness, she may have a shot, but she'll need the PR power of her studio to pull it off.

**BEST SUPPORTING ACTRESS:** Charlize Theron (*Snow White and the Huntsman*, directed by Rupert Sanders)

U.S. Release: June 1, 2012

**FYC:** It seems genre films are the trend for the first half of the year and I've already noted two performances from separate films that may have a chance come Oscar time (*The Grey* and *The Hunger Games*). Enter the third. To be sure, *Snow White and the Huntsman* is a genre film, as a twist to the famed fairy tale. In this adaptation, the Huntsman (Chris Hemsworth) is enlisted to lure Snow White (Kristen Stewart) into the woods to be killed, but becomes her protector and mentor in a quest to vanquish the evil queen, Ravenna (Charlize Theron). And what an evil queen she is! In the history of evil queens, I can't recall a portrayal that so exactly encapsulates the beauty, ruthlessness, and cruelty most evil queens

perpetuate. While several have captured the basics, Theron has proven a deep character understanding, through which her Ravenna becomes a living, breathing being instead of an on-screen caricature. Despite a Best Actress win for *Monster* in 2004 and having been nominated again for the same honor in 2006 for *North Country*, she will have a tough climb to Oscar this time around, as the cards seem stacked against her. For one, there has not been a precedent set for rewarding female villains in genre films geared towards a younger audience. Second, whether anyone cares to admit it or not, Oscar is a political beast and in most cases, acting honors are generally plucked from films with high box-office returns. Finally, given the first two circumstances, the film and Theron's performance will need a landslide of support from critics, which doesn't seem to be the case at this stage. Of course, when it comes to Oscar, anything is possible.

**BEST ANIMATED FEATURE:** *Brave* (directors: Mark Andrews, Brenda Chapman, Steve Purcell)

U.S. Release: June 22, 2012

**FYC:** Speaking of non-existing precedents, have you heard about Disney and Pixar's latest collaboration, *Brave*? It's an animated feature that breaks all the rules as it boasts the first ever female heroine in a Disney film. A wretched curse plagues headstrong Princess Merida (Kelly MacDonald), who must rely on bravery and archery skills to undo it amidst chaos that resulted when she defied an age-old kingdom custom. Unlike Yonebayashi's work, Pixar Animation Studios has made a name for itself by speaking to the masses and delivering the shiniest, newest toys from its toolkit. For its premiere collaboration with Disney, toys are exactly what they delivered with 1996's Special Achievement Award winner, *Toy Story*. The film relied on top of the line animation techniques, the likes of which hadn't been seen before—the result was astounding. By delivering a new form of animation, the collaborators sent a shockwave through the animation field and forever changed the game. This latest outing suggests more of the same as the trailer delivers more of the finite detail within computer generated animation we have come to expect from the studios. While not organic in the least, the animation created by the two powerhouses is virtually unstoppable. With two very successful sequels to *Toy Story* created over the course of fifteen years, as well as a steady stream of



other films including, among countless others, *Monsters, Inc.* (Best Animated Feature in 2002), *Finding Nemo* (Best Animated Feature in 2004), *Wall-E* (Best Animated Feature in 2008) and *Up!*, which was nominated for Best Picture and won Best Animated Feature in 2010. The same awards were bestowed upon *Toy Story 3*. Given the acclaim and honors Disney/Pixar films have enjoyed over the years, it seems that a Best Animated Feature nomination shouldn't be hard to come by for *Brave*. However, the very idea of the film being led by a female heroine has the public split. Much like Obama's election was an American first in 2008, the public will have to decide if it's ready to receive an animated, female heroine.

**BEST PICTURE:** *Beasts of the Southern Wild* (director: Benh Zeitlin)  
U.S. Release: June 27, 2012

**FYC:** Following hot on the heels of a Grand Jury Prize win at Sundance, Benh Zeitlin's premiere feature film also took home the Camera d'Or in the Un Certain Regard category at this year's Cannes Film Festival, making it the lone Best Picture contender derived from the festival circuit so far this year. The film follows Hushpuppy (Quvenzhané Wallis), a six-year-old girl who leaves her Delta-community home to seek out her mother while her father lays ill and environmental changes release an army of prehistoric creatures called aurochs. Largely thought of as an allegory for Hurricane Katrina, the film seems to be sweeping over film festivals, obliterating everything in its path—much like its hinted point of origin. This can almost certainly be attributed in part to Wallis' stunning performance that has already been put on many critics' Best Actress watch lists. In addition, the film

finds strength from Dwight Henry, who portrays Hushpuppy's father, Wink, and who, like Wallis, is a first-time actor. *Beasts* has managed to build momentum nearly five months after its Sundance inception, which is certainly a good sign for the film as we head into Oscar.

Among other noteworthy pieces of film this year: Wes Anderson's *Moonrise Kingdom*, which bowed at Cannes and has received mostly positive critical reviews, John Madden's *The Best Exotic Marigold Hotel*, and performances by Linda Cardellini and Michael Fassbender in *Return* and *Prometheus*, respectively.

As we all know, when it comes to Oscar, all bets are off, but a dig through the year's first half of offerings can help us narrow the scope a bit as we toss them into the Oscar funnel and see what comes out the other end. ♦

## PDA Corner—Annual PDA Retreat, Career Development Awards, and Upcoming Elections

ASMA HATOUM

The PDA focused mainly on professional development this spring. In addition to hosting the ongoing Tri-Institutional PDA seminar series, we channeled the bulk of our efforts toward planning and organizing the annual PDA retreat. After careful consideration of potential venues and a few site visits, we decided to hold the retreat at the Interlaken Inn Resort and Conference Center in Lakeville, Connecticut. The resort is situated on a lakefront property in the beautiful Litchfield Hills, which promises to provide a pleasing scenic backdrop for the event. The retreat will take place over two days and one night on September 12-13, 2012.

Our theme this year is prominent women in science, and after considering potential keynote speakers suggested by the postdoc community, we have invited Dr. Pamela Silver. She is one of the founding members of the Department of Systems Biology at Harvard Medical School and the first Director of the Harvard University Graduate Program in Systems Biology. Her accomplishments have been recognized with numerous awards and honors including a Presidential Young Investigator Award from the National Science Foundation and an Innovation Award from BIO, the world's largest biotechnology organization. A comprehensive description of Dr. Silver's research interests and achievements may be found at the following website: <http://wyss.harvard.edu/view-page/128/pamela-silver>. Dr. Silver promptly and enthusiastically accepted our invitation and she is looking forward to meeting us at the retreat and delivering the keynote address.

Our program will also include other guest speakers from outside and inside The Rockefeller University. We are delighted to announce that our president Marc Tessier-Lavigne has also accepted our invitation to attend the retreat. He will be one of the guest speakers participating in a panel discussion on a current

topic in science (to be announced). In addition to the keynote address (on the first afternoon) and panel discussion (on the second afternoon), there will be ample time allotted for postdoc-research talks on both days. For postdocs who are interested in presenting their work and wish to reserve a slot in advance, please e-mail the PDA at [pda@rockefeller.edu](mailto:pda@rockefeller.edu). Registration details and the call for speakers will be announced in the coming weeks. We will also be sending out a detailed program for the retreat as soon as the talk schedule is finalized.

In addition to planning the retreat, the PDA distributed career development awards this spring. These awards are granted twice a year for partial or full reimbursement of expenses associated with attending conferences and/or workshops. In April, thirteen applicants were considered, and six were awarded \$500 to cover conference expenses. Preference was given to postdocs who had been employed at Rockefeller for three to five years and who had not yet attended a conference or workshop. Stay tuned for the next call for applications, which will take place in the fall of 2012.

The time to elect new PDA Board members is approaching. We will be accepting nominations throughout the month of July, and elections will be held in the beginning of August. Serving on the PDA Board and representing postdoc interests to the administration is an excellent way to help build our community while gaining valuable leadership experience. Do consider becoming a PDA representative and stay tuned for upcoming election announcements.

Finally, the PDA has not forgotten about the social front! We are organizing a summer Wine, Cheese & Appetizers party, which will take place at the end of July (details will soon be announced). We hope to see you all there! ♦

## RU Art Number 6

CHRISTINA PYRGAKI

Entering the Rockefeller Research Building (RRB) lobby there is no escaping the vigilant eyes of the sculpted and painted portraits arranged in a row along both of its side walls. And when you leave RRB late in the evening, after a long day in the lab, tired, with your attention divided between the experiments done and the experiments that still need doing, exiting the elevator and walking towards the doors can be an eerie experience. John D. Rockefeller's marble bust, created by Jo Davidson, stands out as the most impressive amongst those in this collection.

Jo Davidson (1885-1952), who was primarily a portraitist, became an academic portrait sculptor in marble, bronze, and terracotta and sculpted portraits of many of the world's famous personalities. He did not have his subjects pose; rather, it is said that he was an outgoing personality who preferred to observe and speak with them, to get to know them as people. A remarkably clear-sighted and observant portraitist, Davidson could evoke the essence of the sitter's character. Thus, there was no flattery in any of the portraits he created; what you see is essentially who the subject is, or rather was, not just what he looked like, nor what he wished to look like, nor what he wished to be for that matter. "That's Gertrude Stein, that's all of Gertrude Stein, that's all of Gertrude Stein there is," Stein once remarked, referring to her massive bronze likeness sculpted by Jo Davidson.

Can we safely conclude then that what we see of John D. Rockefeller through this haunting bust is who he actually was? The bust depicts a distant, quiet man for whom ideas seemed to be constantly brewing in his mind. His slightly turned head, upward look, and barely raised hairless skin where his eyebrows once were (he lost all his hair due to stress-induced alopecia at the age of 52) suggest indifference, if not disdain, for all that is going on around him. He is looking up and forward, which could be a metaphor for his attitude throughout his entire life. His mouth is held in a straight line, with a slight downward bent at the corners. It is almost impossible to imagine this mouth forming a smile. It makes him look strict, serious, somber, as was his upbringing by his austere Baptist mother, but also, surprisingly for a man of his status and wealth, cheerless. The lips, which he held so tightly sealed throughout his entire life ("Success comes from keeping the ears open and the mouth closed," he used to say) are the most poignant feature of his face.

You can tell that this is the bust of a man who was "all-business," which, I guess, is the only way a man who started a company at the age of 19 and grew to become the wealthiest man in history could be. But, even though the bust perfectly portrays the industrialist in his all-business, aloof persona, it does not make it

at all easy to see the philanthropist, the man who from his first employment as a clerk at the young age of sixteen sought to give away one-tenth of his earnings to charity.

John D. Rockefeller's donations grew with his fortune and the total of his lifetime philanthropic work has been estimated at about \$550 million. He founded the University of Chicago (1892), and The Rockefeller University—formerly Rockefeller Institute for Medical Research—in 1901. He also founded the General Education Board in 1903 and established the Rockefeller Sanitary Commission, which was largely responsible for eradicating hookworm in the South by 1927. His fortune reached \$900 million by 1912 despite his already having given away hundreds of millions of dollars. When he died, on May 23, 1937 his estate totaled \$26,410,837. He had given most of his property to his philanthropies, to his son, and to other heirs. The eradication of hookworm in the South alone would merit his place as one of the great humanitarians of the twentieth century, but his reputation was so sullied that he never received the credit he was due for this great act on behalf of humankind.

I would be tempted to think that his sullied reputation was also the reason that the marble bust does not exhibit any of the kindness that one would assume characterizes a philanthropist of Rockefeller's magnitude. It is unlikely, however, that Davidson would allow such bias to interfere with what he saw, as he got to know his subject. Could it be that Rockefeller's humanitarian action was not the result of kindness, but that of duty? He, himself, stated: "Every right implies a responsibility; every

opportunity, an obligation; every possession, a duty." He had many possessions, so his duty was, again in his own words to "... make money and still more money and to use the money I make for the good of my fellow man according to the dictates of my conscience." Is this the reason that the exquisite bust that Davidson created depicts a strict, stern old businessman and not a humanitarian? Maybe, but that is not really important. What really matters is that Davidson, in all his artistic genius, captured the quintessence of the astute industrialist and immortalized him in marble, so that he can solemnly observe the scientists of the institute he funded while they serve science "*pro bono humanis generis*," as John D. Rockefeller, the humanitarian, intended it! ♦

### References:

1. Jo Davidson, *Between Sittings* (New York, NY: Dial Press, 1951)
2. Chernow, Ron. *Titan: The Life of John D. Rockefeller, Sr.* New York: Random House, 1998.
3. [http://www.brainyquote.com/quotes/authors/j/john\\_d\\_rockefeller.html#St41M5DkQ1t2dUys99](http://www.brainyquote.com/quotes/authors/j/john_d_rockefeller.html#St41M5DkQ1t2dUys99)



Photo by the author



# Culture Desk: Top Five Concerts of All Time

BERNIE LANGS

I keep a magnetic button in my office that I bought at one of the stores at Downtown Disney in Orlando, Florida, that reads: “I May Be Old But I Saw All the Cool Bands.” Here are the top five concerts I’ve seen in my lifetime. It’s a tough choice:

1. The Rolling Stones at Shea Stadium, early 1990s: The Steel Wheels Tour. My good friend and long-time guitar jamming partner must have sold his house to get tickets on the field to see this extravaganza. The sets moved at rapid-fire pace and highlights included the obscure psychedelic 1960s romp, “2000 Light-years from Home” and an extended jam on the solo by Keith Richards during “Honky Tonk Woman.” A great emotional moment came during the ballad “Ruby Tuesday” sung by Mick Jagger in a strong voice. When my friend and I recognized the opening chords of the song, we exchanged a glance that read, “It doesn’t get any better than this.”

2. Paul McCartney at Yankee Stadium, July 2011. The same friend brought me to see Paul McCartney play his greatest hits from a career spanning decades. See my review in these pages from last year.

3. David Bowie at Madison Square Garden, 1978: The Stage Tour. This is such a fond musical memory for me. I was already convinced that the oddities on Bowie’s philosophical masterpiece album *Heroes* were utterly brilliant, but to see him perform those

songs live as well as those from *Station to Station* and *The Rise and Fall of Ziggy Stardust* led to a night of pure magic. The show at the Garden was the very last night of the tour and the band was on fire. I’ve since read that Bowie’s musicians held back on that tour because of what they felt was a low pay rate, but there was no evidence of this during that magical evening.

4. The Clash at the Music Machine (London), 1978. I wasn’t very familiar with this band when I decided to check it out one night during my six-week stay in London when I was about 21 years old. The crowd bounced madly and furiously in delight to each song and Joe Strummer was mesmerizing. Two of The Sex Pistols, then a new band, joined The Clash for the encore. I think my eyes were as wide as saucers in amazement throughout the show. I still remember thinking that Joe Strummer was his generation’s Jimmy Cagney!

5. Bob Dylan and The Band at Nassau Coliseum, 1974: The Before the Flood Tour. My very first concert and what a concert to come in on. My brother was a big fan of The Band and kept saying he was taking us to see them more than the iconic Dylan. That didn’t last long. The Band played wonderfully, but Dylan had us all enthralled and hanging on every word he sang and every breath he took into his harmonica. I’ve since seen Dylan many times, but none of the shows were better than that night’s. I also caught The Band one more time in the 1970s, and although they were good, it was obvious that their hearts weren’t completely in it. One member didn’t come out for the encore.



Close runners-ups include The Who in 1974 at Madison Square Garden and George Harrison at Nassau Coliseum around that time. Captain Beefheart at the Paradise Club in Boston in 1980 was as surreal as any concert can be. Television at a small venue in my hometown of Roslyn, New York, was exceptional and thrilling. On the classical side, I’m proud to say I was in the audience for Leonard Bernstein’s Young People’s Concerts throughout the 1960s.

The list of the groups that I haven’t seen in concert but wish I had has to be topped by Led Zeppelin. The thought of seeing Jimmy Page, Robert Plant, John Paul Jones and John Bonham onstage at the Garden in the 1970s is unbelievable to me. I also had a chance to see Fleetwood Mac at the Garden at their zenith in the 1970s, but the scalper I closed the deal with got a higher bid just as the ticket was about to change hands. Oh yeah—it would have been nice to see The Beatles. One of my elementary school classmates in the 1960s went to the famous show at Shea Stadium. When she “friended” me recently on Facebook, I asked her about it. She still can’t believe she was there. ☺

# Marx was a Neuroscientist, Part 1: The Two Cultures and the Scientistic Revolution

BENJAMIN CAMPBELL

I must interject an intermission into my discussion of economics. The topic is remarkably depressing, and I imagine few readers wish to spend their summer reading about such topics as the farcical global debt bubble or the predictable failure of yet another “sustainable development” summit. Further, I am supposed to be completing a Ph.D., so perhaps I should be discussing neuroscience instead of economics. After all, a bridge to the sciences may help us more fully appreciate the absurdity of capitalism.

The persistence of economic nonsense is, in fact, strongly related to the current intellectual fragmentation. Where C.P. Snow coined *The Two Cultures* to describe the divide between the sciences and humanities, one would need to scale this by orders of magnitude to account for the contemporary atomization of academia. As Norbert Wiener put it in *Cybernetics*, the scientist “will be filled with the jargon of his field, and will know all its literature... but, more frequently than not, he will regard the next subject as something belonging to his colleague three doors down the corridor, and will consider any interest in it on his own part an unwarrantable breach of privacy.” This observation should not be limited to the sciences, and the lack of communication grows markedly the more distant any two fields. At times this has degenerated into absurd quarrels between the worst of postmodern relativism and the worst of scientific reductionism.

Of course, scientists often speak of bridging the divide between the “two cultures.” Frequently, however, this reflects a desire for an increase in scientific influence over culture, rather than a mutually beneficial discourse. For instance, Snow’s original lecture was not really about reconciling the two cultures so much as praising science and denouncing what had become of “traditional culture” (which probably explains why scientists reference Snow so often). In more recent years, John Brockman has launched the “third culture” of Edge.org, which features “the most complex and sophisticated minds” of public intellectual discourse. Nearly all are scientists, who Brockman claims “are taking the place of the traditional intellectual.”

Those scientists auditioning for the role of new public intellectuals have, with few exceptions, failed the public miserably. To the extent that they even engage with broader social issues, they focus on easy targets (e.g. religious fundamentalism), content to relitigate the past while ignoring the difficult and uncomfortable questions of the day. The result is little more than a scientific polish applied to the establishment technocratic wisdom, while the historic challenges currently facing humanity are deflected and downplayed. At this pivotal moment, the whiggish view of inevitable progress that pervades this type of scientism is not only unwarranted, but is in fact completely irresponsible. As a result, the few people with insightful things to say about the degenerate state of late capitalism tend to be found on the other side of the “two cultures” divide, meaning their insights are usually lost in translation, and can thus be conveniently ignored in favor of a pseudoscientific economism by capitalism’s apologists.

Given this regrettable state of affairs, Jonah Lehrer’s *Proust was a Neuroscientist* was bound to spark my interest. Here, a bold young Rhodes Scholar endeavors to bridge Snow’s chasm by discussing the “artists who anticipated the discoveries of neuroscience.” Sadly, as an exemplar of this new commentariat, Lehrer’s limited knowledge of the humanities was surpassed by his superficial understanding of neuroscience. The result was a collection of astonishingly poor essays, centered around such dubious associations as from Aplysia to Proust’s madeleine.

Here, I will attempt something similar to what Lehrer intended, although hopefully more convincingly. As I will argue, not only are the insights of the “other culture” essential for understanding the world, but they have been paralleled by our unfolding understanding of the brain. This will require that we begin with some preliminary issues emerging out of the crisis of the Enlightenment.

## The Missing Shade of Blue

Following on the heels of the scientific revolution and coinciding with the bourgeois defeat of feudalism, the Enlightenment was a time of competing and contradictory interests. Much like today, these competing interests were represented in a dominant ideology that was quite inconsistent.

On one hand, the enormous achievements of scientific naturalism tended towards a commitment to empirical observation as the ultimate source of knowledge. Yet most Enlightenment thinkers were also deeply committed to reason in religious, moral, and political matters. Further, scientific progress depended on a leap between the two domains of observation and reason, and there was no clear sense of how to bridge that gap. For instance, the Copernican revolution was not something that fell naturally out of empirical observation; the idea of the earth moving around the sun actually flies directly in the face of everyday human experience. Worse yet, the two poles of rationalism and empiricism tended to undermine each other. Taken to an extreme, rational criticism led to skepticism about the existence of the external world. Conversely, a commitment to empiricism could lead to a materialism that denied any role for human rationality, and worse, God. The only way of preserving both would appear to be an awkward and tenuous dualism.

David Hume would give the empiricist tendency its fullest expression in his *Enquiry Concerning Human Understanding* (1748). In his masterwork, Hume argued that knowledge ultimately derives from sensory associations, and that “all our ideas... are copies of our impressions.” To Hume, the “creative power of the mind amounts to no more than the faculty of compounding, transposing, augmenting, or diminishing the materials afforded us by the senses and experience.” Hume’s ideas were undeniably quite advanced for his time. For instance, a century before Darwin, Hume argued that the difference in cognition between humans and animals was merely a matter of degree. As we will see, he even anticipated problems in the process of induction that would be formalized much later.

In one form or another, the type of empirical and associative argument advanced by Hume would have a deep influence on the Anglo-American philosophical tradition, and would eventually become dominant in the emerging fields of psychology and neuroscience. Indeed, Hume had suggested that his reasoning could be extended to account for the “fully determinate mechanisms” that explain “the actions and volitions of intelligent agents.” Early physiological work by Charles Sherrington and others would demonstrate the type of stimulus-response associations that characterize the neurons of the peripheral nervous system. It was a natural extension for “behaviorists,” like John Watson, Ivan Pavlov, and Edward Thorndike, to elaborate on such stimulus-response associations to explain most, if not all, of brain and behavior. Thorndike’s “law of effect” asserted that stimulus-response associations were modifiable by what we might now call reward, and B.F. Skinner would greatly elaborate on this type of research with his newly developed operant conditioning chamber.

Even today, if we were to translate the *Enquiry* into the modern language of information theory, many neuroscientists would find little to disagree with in a Humean view of the brain. There has been a notable revival of operant conditioning research in its current incarnation of reinforcement learning, in which the modification of stimulus-response associations is thought to be mediated by dopamine. Like so many things, the problem with Hume’s associationist thought isn’t that it is necessarily wrong, but rather that it is incomplete.

Hume seemed to recognize the problem. He asked his reader to imagine a person “perfectly acquainted with colors of all kinds, except one particular shade of blue.” Would such a person be able to imagine the missing shade “though it had never been conveyed to him by his senses?” Hume answered in the affirmative but nevertheless concluded that “this instance is so singular, that it is scarcely worth our observing, and does not merit, that for it alone we should alter our general maxim.”

### The Cognitive Revolution

It was Hume’s *Enquiry* that the German rationalist philosopher Immanuel Kant claimed to have stirred him from his “dogmatic slumbers.” The problem facing Kant in his *Critique of Pure Reason* (1781) was to preserve a role for reason in the face of Hume’s empiricist challenge.

Kant fashioned an ingenious solution. He ceded the underlying point that we only know about the world through appearances, rather than possessing knowledge of “things-in-themselves;” such was his critique of “pure” reason. But if all of our knowledge of the world is gained through *a priori* forms of thought, then we may possess knowledge about these forms of thought through which we see the world. That is, we “establish something about objects before they are given to us.” This, which he immodestly termed his “Copernican revolution,” allowed Kant to retain a role for reason among the forms of thought that the human mind constructs.

Kant’s response to Hume would be paralleled nearly two centuries later by the reaction against behaviorism that is often termed the “cognitive revolution.” For instance, Skinner had taken the behaviorist program to its logical conclusion by analyzing human language as a form of operant conditioning in his

*Verbal Behavior* (1957). A major salvo of the “revolution” would be Noam Chomsky’s review of the book where he argued forcibly against the poverty of a purely associative view that ignored the forms of representing language in the human mind.

Such a focus on Kantian “forms of thought” was to characterize the nascent interdisciplinary study of cognitive science, which overlapped with and was greatly influenced by the emerging discipline of “artificial intelligence” (AI). For instance, one of the major problems in AI was programming computers for pattern recognition. Early attempts at doing this involved matching sensory information to given templates. More advanced work would incorporate a greater level of detail, such as the detection of edges and shapes that could be reconstructed into spatially invariant forms, but the general viewpoint remained one of observing the scene as filtered through *a priori* forms. This work was greatly encouraged by the pioneering studies of neurophysiologists David Hubel and Torsten Wiesel, which appeared to suggest that such a strategy of hierarchical feature extraction paralleled that of visual cortex.

Assuming incoming information had been suitably represented in such “forms of thought,” AI pioneers Allen Newell and Herbert Simon recast intelligence as the symbolic manipulation of such representations, and this view of symbolic processing was to dominate early cognitive science. It might seem strange that many scientists envisioned the brain as similar to a computer. One reason for this, as Wiener pointed out, is that people have always viewed themselves through the lens of their contemporary science and technology—from the clockwork mechanistic world of Newton’s time, to the age of steam engines and thermodynamics, the age of communication networks and information, to that of the digital computer. But another reason for the dominance of the symbolic processing accounts of the mind was the strong influence of symbolic logic, best exemplified by Alfred North Whitehead and Bertrand Russell’s *Principia Mathematica*, on early twentieth century thought. This influence was personified by Walter Pitts, a logician strongly influenced by Russell, whose collaboration with the neurophysiologist Warren McCulloch on *A logical calculus of the ideas immanent in nervous activity* (1943) would prove highly influential.

From the vantage point of posterity, these early endeavors were characterized by a remarkable overconfidence. AI did not come close to living up to the early hype of its founders, as programming machines for “intelligent” behavior turned out to be much more difficult than many assumed. As for cognitive science, one needs only to read the debate between Jerry Fodor and Steven Pinker over the latter’s *How the Mind Works* (1997) to get a sense of how little progress the discipline had made in elucidating the title.

Not everyone was sold on the initial promise of AI. Reflecting on the progress in his remarkable synthesis *The Entropy Law and the Economic Process* (1971), Nicholas Georgescu-Roegen put it this way: “The reason why no computer can imitate the human brain is that thought is a never ending process of Change which... is in essence dialectical.”

The next part of this series will explore what this might possibly mean, and how it relates to the emerging conception of the brain. ◊



*Beach Volley* by Elodie Pauwels



*Take a Seat* by Carolina Prando



*Natural Selections* is not an official publication of The Rockefeller University. University administration does not produce this newsletter. The views expressed by the contributors to this publication may not necessarily reflect views or policies of the University.