VERVE

BEHIND THE SCIENCE

NC STATE UNIVERSITY | Issue 3 | SUMMER 2017

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NC STATE The Graduate School

"Sólo el que ensaya lo absurdo es capaz de conquistar lo imposible."

Only one who attempts the absurd is capable of achieving the impossible.

- Miguel de Unamuno

Photography credit: Ahmed Mohamed

VERVE

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FROM THE **EDITOR**

It's a strangely challenging task
to bring postdocs together.
Perhaps it's because many of us are
content with solitude
– a trait that helps us cope with
the long working hours,
most of which consist of
quiet concentration.
Or perhaps it's because
we're all aiming
for something different,
and traipsing along
an uncertain career path
that demands something particular
from each of us.
Or maybe it's because
we have to place our research
at the top of our priority lists,
above committee meetings
and social events,
- because although
we're no longer students,
we know we haven't made it yet,
and there's still a long way to go.
But as solitary as our work might be,
and as unique as
our career paths might seem,
even across different disciplines
there are similarities
in our goals,
our experiences,
and our struggles.
So, to reach out to all those postdocs
working alone right now,
in this issue of VERVE we offer some words from
graduate students, postdocs and faculty,
whose own experiences and opinions
might be appropriate
for many of us,
no matter where we are right now,
or which direction we're going in.

Greer Arthur, Editor of Verve

LEAVING ACADEMIA

HOW & WHY

WRITTEN BY
ANDREW ARNOLD

In the years leading up to 2015 I was determined to become a professor, but by 2016 I had decided to leave academia for a position at Google in Mountain View, California, where I have just started my new job. This is an account of my reasons for leaving academia, and how I managed to make the transition.

It's not easy to have an optimistic view of a career in academia, but from my experience of research in computer algebra, the path towards professorship is particularly tough.

Computer algebra uses automated processes to bypass long and complicated algebra equations. As a discipline, it sits somewhere between mathematics and computer science. Although related to both fields, computer algebra is at home in neither, so exists as a separate discipline.

This segregation was arguably one of my main problems with remaining in academia. Its narrow focus makes anyone studying it highly specialized, so tenure-track positions in computer algebra are rare. During my job search, I found only a handful of opportunities in Europe – I found none in the United States – but I wasn't convinced I wanted to start a new life abroad for the sake of pursuing tenure.

Computer algebra hasn't always been my specialty. During my PhD at the University of Waterloo in Ontario, Canada, I studied computer science. There, I was part of a broader field and became thoroughly integrated within the entire research project. I enjoyed the work and could see the progress. Feeling like an essential cog in a larger mechanism gave my work greater value and meaning.

It was in my first position as a postdoc that I transitioned into computer algebra, and I immediately noticed how narrow the field was. My research group was miniscule: beyond a weekly meeting with my supervisor, I worked alone. Without a busy, multidisciplinary team to work within, the pressure to publish also became a heavier burden.

Eventually, disheartened by my position, I also began to bemoan my salary. Though comfortable, in comparison to my friends who had chosen the industrial or technology sectors after graduate school, even my wages seemed too low to make the job worthwhile.

I remember sitting in a departmental meeting, feeling somewhat dejected that the average starting salary of a newly graduated student with a bachelor's degree in mathematics significantly exceeded my own.

It didn't take me long to check other sectors to find out what other people were being paid. After a quick search I was stunned to discover that, excluding bonuses, a starting salary in the technology sector was roughly triple that of a postdoc. Money isn't a primary goal for me, but already struggling with my tenure-track job search and isolated research, it certainly weighed in on my decision to leave academia.

So, in 2016 I began to prepare for post-academic employment.

First of all, I needed a direction. I had been a theorist for many years so knew I'd need to brush up on my technical expertise if I was going to be a competitive candidate for industry.

"IT'S NOT EASY TO HAVE AN OPTIMISTIC VIEW OF A CAREER IN ACADEMIA."

"THE PRESSURE TO PUBLISH BECAME A HEAVIER BURDEN."

After speaking to friends who already worked in industry many were able to advise which skills I would be best to invest in. For my field, the top recommendation was software engineering, so I chose Machine Learning and started thinking about how I could start studying.

I signed up for online programs such as the Stanford Machine Learning course, which provided an optional certificate upon completion for a fee of $80. I also paid $200 per month for an online nanodegree with Udacity, focusing on relevant technology such as self-driving cars that I hoped to work on in the future. The work pace was flexible, and critically this particular course provided feedback on assignments.

Through networking with an old contact from graduate school I eventually managed to get in touch with a recruiter from Google. I secured an interview and started to prepare, taking time to learn from as many people as possible who could give me interview advice. Generously, my supervisor at NC State supported my job search and granted me time for this preparation.

My first interview was optional and via phone, an option I accepted because I needed the practice. The following week I attended a challenging in-person interview, and had to complete problem-solving tasks that were relevant to the job I was applying for.

I received good feedback from my interviews and my application, along with my resume, was sent to a hiring committee. Constructing the resume took time. Rather than list out my qualifications in a typical academic style, I made sure it fitted the basic expectations of a technical-based resume. At the top I summarized my skills and interests, and carefully reordered the subsequent sections by relevance to the job.

By some good fortune and a great deal of preparation, I was hired by Google. Interestingly, the job placement wasn't automatic. Instead of being allocated to a fixed position I was able to talk to existing teams in different places to make sure I found the one that was right for me.

My recruiter advised I speak to a team in Mountain View, and I was able to chat to a team manager. After discussing the project and getting to know her, we agreed that this team was an ideal fit for me, so I signed the official job contract.

Job hunting is always intimidating, but you'd be surprised by just how many people you can make contact with and the places this can get you to. By reaching out to friends, old colleagues and classmates first, you can immediately expand your network. From there, branching off to make new contacts each time will allow you to discover new routes towards your target job, as well as gain advice and expertise from people already working in a similar area.

There's no right or wrong time to leave academia – we all have our reasons for either leaving or staying. My own motives for leaving were neither unique nor common. My advice to postdocs considering a position outside academia is this: Don't underestimate the time you need to prepare. Academia is a useful training ground and with some planning and networking, you're probably a lot more hire-able and well-prepared than you think. ■

- Andrew Arnold

NC STATE The Graduate School

If you're interested in transitioning into an industry career, NC State can help. Their Professional Development Programs offer industry training and personal development coaching for all NC State graduate students and postdoctoral researchers.

If you'd like to know more, contact Jason Cramer by email (jmcramer@ncsu.edu) and visit the Professional Development Website:

https://grad.ncsu.edu/students/professional-development

Image courtesy of Wan Mohd (Flickr)

One of the most common conversations among junior faculty, postdocs, and graduate students revolves around the question, "What does it take to be a successful academic?" The most common follow-up question is, "Is the cost worth it?"

We are inundated with stories and experiences involving wise and senior academics who speak of 80 to 90-hour work weeks, lack of a family, no hobbies, no social life, and 100% devotion to all things scientific and career as if this approach to life was required for any success in the academic world.

I was inspired by a tweet from one of my colleagues, Dr. J. D. Farrell-Campbell (**@Campbell_JD_**), who wrote in response to a conversation concerning expected work hours among academics with, "If this is the cost to publish in **@nature** or **@sciencemagazine** it is not worth it. **@raulpacheco** & **@Shawpsych** are both successful & have a life."

It is extraordinarily kind of Dr. Farrell Campbell to both include me in the company of Dr. Raul Pacheco-Vega, and number me among successful academics. But thanks to Dr. Farrell-Campbell, I feel the need to create a meditation on success in academia.

I have written elsewhere on my blog, Research to Practice, that I may not be a typical academic because I have no real ambition and I simply enjoy the work. I actually learned only two years ago that the vast majority of awards won in academia are self-nominated — I had no idea that was an option.

As someone who came to academia relatively late in life (my tenure track job started when I was 42-years-old after having a career as a psychologist for 16 years), I don't have

STEVEN R. SHAW

HOW (not) TO: ~~fail~~ SUCK ~~struggle~~ at being an academic??

WHAT DOES IT MEAN TO BE A SUCCESSFUL ACADEMIC?

particularly good socialization as an academic and am used to a different professional culture. I'm just happy to have a job with no heavy lifting.

I do not understand discussions of academic success in general. There are so many roles and functions that an academic can fill that there appears to be little overlap.

For example, the environments are dramatically different. Working at a community college (or CEGEP), liberal arts school, state school, R1 institution, or research institute all constitute being an academic, but have few skill sets in common.

Roles and expectations also vary among fields of study. The skills required in philosophy, medical education, social work, drama, genetics, and many others are widely different; as are the criteria used to measure success.

Research output is a widely agreed upon metric for success. But even within the same university and the same field of study, some academics are successful for being leaders in university governance, outstanding teachers and mentors, involvement in student life, consultation and business partnerships, university-community partnership, and many other measures of success. There are so many metrics for measuring academic success that I am not really sure how success is defined.

There is also an individual perception of success. I am always surprised by how many people are driven to achieve by anger, ego, money, making one's parents proud, to prove to others that they are not a failure, and other external factors.

Most fields even have rankings of the most influential or most productive scholars in each specific field. Convoluted metrics of journal impact are used to quantify and rank scholars. It makes me giggle a little bit that some scholars are competing to be tops in the field of creating new journal impact factors and ranking other scholars (that should be called meta-scholarly studies, if it isn't already). Different people have different needs for objective success in their field.

When I left clinical work to try academia, my close friend, former partner, and respected colleague berated me for over one hour for abandoning children who need me so that I could write papers for the judgment and entertainment of other people who write papers. That hit a little close to home and hurt, but was a valuable perspective.

I have a fairly simple view of success as an academic that revolves around two criteria: I want my students to meet their professional goals and for everyone else to leave me alone.

Honestly, there are no publications in *Nature* or *Science*, no awards, and no other status that are as productive and valuable as making small contributions and supporting the success of students. A lot of people do not believe me on that one (yes, I acknowledge that this is part of the privilege of tenure), but it is true. I also want to publish enough papers that make contributions to my field, have enough grant money, and have enough academic accomplishments so that I do not become an embarrassment to the department and require the attention of the department chair. I know that I have an h-index, but I do not know what it is and I do not know how many refereed publications I have written. I want to study what I want and with whom I want.

Ultimately, the goal is to indirectly influence future professionals and improve the outcomes for many more children than I could ever help by myself. That is success as an academic for me.

There is the second part of the equation. Is it worth it? Do I actually have a life? I work fairly long hours, but I don't keep track because that would probably be a little bit depressing. About 50-60 hours per week, I guess. I come home every night to cook dinner for my family (my wife doesn't cook). I am still married after 25 years. My children still seem to like me and we have conversations every day. My dog is probably a little bit undertrained and I do not socialize much, but have good friends. I have simple hobbies of training judo three hours per week along with my younger daughter and I go to the gym three days per week. So that's enough for me.

Many thanks to Dr. J. D. Farrell-Campbell for considering me a successful academic with a life. By objective measures, I am a fairly mediocre academic and I am okay with that. Yet, I believe that I am successful and the work is worth it to me; but only for my context, specific definition of success, and desired quality of life. ■

IS IT WORTH IT?

IS THIS THE LIFE I WANT?

SHAW is an associate professor in the Department of Educational and Counselling Psychology at McGill University, Montreal, CANADA.

This article was originally published on his blog:
https://researchtopracticeconnections.wordpress.com

Image courtesy of Mohammad-Amir Aghaee

PIPETTES AND PAINT BRUSHES

THE ART OF BECOMING A SCIENTIST

Every scientist eventually reaches a point in their education when creative thinking becomes essential. When Mohammad-Amir Aghaee finally realized this, he threw down his pipette in frustration, left his laboratory and walked off in search of a paint brush.

It wasn't that he couldn't cope with the work. It was 2011 when Aghaee stormed out of the lab, and only two years earlier he had graduated from University of California (UC) Berkeley with awards and honors tucked under his arm. But within months of starting graduate school at UC Davis his confidence was replaced by feelings of inadequacy.

"When I was an undergraduate I was as happy as a clown," Aghaee says. "But it fell apart in graduate school. It was like driving a Prius into a river."

For Aghaee, graduate school was nothing like he'd expected. The hours were long, the work was tough, and he was no longer spoon-fed the facts. Instead, he was placed in a laboratory, handed a lab coat, and told to find the facts for himself.

"I'm not a whiz-kid," Aghaee explains. "But [as an undergraduate] I knew how to handle the system. Graduate school was that moment of 'welcome to the real world'."

Image courtesy of Mohammad-Amir Aghaee

Although he thought he'd bitten off more than he could chew, he managed to conceal his struggles for a while. But when his insecurities began to manifest as visible failures he started to question whether he could – or should – continue.

Towards the end of his first year of graduate school, Aghaee's first application for funding was refused.

Another five refusals followed and, unable to ignore these outright rejections, he considered quitting graduate school altogether.

Science had never been his first choice. It had simply been a logical career move; a science degree was expected to be useful.

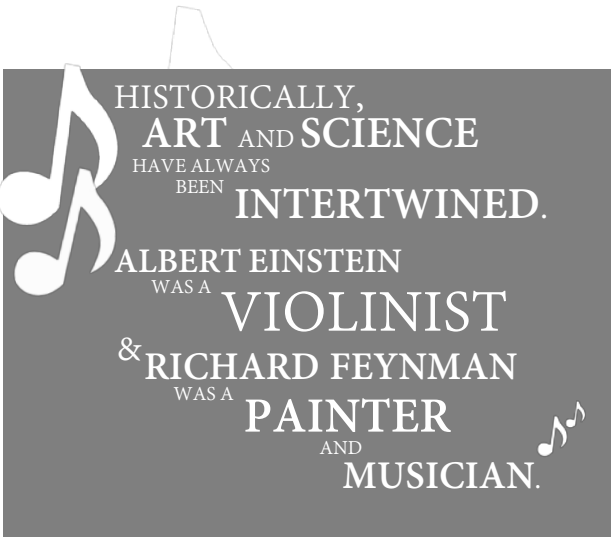
But now, disheartened by his lack of progress, it occurred to Aghaee that he needed a distraction; something intuitive that would reinvigorate his work. As he considered his options, he remembered a time when all he wanted to do was paint.

Years ago, displayed on a wall in his family's home in California, there had been a painting of a centuries-old warship. The ship faced forwards, almost appearing to sail out of the frame and into the room. Satisfyingly thick brush strokes of reds and yellows swept loosely around the ship's wooden boughs and across the water, seeming to set the whole painting ablaze. A young Aghaee would sit and stare at the ship, captivated, marveling at the skill of the artist.

With his self-esteem at an all-time low, he assumed he'd fail at painting. But after buying a few paints and brushes, he quickly took to the refreshing simplicity of daubing paint on canvas. He started with the basics, playing with colors and learning to sketch, and soon his untrained brush work became controlled, smooth and deliberate.

Before long, Aghaee incorporated painting into his weekly schedule, using it as a therapeutic break from his studies and lab work. At first he painted landscapes and still-life objects from photographs. But as his confidence grew he allowed a few dreams to drift in, and began to decorate his work with details from his imagination.

A few months later, when he took a step back and realized his progress, he simultaneously discovered he'd almost completely forgotten to worry about his performance in the laboratory.



"When you're doing something you're good at, you forget about your own inadequacies," Aghaee says. But as well as boosting his confidence, the artistic creativity he nurtured while painting also benefited his work as a scientist.

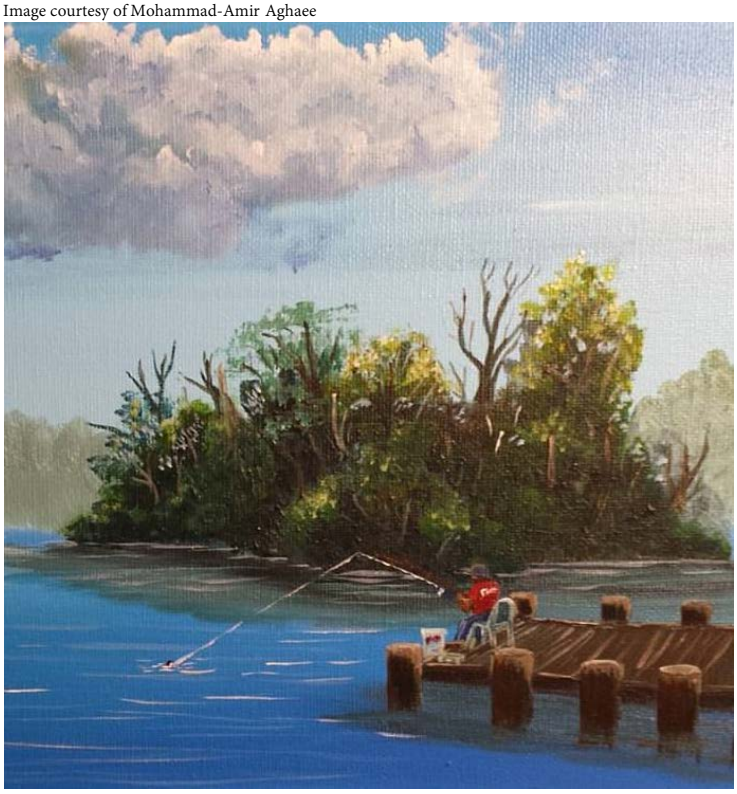
Despite the fact that science is a data-driven industry, innovation is key to generating new ideas for solving problems and producing data. Art and scientific research have always been intertwined. Historically, many scientists have invested their time in art and music: for instance, Albert Einstein was a violinist, and Richard Feynman was a painter and musician.

The trend continues today: Erich Jarvis, a neurobiologist at The Rockefeller University, was once a ballet dancer, and Francis Collins, director of the National Institutes of Health, plays guitar. Recognizing the impact of art on scientific innovation, even the National Science Foundation has funded workshops aimed at integrating art and design into STEM disciplines, revising the acronym to "STEAM".

Throughout the rest of his graduate degree program, Aghaee not only used painting to relax, but also to visually catalog his own improvement as an artist, which was easier to see than his improvement as a researcher. He learned patience, carefully planned and analyzed his experiments, and accepted that negative data and setbacks were not personal faults, but natural stepping stones in his education.

Eventually, his perseverance was rewarded. By the time he earned his doctoral degree, Aghaee had published two journal papers and won the Entomological Society of America's John Henry Comstock Graduate Student Award. In 2015, he accepted a postdoctoral position in NC State's Department of Entomology and Plant Pathology.

Image courtesy of Mohammad-Amir Aghaee



Now, halfway through his second postdoc and facing a highly competitive postdoc market, he's under no illusions that reaching the next step of his career will require more hard work. Painting remains an important part of his day – something he believes will always be the case. After all, science doesn't get easier, it only gets more interesting. If he chooses to remain in academia, the pressure and workload will only increase.

"Doing a PhD isn't hard, it's just doing what you're capable of doing. It's all about a mental block," he says. "Tenure is about persistence – it's not about whether I *can* do it, it's about whether I *want* to do it. I know I need to keep pushing boundaries." ■

- Greer Arthur

Mohammad-Amir Aghaee is a postdoctoral scholar and NIFA Research Fellow at NC State University.

His current research focuses on cotton bollworm, and this means he spends most of his working day wading through cotton fields, collecting plant samples.

His published work can be found in the *Journal of Economic Entomology*, *Trends in Food Science and Technology*, and *Pest Management Science*.

You can follow his artwork (and food photography - he's avid cook, too) on his Instagram, @doctorizadi.

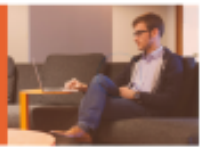
NC STATE UNIVERSITY The Graduate School

Find out more at grad.ncsu.edu/students/professional-development/

The INDUSTRY IMMERSION Program

Are you curious about industry careers?

Do you possess the skills that industry companies seek?



A program for doctoral & post-doctoral researchers

July 30th - August 4th, 2017

PRAISE FOR THE IMMERSION PROGRAM FROM LAST YEAR'S PARTICIPANTS

"The best week at NCSU!"

"This program should be required of all PhD students. It's relevant, and necessary with the current job market."

"One of the best experiences in my career. I would recommend everyone that wants to transition to industry go through this program."

"Make it a required course. This program was far more helpful to me than some of our core courses."

"The Transition to Industry Program changed my perspective on how I view this transition. Before this week I felt helpless and discouraged, but I now feel energized and that I have the correct tools to take on this move."

Beyond a deep understanding of scientific methodology and techniques, those planning to transition from academia to industry are expected to display the following core competencies:

- Familiarity with key concepts of the biotechnology market (funding, commercialization, IP, RA)
- Knowledge of business models used by biotechnology firms
- Technology evaluation
- Experience with basic concepts of business strategy
- Professional soft skills: teamwork, leadership, spoken and written communication

INDUSTRY GUESTS Industry professionals from several companies will participate in four career panels and numerous presentations and networking activities offered throughout the week.

TOPICS

Introduction to industry careers	Commercializing science
Entrepreneurship & startups	Teamwork & Leadership
Industry segments	Legal & intellectual property
Research & development	Market assessment
Regulatory affairs	Management practices
Embracing diversity	Business strategy & company financing

ACTIVITIES

Professional photo session	Management panel
Public presentation strategies	R&D panel
Project management	Alternative careers panel
Human resources	Business card design
Resume, CV, & cover letters	Interview skills
Linkedin development & use	Network skills & events
HR panel	Elevator pitches

BRAIN FOOD

Bircher Muesli & Yoghurt

This recipe was originally created by Dr. Maximilian Oskar Bircher-Brenner, a Swiss physician, for the purpose of providing all basic macro nutrients in one meal. In particular, the muesli provided essential nourishment for those of his patients who struggled or refused to eat enough.

Make this basic recipe one of your go-to breakfast dishes, or a filling, healthy snack during the day. Be as creative with the ingredients as you like – this recipe is perfect because it can be tailored to suit every taste. It's also an ideal solution for people who don't have enough time to cook something fresh every day – it can be refrigerated in an airtight container for you to dip into whenever you need a boost throughout the working week.

- Alex Franke

NUTRITIONAL FACTS
PER SERVING

Calories: 268 kcal
Carbohydrates: 1.3 oz (35 g)
Fat: 0.4 oz (10 g)
Protein: 0.4 oz (10 g)

PREPARATION TIME

15 minutes + soaking overnight

REAGENTS LIST
(FOR 3 SERVINGS)

2 oz (57 g) rolled oats
1.5 oz (42 g) raw almonds
1 apple
3 fl oz (90 ml) apple juice
2 oz (57 g) dried apricots
½ cup milk (dairy or non-dairy)
3 heaped tablespoons of plain yoghurt

(Optional: Honey or Agave Syrup to sweeten)

PROTOCOL

DAY ONE

1. Chop almonds and dice apricots
2. Combine oats, almonds and dried fruit with apple juice
3. Stir thoroughly
4. Leave to soak in fridge overnight

DAY TWO

1. Cut apple into chunks
2. Add apple and yoghurt to oat mixture
3. In small stages, while mixing, add milk until you achieve your preferred texture
4. Add honey or sweetener to taste
5. Dig in

SUPPLEMENTARY INFORMATION

Use cashew nuts, pumpkin seeds or sunflower seeds as alternatives to the almonds.

Try adding more than one type of dried fruit – raisins and dates work really well.

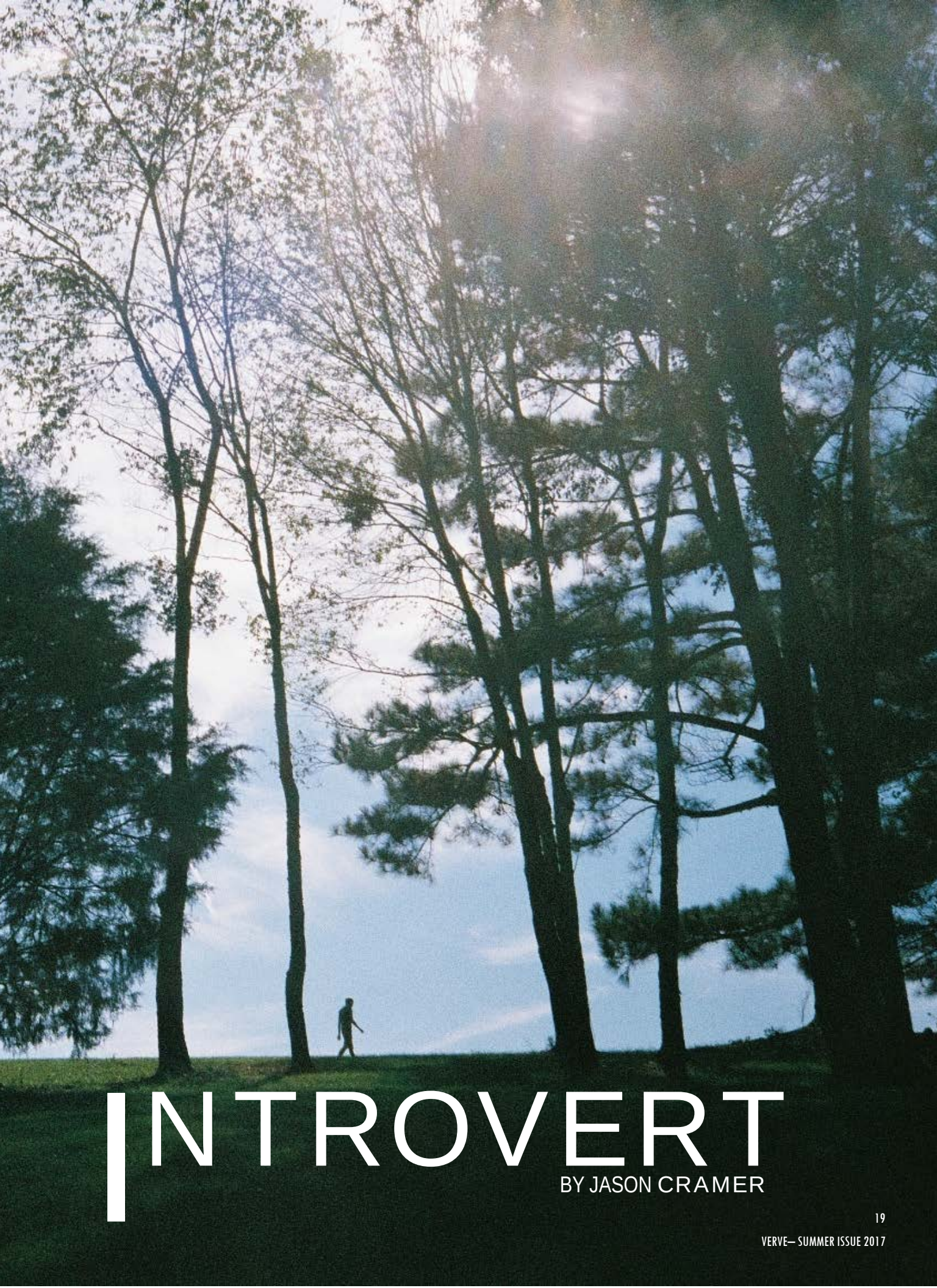
Add coconut flakes, bananas and chia seeds for different textures.

You can also add half a tablespoon of ground cinnamon or cardamom for more flavor.

Photography credit: veganbaking.net (Flickr)

6 CAREER TIPS FROM AN

Photography credit: Greer Arthur



INTROVERT

BY JASON CRAMER

"You're in your head too much."

"Be more sociable."

If I was given a dollar for every time someone has said something like this to me,
I wouldn't be rich--but I'd probably have enough money to buy myself a nice dinner at Sullivan's Steakhouse in downtown Raleigh!

Earlier in life, I envied my friends who could confidently stroll into large crowds of people and be highly energized by the noise and bustle of the environment. I, on the other hand, found myself quickly drained of energy.

It wasn't that I was unsociable - in fact, I'm quite the opposite; I enjoy meeting new people and spending time with friends. But whenever possible, I opt for a quiet conversation with one or a few people, rather than interactions with many people at once.

At some point, I began to assume that something must be wrong with me because I didn't experience social events like my friends. This circumstance extended beyond my social life and projected into my professional work. I thought that I if I could assert myself more effectively in public, like my extroverted friends, then I would be happier and more successful.

This goal was very difficult to achieve, and whenever I tried to transform myself in this manner, I felt like an imposter. After many unsuccessful attempts to achieve this transformation, I became more convinced that this feature of myself was a flaw that would ceaselessly haunt me and continue to hurt my relationships and professional life.

Fortunately, a few years ago I came across some articles about introversion in popular media that eventually led me to a book: *Quiet: The Power of Introverts in a World That Can't Stop Talking*. My suspicions were confirmed within the first twenty pages, and throughout the rest of the book, Susan Cain, the author, helped me to understand much about the way I respond in social and professional situations.

At that point, I arrived at a realization: There's nothing wrong with me, I'm an introvert, and that is not a flaw.

My introversion came as a surprise to me, but after some reflection I realized that the introverted, imposter feeling had been with me all along.

I left a teaching career to pursue a doctorate in biochemistry to gain true scientific research experience, and perhaps more somberly, because I felt like a fraud for training students to become scientists when I had not been one myself.

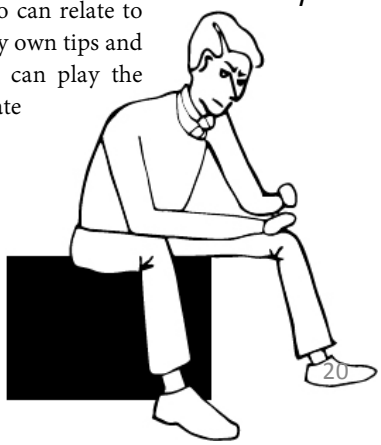
An advanced degree in science helped me gain the experience I wanted and opened many opportunities for my career, but still didn't help me to perform like an extrovert in public situations. In fact, it only amplified my anxiousness about my perceived social inadequacies.

I did learn, however, that extroversion plays an important part in academic research: obtaining funding from government entities, private donors, industry partnerships and fundraising requires strong social prowess. What's more, researchers must be confident and assertive, and possess strong presenting, reasoning and collaborative skills to effectively communicate their research to others.

These circumstances allowed me to understand why my introversion had such a strong impact on my life, and I was, at last, able to start effectively managing my relationships and career.

Over time, I developed a set of strategies that allow me to summon some extroversion when needed, and in general, to move my career forward. So, in case there's anyone out there who can relate to my story, here are a few of my own tips and thoughts on how introverts can play the extrovert role to better navigate their careers.

"I felt like a fraud for training students to become scientists when I had not been one myself."



1 BUILD A PERSONAL BRAND

A common trait for academics, particularly for introverts, is to feel like a fraud, and place too much weight on the contributions of others; this is facilitated by many aspects of academia. For example, we often avoid taking ownership of our work, and instead refer to ourselves as "we" rather than "I" – despite knowing that it was "I" who performed the work. While this is traditional and perfectly acceptable in papers and presentations, it can smother confidence when networking and job searching. By building a personal brand – a professional image that communicates the unique benefits you offer and how you stand out from competitors – you will reflect on your strengths, values, passions, and vision. Along the way, you will discover features that allow you to differentiate "we" and "I" when you market yourself to others. To create a personal brand you should first identify your skills, core values, passions and career goals, and then use these to define the unique value you embody. One strategy I strongly recommend is to create an online portfolio of your work, perhaps a personal website, which stockpiles your experience and allows employers - from anywhere in the world - to better visualize your unique value.

2 GET NETWORKING

Networking often inspires dread in introverts for many reasons, one of which is small talk. This, I can assure you, is something that almost everyone – even extroverts – finds difficult. Nevertheless, meeting new people and engaging in conversations can strongly serve your career if it leads to new relationships with people who realize your unique value. Relationships affect the job offers you receive, career transitions you make, and the business opportunities you find. But, remember: one authentic new relationship is worth more than a dozen business cards.
It's not fun for all of us, but try to engage in some networking for few minutes a day. Stepping outside of your comfort zone often leads to great results – and if you don't know what to say, ask others questions about themselves. It's never a bad thing to be labeled a great listener, and you'll always learn something new.

3 FAKE IT 'TIL YOU MAKE IT
(but be true to your core values)

Pretending to be an extrovert is sometimes necessary. I used to feel like an impostor when I pretended to be extroverted in social situations, but now I realize it's completely acceptable to do so for the sake of my work and the people I love. After much time and practice, I'm proud to say that most people have no idea how introverted I really am. You can 'fake it' by making eye contact and smiling while maintaining a confident posture and demeanor. But don't abandon your core beliefs; they represent a key part of your authentic self and you shouldn't act in a manner that moves you away from those principles. This is especially important when job hunting, and is something your personal brand can help with. For instance, meaningfulness and impact are two of my core values, but if I ignored them I'd risk entering a job that makes me miserable and severely restricts my job performance. With the self-awareness that personal branding fosters, you identify what you really want from your career, and which steps you need to take to achieve that vision. A personal brand allows you to identify the niche you fit into, meaning you can strategically position yourself within a competitive job market and select jobs that are the right fit for you.

5 REALIZE THAT INTROVERTS MAKE GREAT LEADERS

Although extroverts find it easier to win the spotlight, introverts are often well equipped with excellent leadership skills. Most introverts are able to listen and empathize, and often able to handle situations with delicacy by taking their time to consider what they want to say. By being humble and handling ambiguity, introverts are also able to acknowledge personal mistakes, assumptions, knowledge gaps, and limitations – all useful leadership and team-player qualities. Along those same lines, introverts are also able to apply their creativity and individuality to a multitude of circumstances, rather than blindly concurring with others. These are all key leadership features that apply to any job sector.

4 COMPLETE THE MBTI

Yes, I know, the Myers-Briggs Type Indicator (MBTI) is controversial, and we could probably debate the scientific reliability of the assessment all day.

Nevertheless, the test can provide some illuminating and potentially transformative information about your personality. Moreover, the results include strategies for managing interpersonal relationships. When used effectively, this information can build leadership qualities while also providing important details that you can use to develop your personal brand.

6 FIND TIME FOR REFLECTION

I'm sociable, but there's a distinct limit to how much time I can spend with people. When I need to recharge after being in a stressful, busy situation, I do so through quiet time by myself.

And it's not only us introverts who benefit from solitude; everyone – extroverted or introverted – can benefit from disconnecting from the noise of the world every now and then. Quiet introspection prompts innovation and helps solve difficult problems.

NC STATE The Graduate School

If you have any questions about your career path or professional development, visit NC State's Professional Development Website (https://grad.ncsu.edu/students/professional-development) or contact Jason Cramer by email (jmcramer@ncsu.edu).

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CAN I BE POSITIVE ABOUT MY NEGATIVE DATA?

"I'm disappointed with the negative result," my advisor finally blurted out after a moment of awkward silence. "This is probably the end of the project."

My heart sank, but I wasn't surprised. I'd been trying to create a 3D model of pancreatic cancer in the lab so that I could test how some anti-cancer drugs work, and had just handed over my latest results to my advisor. The results showed that my model didn't work – some of the key signatures of pancreatic tumors weren't there. Without being able to mimic the cancerous environment I'd have no idea whether or not the drugs being tested were working the same way I would expect them to work in an actual tumor.

A few months later I came across a research article reporting negative results that looked very similar to the ones I'd reluctantly presented to my advisor. The authors of the paper had done more in-depth work than I had, but had still concluded that the model was useless. While it was reassuring to know that other scientists were struggling with similar problems, I realized, with dismay, that the article had been published before I started my project. Nevertheless, it was not easy to find because the negative data was just a small section in the paper. If I had found it sooner I could have learned from their work and saved myself a lot of time and effort.

As frustrating as this was, I know negative results are an unavoidable and essential feature of science. This particular encounter wasn't a first for me;

> "POSITIVE RESULTS PUBLISHED IN **HIGH IMPACT** JOURNALS GIVE US THE NECESSARY **EDGE** TO OUTCOMPETE PEERS."

some of my earlier work had failed too.

My first project in thesis lab had revolved around searching for new pancreatic cancer vaccines, which could fight cancer by teaching the immune system to recognize the warning signs and destroy cancerous cells.

In a cancerous tumor, cells look abnormal and produce unusual proteins, and by injecting small pieces of them into a cancer patient, the cells of the immune system are put on high alert. When they know what to look for, protective immune cells track down and destroy anything that looks similar to the abnormal cancerous proteins. My task was to find one such piece that could act as a warning and lead the immune cells to the cancerous target.

My first few months in the thesis lab were spent narrowing down the list of suitable vaccine candidates. After choosing the best options I started to test them in animals. But to my utter disappointment, none of my chosen pieces worked as a vaccine.

Disheartened, I moved on. Except for my advisor, and a brief mention during a department presentation, I didn't show the negative results to anyone. I didn't think anything of this at first, but later, after finding the research paper about the unsuccessful pancreatic cancer model, I started to question why I hadn't put any effort into publishing my negative experiments. Did I believe that they were as important as my positive data? At the time – no, I did not. But wouldn't it help others if the results were made public?

As a graduate student, I've learned that academic research is supposed to be objective and unbiased. However, I've also discovered that it is difficult to thrive – or survive – in academia. From what I can see, exciting, positive results published in high-impact journals give us the necessary edge to outcompete peers in a race to win tenured jobs and secure funding. Since starting my academic career I have realized that we must sell our research and package it in a way that makes it either impressive or interesting.

The comedian John Oliver on his show *Last Week Tonight* recently did a piece about science communication, and pointed out that nobody would care if a scientist showed up and told everyone that there's "nothing up with acai berries". To me, this makes sense, and fuels my preference for positive data; papers built on negative data are not cited as much and require far more effort to justify, so they are not as academically rewarding to write. They're also less likely to be published.

As someone who wants to build a strong academic career, I do not feel incentivized to publish negative results, although I acknowledge that we should talk about them. My priorities focus on establishing my dissertation on the strong foundations of a rational hypothesis that is corroborated by positive rather than negative results.

To me, it always seems safer and more rewarding to invest in positive data. As well as the low impact factor of negative data, there's also the stigma to consider. From my experience, failed experiments look more like the products of a poorly constructed hypothesis, or a lack of scientific insight – both of which reflect poorly on the researcher. To avoid this, it's easier to let negative results rot away on a hard drive rather than share them with the scientific world.

> "I DO NOT FEEL **INCENTIVIZED** TO PUBLISH **NEGATIVE RESULTS**, ALTHOUGH I ACKNOWLEDGE THAT **WE SHOULD** TALK ABOUT THEM."

However, since reading the paper about the pancreatic cancer model, it seems obvious that negative data isn't something that should always be associated with sloppy science. In fact, it can provide useful insight and limit the number of times we make the same mistakes.

My advisor tells me: "Negative data are important as long as they teach you something." This is good advice, but while I would like others to publish their negative data, I still struggle to justify whether it's worth spending more time on sharing my own negative results. After all, if we're all fighting for the same jobs, I'd be at a disadvantage if I slowed down to work on my negative data, while others raced ahead with their positive results.

Biology and immunology are complicated and empirical sciences, which only magnifies the problem caused by sweeping negative data under the rug. Academia is a tough industry, and although there is a lot of bias, I'm starting to see that we must all take responsibility for our own research. If we were somehow able to forget about our careers, our funding and our futures, and take a step back to focus on reporting only excellent science – regardless of whether or not it's negative or uninteresting – I'd quickly work towards publishing all my data, rather than just the good parts. But will that ever happen? I'm not sure. ■

- Manisit Das

Manisit Das is a Graduate Research Assistant at University of North Carolina Chapel Hill.

His current research focuses on local and transient immunotherapy in pancreatic cancer. His published research can be found in *RSC Advances, ACS Applied Materials and Interfaces,* and *Sensors and Actuators B: Chemical.*

JUSTIN SCHWARTZ: WHY YOU SHOULDN'T BE AIMING FOR TENURE

Junior academics face a lot of uncertainty in terms of their career prospects, and whether they can get tenure is a prominent concern. But according to Justin Schwartz, getting tenure isn't what they should be thinking about.

"If a person's just thinking about how to get tenure, then to me they're thinking too short term," says Schwartz, head of NC State's Department of Materials Science and Engineering and Kobe Steel Distinguished Professor.

Sitting in his office, he recalls a talk about large superconductor magnets he once gave at a conference. The audience was comprised chiefly of material developers, some of whom had never even seen the type of magnet he was developing.

At the end of the talk he was approached by a

Photography credit: Greer Arthur

colleague, who admitted that he hadn't considered what the material being developed would be used for. For Schwartz, whose work has always been driven by the perception of the material's intended application, this mindset puzzled him.

"It's almost like studying diseases without actually thinking about how you might cure them," he reasons. "A lot of people come at it from that perspective, and want to understand the phenomenon from that purely scientific side. But engineering is the combination of understanding it and then manipulating it."

This mindset has been rooted in Schwartz's engineering research since the start of his academic career. His PhD work at Massachusetts Institute of Technology (MIT) was computational: he designed low temperature

superconductor magnets using computer-based models.

Superconductor magnets consist of coils of wire which, when cryogenically cooled to temperatures below 20 kelvin (-424°F), can carry enormous electric currents. The useful side effect of these currents are powerful magnetic fields, the type necessary for magnetic resonance imaging (MRI), or massive particle colliders, such as the 17 mile-long Large Hadron Collider based at the European Council for Nuclear Research (CERN) in Switzerland.

Throughout graduate school Schwartz calculated how the magnet's materials might fail. "My drive was always: This is what you need to build a magnet. What do we need to go [from] where we are, to there?" he explains.

By understanding what his research would be used for, he was always able to work toward a clear end goal. His key tactic was first to identify what he was aiming for – to create a stronger magnet, for instance – and then, to learn from as many fields as necessary to reach his target.

The first lesson he needed was being taught 6,688 miles away in Japan where, just before he'd finished his PhD in 1990, a new, more powerful superconducting material had been discovered.

"All of a sudden superconductivity became a much hotter field that everybody wanted a piece of," Schwartz says. "Everybody in the US was working on one material, and the Japanese had discovered a different one. [If] I go to Japan and I come back, I'm one of the few people in the US who's ever looked at that material."

To work with these researchers and learn about the new material, Schwartz won a place on a program that awarded young scientists with the funds they needed to travel to and work in Japan.

The laboratory he worked in was based in Tsukuba, a small, quiet town nestled amongst rice paddy fields, about one hour outside of Tokyo.

In the early 1990s, very few foreigners lived or worked in Japan. Of the two hundred employees working in the Tsukuba laboratory, only one scientist was non-Japanese. But for Schwartz, who had no hands-on experience in an experimental laboratory, the language barrier proved to be unexpectedly convenient.

"I was basically able to hide the fact that I had no idea how to do any experimental work, in the fact that I didn't speak any Japanese," Schwartz chuckles. "If I didn't know what I was doing, they just assumed it was language rather than know-how."

After spending six months in Tsukuba, he returned to the United States to a faculty position at the University of Illinois. Now, equipped with a few basic sentences of Japanese and expert knowledge of Japan's new material, he enjoyed a competitive edge over the plethora of other superconductor researchers.

Schwartz's reputation as a leader in the field grew quickly. Instead of going through the motions to get tenure, he kept his focus on the big picture of his research. In 1993, he took a leap of faith and moved from Illinois's premier engineering college to Florida State University (FSU). Within ten years, his group earned national status for FSU's relatively young magnet laboratory, and set a record for generating the world's largest magnetic field

"IF I DIDN'T KNOW WHAT I WAS DOING, THEY JUST ASSUMED IT WAS LANGUAGE RATHER THAN KNOW-HOW."

> “WHEN PEOPLE ASK ME: **‘WHAT HAVE YOU ACCOMPLISHED IN YOUR CAREER?’** I’M PROBABLY GOING TO VERY QUICKLY START TALKING ABOUT **MY STUDENTS.**”

with their superconductors.

After setting the world record he decided to think strategically. To continue to advance his career, he knew he needed to broaden his research, and avoid becoming too specialized in superconductivity. He searched for a university that could provide a broad umbrella of expertise to work with, and in 2009, he began a new chapter at NC State.

“This is a big, broad-based, outstanding engineering school. It has expertise from department to department,” says Schwartz. “Just within materials science, the expertise from door to door can be quite varied.”

With extensive experience to reflect upon, he started to carefully cultivate a distinguished research environment within his department. As well as stretching out into new disciplines, he also invested a great deal of time and energy into one particular aspect of his role as a research scientist.

“When people ask me: ‘What have you accomplished in your career?’ – I’m probably going to very quickly start talking about my students. This is academia,” he states. “[Teaching and academia], they’re not disparate functions. The classroom and the lab are two legs of the same stool.”

In particular, Schwartz strongly encourages his students and postdocs to take ownership of their careers. “That doesn’t mean they’re on their own,” he says. “You get input, but we’re not looking for those who still have that undergraduate mindset of ‘tell me which boxes I have to check so I can go to the next step’.”

As well as practicing their independence, he expects anyone he hires, regardless of which stage they’re at in their career, to aim for a grand goal: to enter the National Academy. Of course, he doesn’t expect everyone he hires to reach this point, since there are a multitude of unknowns that could prevent a qualified person from getting in. But a long term view is essential, he clarifies, to maintain a productive trajectory.

“You know, if you’re thinking about trying to climb Everest, you’re not worrying about base camp,” he says. “The mindset I want people to have is: assistant – associate – full – distinguished – endowed – academy. If you’re not thinking that, then yeah, you’ll probably get tenure – but then what? *Then* you’re going to start thinking about the next step? That doesn’t make sense.”

There’s no surefire rule to success in academia, but it’s easy to make classic mistakes. Becoming too focused and ignoring the big picture is a significant flaw in any vocation, particularly if the career path is never strategized.

And even then, there’s not always an obvious route to success. Although teaching may not be listed on the entry ticket to the National Academy, Schwartz attributes a major part of his success to his students.

“My ability to go into different directions, to explore them and decide whether to stick with them or not, is enabled by the curiosity and drive of the student – and that’s the fun relationship.” ■

- Greer Arthur

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Got a question?

Contact a member of NC State's Postdoctoral Association (PDA) and we'll be happy to help.

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THE MUSLIM TRAVEL BAN

WRITTEN BY

AHMED MOHAMED

On March 6 this year, President Trump signed a new executive order banning visitors from six majority Muslim countries: Iran, Yemen, Syria, Sudan, Somalia and Libya. The second ban enforces a 90-day ban on travelers from these countries, although unlike the first order, excludes those traveling from Iraq. At first, the revised ban featured heavily in news reports, but since then it has disappeared from headlines and been replaced by other international crises. Although both travel bans were successfully blocked by the courts and, as a result, have probably been largely forgotten, these orders inflicted damage, and the aftermath will not be short-lived. Since the orders were signed, families have been separated, and education, employment and residency, if not withdrawn already, hang in a limbo of uncertainty for anyone impacted by the ban. The court orders that currently block the bans are fragile and only temporary, and will likely come under threat when Supreme Court nominee Neil Gorsuch is confirmed.

As a Muslim and Arab American, I was deeply saddened by the use of religious affiliation as a basis for political decision-making. I also feel the pain of innocent people who have travelled from, and still reside, in the countries targeted by these executive orders. Today's state of affairs could certainly make the founding fathers of this country roll in their graves. That, and the fact that a position once held by Washington, Lincoln and Adams is now held by someone whose words must be bleeped and censored on cable news.

However, above all, I am troubled by the fact that our elected president is a divisive figure who is trying to pit various groups against each other, that he has chosen a white nationalist for a right hand man, and that has no regard for truth, science, or any form of disagreement. He also awards the highest political positions to his poorly qualified family members. Ironically, these are the same things I thought I left behind me when I first left Africa.

Enough has already been said about the travel ban, and how and why we elected Trump as president. Multiple court rulings that have labelled the bans unconstitutional – basically, deemed them to be racist – and there is nothing more I would want to say about that. However, what I would like to discuss is that regardless of whether or not you support Trump and what he stands for, you must consider what he embodies: the deep negative sentiments held by some toward Muslims, Arabs, Mexicans and other minorities, as well as the current economic conditions. It is no secret that the President is very selective in his discrimination; immigrants upholding business ties with him, or brought here to work in his vineyard farms, or who have married him, are exceptions to his ruling.

My reason for writing this is because I want my words to serve as a reminder. It's all too easy to forget about a topic as soon as the stories disappear from our Facebook news feeds, our television screens or our favorite YouTube channel. I do not want anyone to forget that during his campaign, he said "Donald J. Trump is calling for a total and complete shutdown of Muslims entering the United States."

Today, there are 50 Muslim-majority countries, and 1.6 billion Muslims in the world who together represent 22% of the world population. That is a staggering number of people whose religion means they are targeted by Trump's proposed blanket ban. As a believer in the basic principles of justice and human rights, you do not need to be a Muslim or have sympathy for Muslims to be both terrified and outraged by this statement. To make matters worse, Mr. Trump and his team are considering, or have considered, whether to introduce a Muslim registry for Muslims inside the United Sates which, I presume, will include US citizens. To put this in context, the only current registries I am aware of are reserved for diseases such as cancer and suspected Ebola cases.

With this to compare to, it becomes overwhelmingly clear that Trump and his administration want to achieve one thing: to emphasize that Muslims are not welcome, because we are all associated with "Islamic terrorism". This is despite the administration's claim that the travel bans are being used for the sole purpose of protecting the country. This claim is as credible the President's declarations that his inauguration drew in large crowd; the worst terrorist attack on American soil, which took place on September 11, 2011, has been linked to Saudi Arabia, and yet this kingdom was not listed in either the first or revised travel bans. Meanwhile, other countries such as Iran, whose citizens are not linked to any terrorist attacks on the United States, are named. In fact, this president and his administration's attitude toward Muslims in particular plays right into the hands of terrorists by helping them shape the military campaign against terrorism by the general targeting if Muslims and Islam. This message is not only useful for recruitment into terrorist organizations, it also stands against the basic principles on which this country was founded.

And yet, despite the dark direction that this president is trying to take us in, I remain optimistic. I have been greatly inspired by the level and determination of the vast number of Americans who have opposed these divisive and discriminatory policies. The large numbers of people who reacted quickly to this racist presidential agenda and marched in protest in Washington DC is reassuring, and a hopeful indication that this country will not be so easily swayed. The current magnitude of opposition and resistance to the President's agenda among people from various political stripes (not just those who considered themselves liberals) are also good indicators that the American people reject this agenda, and that the United States will likely remain a country that will provide a refuge for those fleeing dictatorship and tyranny and seeking better lives. ■

Ahmed Mohamed immigrated into the US from Mauritania, West Africa, in 2000 to pursue an academic research career, and currently works as a postdoctoral researcher in NC State's Department of Biological Sciences.

His published work can be found in *Journal of the American Veterinary Medical Association*, *Veterinary Parasitology*, and *Preventive Veterinary Medicine*, among others.

Photography credit: The Preiser Project (Flickr)

T. Robert Harris

THE SWITCH MAKER

When the office clerks of the US Census Bureau finished counting the results of the 1880 population survey, they were seven years overdue. But since every single one of the 50 million census questionnaires had been counted by hand, the fact that it had been completed at all made it an impressive achievement. Ten years later, the inventor Herman Hollerith revolutionized the process by replacing the clerks with a machine that could count holes punched into cards. Though cumbersome and complicated, the machine's automation was more reliable: each time a metal pin passed through a hole in the card, an electric circuit was switched on. Since then, despite engineers trading punched cards for computer chips, and replacing punched holes with transistors, the primitive on-off signal has been impossible to beat, and remains the foundation of present-day computing.

"The essence of digital electronics is the transistor, an electronic switch," says Dr. T. Robert Harris, a postdoctoral researcher in NC State's Department of Electrical and Computer Engineering. If a computer was deconstructed right down to its motherboard, and then picked apart even further, at the very core would be an intricate patchwork of microscopic transistors. Each transistor is the most modern manifestation of the holes in archaic punch-cards, acting as an electronic switch with two possible positions: 1 (ON) or 0 (OFF).

Alone, each transistor, whether on or off, doesn't do a lot, much like a single letter on a page doesn't say anything. But when multiple transistors are used in combination, the series of ones and zeroes forms an instruction for the computer, such as selecting the color of a screen pixel.

To create specific instructions, transistors (known as bits) work together in groups (known as bytes). The more complex the command, the longer the series of ones and zeroes, and therefore the more transistors are required. To cope with the diversity of tasks that computers need to perform, engineers such as Harris have also played with the properties of transistors; depending on their purpose, transistors are built from different materials that yield different properties. Digital transistors only switch on and off; transistors within photonic integrated circuits respond to light rather than electricity; and a number of analog transistors amplify the signal that switches them on.

The point at which it becomes useful to mix and match between different transistor materials is when building an integrated circuit, also known as a computer chip. The main platform of a chip is a thinly sliced wafer of crystal, and on top sit thousands of transistors. Through labyrinths of conducting channels, transistors interact with each other to generate complex computer signals.

To enhance the performance of computer chips, Harris is testing the properties of transistors by mixing together different combinations of transistor materials. His work is part of the Diverse Accessible Heterogeneous Integration (DAHI) program, supported by the Defense Advanced Research Projects Agency (DARPA). A key interest of his research group, led by Rhett Davis and Paul Franzon, Associate Professor and Professor of Electrical and Computer Engineering, respectively, is to simplify and reduce the energy consumption of computers and other electronics by merging their components together.

"THROUGH LABYRINTHS OF CONDUCTING CHANNELS, TRANSISTORS INTERACT WITH EACH OTHER TO GENERATE COMPLEX COMPUTER SIGNALS."

"Basically, do more with less," Harris explains. "Integration simplifies chip design because it reduces the number of ingredients." But this is not as simple as it sounds. New high powered electronics with integrated components can heat up quickly, so a main task that Harris faces is figuring out how to modify transistors so that they can withstand higher temperatures.

Considering the entanglement of components that comprise a computer chip, the speed at which technology advances today is remarkable – but collaboration between research groups is key. Harris's team at NC State are just one part of the DAHI program, which consists of multiple industry and academic partners, all of whom share wafer 'chiplets' made from silicon, indium phosphide (InP), gallium nitride (GaN) and silicon carbide (SiC). "You don't see the wafer, you just see the design on a computer and work on that," he says. "Then, months later, when one of the other institutions has finished with it, you get to work on the actual chip."

The design process begins by asking how the technology can be pushed to its limits and broken. He compares it to the design of car engines. "You would have the highest performance if you could rev [engines] to the point that they would explode due to extremely high pressure," he says. Then, after understanding why it exploded – or, in his case, how the transistor broke – he steps back from the breaking point to a safe amount, and asks how the break can be prevented.

Next, he develops a design based on his analysis of the breaking point, and then tests his work in a computer-based simulation. If it breaks again, he adjusts the design and retests it. So far, Harris has been though this cycle twice, collecting measurements of the performance of his transistors within integrated circuits.

Once this stage is complete, he will calibrate and finalize his design simulations, which will ultimately tell him how well his design will work.

"The integrated technology we're now able to generate is fairly mature," Harris observes. "We've seen it come a long way in a few years with tremendous effort from a large team of government and industry partners working together. Eventually, DAHI will become self-sustaining as demand for this technology eventually increases. One day it will be great to see heterogeneous integrated circuits work their way into consumer electronics such as sensors for self-driving cars, wearables and smart devices."

As well as reducing the cost of the project, DARPA's DAHI program enhances the productivity of chip design. By distributing the workload, processing time and fabrication steps amongst several research groups, DAHI consolidates the process. The collaboration not only smooths the design procedure by promoting communication, it also maximizes innovation by allowing each group to tackle different technical challenges and research interests.

"Unquestionably, the best part about working in this program at NC State has been the people," Harris says. "I like to work with smart and talented people who know how to push technology, but faculty in the Department of Electrical and Computer Engineering have exceeded that by also being genuinely friendly and considerate people to work with." Harris has just accepted a faculty position at Georgia Tech Research Institute (GTRI), and is keen to maintain a strong connection with NC State. "I will be working on similar projects with more variability, focusing on transistor and photonics device physics, and I will certainly be continuing to interface with my mentors at NC State." ■

- Greer Arthur

APRIL 22, 2017

Photography credit: Ahmed Mohamed

THE DAY WE MARCHED FOR SCIENCE

Photography credit: Ahmed Mohamed

On April 22, 2017, people in over 600 cities worldwide marched in support of science. In Washington D.C., despite the gray and rainy weather, thousands of people gathered to advocate for science and research at the March for Science. The official mission statement of the March for Science is as follows:

> "The March for Science champions robustly funded and publicly communicated science as a pillar of human freedom and prosperity. We unite as a diverse, nonpartisan group to call for science that upholds the common good and for political leaders and policy makers to enact evidence based policies in the public interest."

While there were signs and voices that protested against the current administration, most marchers displayed posters endorsing their research and presenting arguments for the value of science. There were also many clever phrases promoting responsible, unbiased research practices, such as the highly popular: "What do we want? Evidence based science! When do we want it? After peer review!"

With the recent, politically-charged focus on climate change, and the March taking place on Earth Day, I was intrigued to see who would turn up, and what the demography of scientists and supporters would look like. In fact, a wide variety of scientists from archeologists and statisticians to zoologists were there, representing the broad spectrum of scientific fields that have played a critical role in the advances and discoveries that have shaped our modern lives. For me, this display of the breadth of science was a crucial element of the March, the significance of which may not have been fully appreciated by some observers. Government-funded scientific research is not limited to medicine and climate change alone; science impacts nearly every aspect of modern life, from communications and transportation, to how we educate our children, and even the food we eat.

The March for Science was a good first step in advocating for science and research, but in order to effect change, the March must not be a solitary event. Instead, it needs to be the catalyst for a larger movement of changing how science is communicated to the public. How can we guarantee popular (and political) support for science without teaching the public to understand the transformative effects of research, how integral scientific discoveries are to our lives, and how scientific research can drive our country toward a better future?

I was proud to march as a scientist in support of my work and in recognition of how important I believe science is to our society. But this is only the beginning. The conversations must continue, both inside the lab and out in the real world, in order to ensure that rigorous scientific research is valued, maintained and advanced. ■

- Serina Mazzoni-Putman

Serina Mazzoni-Putman is a postdoctoral scholar in the Department of Plant and Microbial Biology. She received her undergraduate degree from Michigan State University and completed her Ph.D. at the University of Michigan. Her current work seeks to understand how plants coordinate hormone responses via regulation of translation.

Got something to say?

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