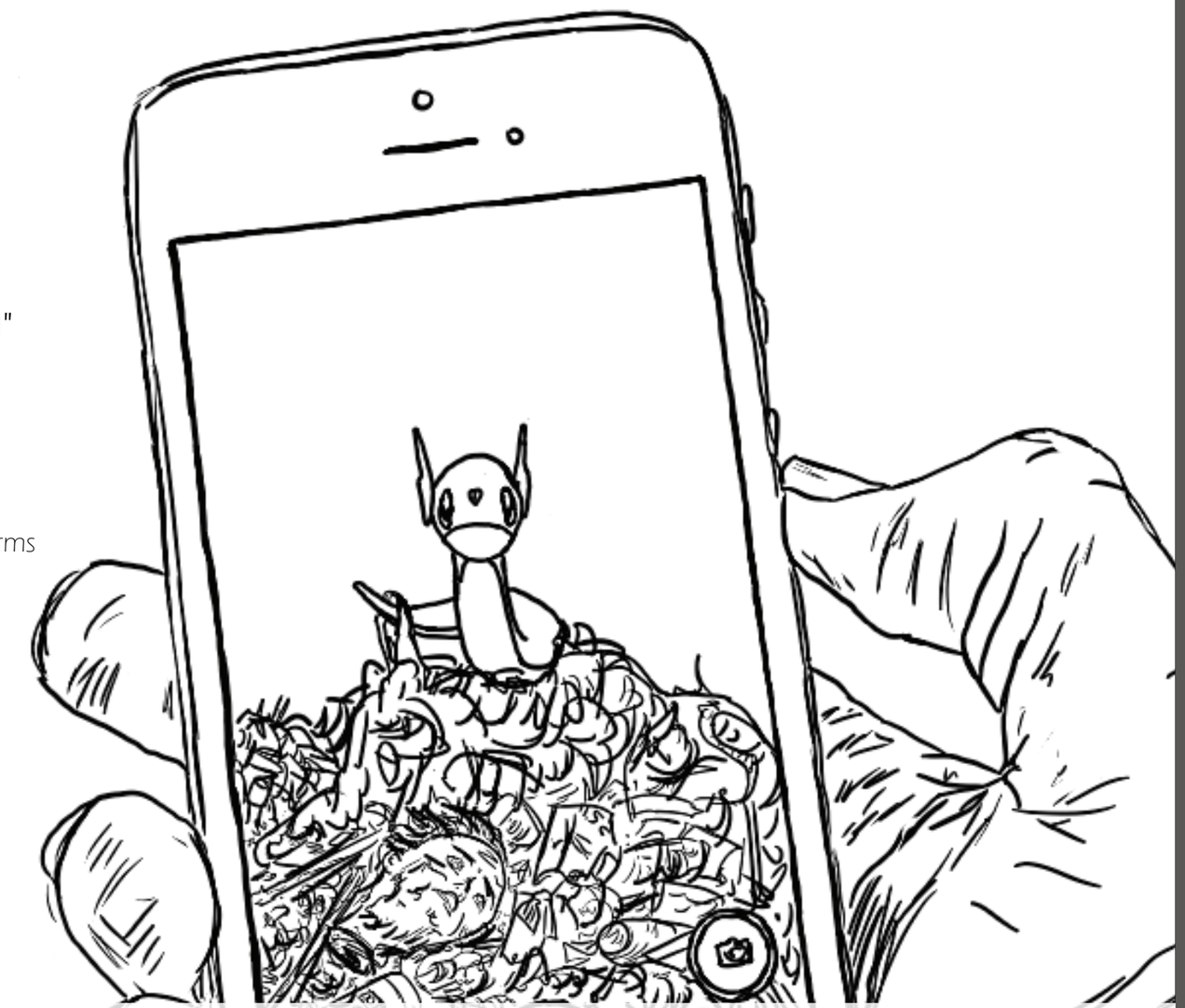
EMERGE

Taking a scientific approach to journalism, and a journalistic approach to science



EMERGE

EDITOR'S NOTE

So much of our society is obsessed with consumption and disposal. According to Duke University's Center for Sustainability & Commerce, the average American produces 4.5 pounds of garbage per day. Just in food alone, the Natural Resources Defense Council reported that we lose nearly 40% from farm to landfill - consumer disposal doing the worst damage.

Our focus in these pages is on the effects of the consumptive lifestyle versus a sustainable one. Especially for this issue, we've tried to put it in a perspective that college students will be able to relate with. We investigate the effects of smartphone disposal, recycling for science, and even spending hours enjoying addicting games.

For our readers who want to be active by finding another use for unwanted household items and performing science experiments at the same time, we've begun a new column entitled "Hax" which seeks inspiration from existing laboratories at UB to share methods of reusal. And of course, here at EMERGE, we like to tell the story in addition to providing insight.

Ideally, we hope our readers will begin to exhibit a healthy dose of doubt and to seek answers to their own questions. Don't take our word for it. We hope you will do your own research being careful to steer clear of the trashy sources.

Our staff is exceptionally thrilled to offer this sophomore issue of EMERGE to our campus community. We hope it will engage you or inspire you to change your world through informed inquiry and awareness.

Take a deep breath in.

EMERGE *is a student-run semesterly publication powered by a team of inquirers from all disciplines who strive to artistically produce technical content by...*

...leveraging technical knowledge to report on emerging, unspoken, and controversial stories in STEM for the entire UB community and beyond

...facilitating a means for expressing scientifically-informed opinions

...illustrating unique data-driven content that is presented simply

...encouraging a creative environment for our team to curate inventive pieces through a wide variety of media

Cover: Heeba Kariapper, "Floating Garbage Entanglement"

Inside Front Cover: Heeba Kariapper, "Pokemon GO Trash"

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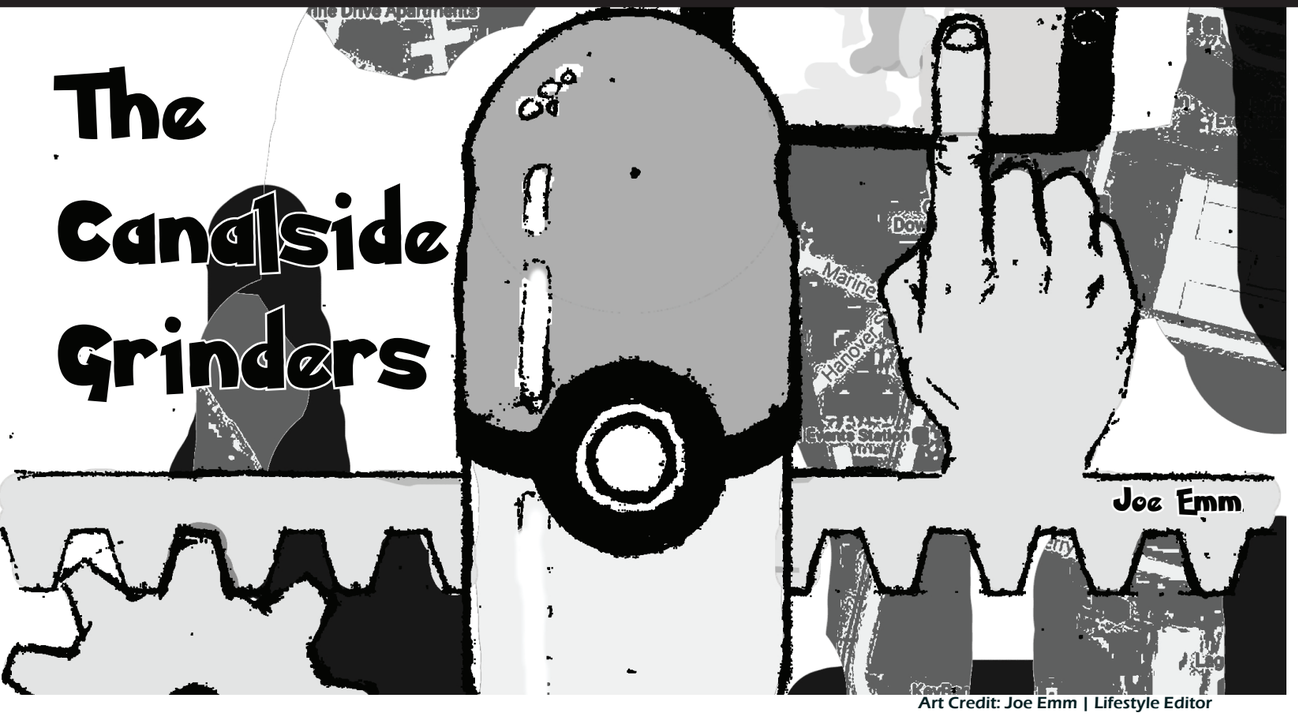


Art Credit: Joe Emm | Lifestyle Editor

"There's three different teams. There's the blue team, yellow team and red team. Blue is Mystic, yellow is Instinct, red is Valor. I'm on Valor, and I'm the strongest trainer on the entire team in the entire country, so it's literally... it's my team... And it sucks, because unfortunately I literally embody... my personality does embody the douchebaggery that is my team," Landon said as I laughingly and noddingly recollected him, years ago, stealing my glasses from my face and hiding them from me for kicks when I had come to his house with friends — we're old acquaintances.

At the time that I spoke to him, Landon was a few days away from level 40, but he's now the second Pokémon Go player, at least in North America, to reach that level — the highest attainable level in the game — and he's the first to reach it with at least one of each capturable Pokémon. The first person to get to level 40, Jimmy Pitts, is, along with Landon, a Buffalonian and a part of a group of players called the "Canalside Grinders" after a popular stretch of Pokéstops along the Buffalo River. They're two of the core members that, for now, meet daily with camping chairs and coolers by the shored ships of the naval park to alternately attack and defend the nearest gym and so on. And according to these Grinders, it's their constancy that allowed them to get so far ahead of the other players of the game. "I just played it a lot more," Landon admitted. "I plan everything out every single day. I play 12 and a half hours a day, so what I do is very routine and specific. But, that's because I literally have to [plan]." "There's a couple other players that if I don't stay on top of my [stuff], they'll creep ahead of me," he later added. Because of the cap on the amount of XP points players can earn in a day, Landon knew that the soonest he could reach level 40 was two days from the time of our meeting. Trainers can earn 600,000 XP a day before they're no longer allowed to catch Pokémon or engage in any of the leveling-up activities for 24 hours. Landon aims to earn about 500,000 XP a day to avoid having to plan around a ban.

I asked what he got from playing the game: "Well, it's ruined my personal life. It destroyed my relationship with my girlfriend." Landon's girlfriend has an issue with how much he plays the game, though they often play it together. "I feel like I found something I can be passionate about that I'm good at, and I wanna do that, and I just don't feel supported." Jimmy Pitts, who was the most subdued of the group despite being the first one to get what they all strove for, spoke about similar disruptions. He broke up with his girlfriend when he first started getting into the game, and though he believes the significant investment of his time and energy into the game wasn't the sole reason the relationship fell apart, he said Pokémon Go was the tipping point. Friends of his had dumped him or at least went as far as threatening to do so because of his 10- to 15-hour daily absorption in the app.

I wondered what could make a game so consumptive of a person's life, finding it especially unusual that a game offering its most dedicated players primarily just the experience of "grinding" — plying away with a certain set of actions for the purpose of advancement — could hold a person's attention so well. It was found in an assessment by the Nottingham Trent University based on the DSM-IV criteria for addiction that Massively Multiplayer Online Role Playing Game (MMORPG) players were more likely to exhibit signs of addiction to their games than non-MMORPG players. The results of the same assessment also suggested that the chief motivation of the players was the escape that these games offered. Considering some defining features of the genre are persisting game environment, customizable characters that can be improved by completing tasks, and high volume of simultaneously playing users that can interact with one another, it's easy to see that these games allow their players to essentially have a second life, making them plausible replacements for lives ranging from the too-mundane to the terrible.

Pokémon Go shares some of these characteristics: Users create avatars, and they share a persistent environment with many other "trainers" that are on the app at the same time as them. But the options when it comes to the appearance of the in-game personae alone are so few that you might suspect the whole Pokémon training thing to be a big settling of interfamily grievances. That persisting environment, too, is just a graphical overlay on the real, physical world, and there is as yet no way for players to communicate except outside of their smart devices, in person, at the Pokestops, nests, etc. The users of the app with whom I spoke mentioned that the social opportunities offered are a large part of its appeal, with many saying they made new friends at those legended points on the map. But one would think that a game whose constitution is, to a large extent, the realm addicted MMORPG gamers are escaping — as is the case with augmented reality games — would not have the same potential to be addictive, or at least in the way MMORPGs are addictive.

After reaching level 40, Jimmy Pitts was sitting relaxedly on some grass by the river, where The Grinders meet, still playing Pokémon Go and anticipating another wind to get him to the next marker of in-game success.

Landon, too, informed me that he's still playing 8- to 12-hours a day.

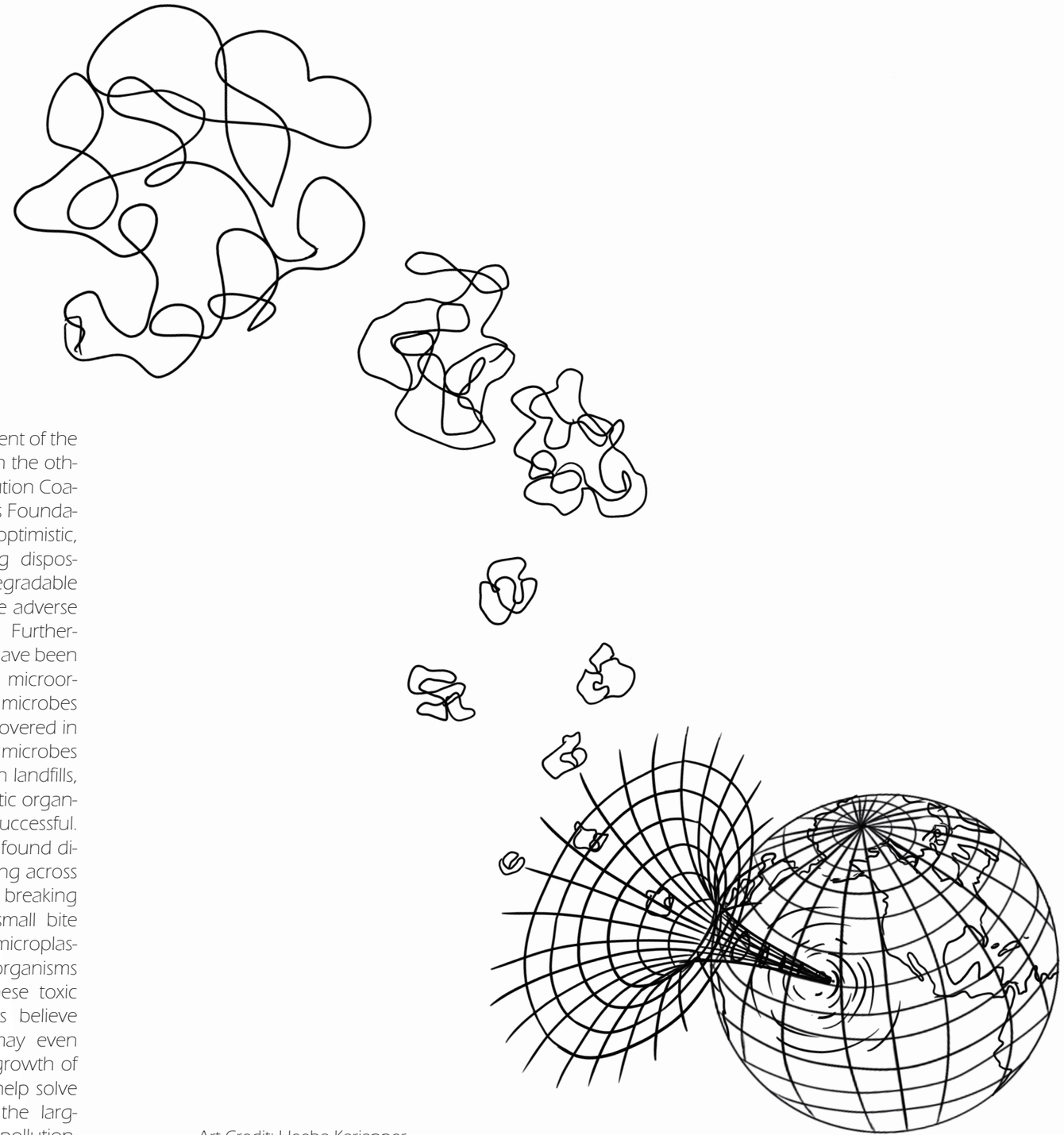
Welcome to "Garbage Island"

Jenna Dombrowski

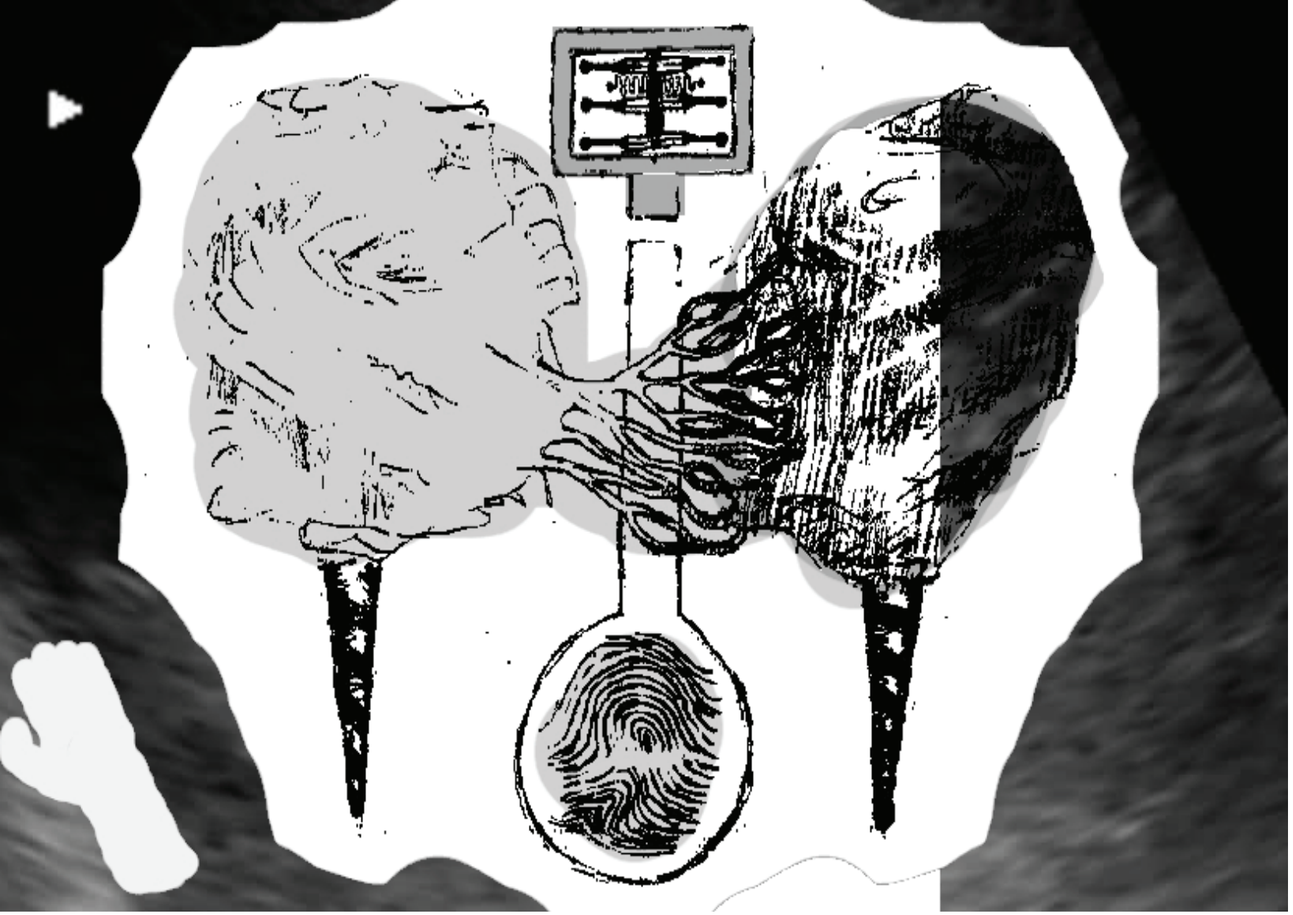
Also known as the Great Pacific Garbage Patch or Pacific Trash Vortex, this expanse of marine debris inside the Pacific Ocean weighs in at seven tons, is about twice the size of Texas, and is nine feet deep. The area is bounded by the North Pacific Subtropical Gyre, a system of ocean currents that spin as a vortex with a stable center. This circular motion draws debris floating in the ocean into this calm region where it is trapped and the "island" is formed. In reality, this "island" cannot be seen by the naked eye since microplastics account for most of the debris, with some larger items like fishing nets as well. For the most part, the waste comes from North America and Asia, with land-based activities accounting for eighty percent of the debris. The remainder is flotsam and jetsam derived from maritime sources, including boaters, cargo ships, and oil rigs.

One of the main issues is that much of the plastic present isn't biodegradable, but instead undergoes photodegradation; the process by which the sun breaks down the plastic into smaller and smaller pieces, without ever fully decomposing the harmful material. In fact, scientists have estimated that the patch has roughly 1.9 million bits of microplastic per square mile. This pollution has detrimental effects, especially to the ecosystem and food web, with poisons — dichlorodiphenyltrichloroethane, also known as DDT; polychlorinated biphenyls, or PCBs; and mercury — found throughout the patch. Even worse, it is predicted that the Garbage Island will double in size in the next ten years. As a result, scientists are striving to find ways to curtail and repair this environmental hazard.

At times, it seems almost impossible to remedy this situation. In fact, the National Ocean and Atmospheric Administration's Marine Debris Program has estimated that in one year, sixty-seven ships would be unable to clean up even one-percent of the North Pacific Ocean. On the other hand, the Plastic Pollution Coalition and Plastic Oceans Foundation are slightly more optimistic, believing that replacing disposable plastics with biodegradable plastics may alleviate the adverse effects on the ocean. Furthermore, new discoveries have been made in the world of microorganisms. Plastic-eating microbes have recently been discovered in these waters. Similar to microbes breaking down plastic in landfills, there seems to be aquatic organisms that are just as successful. Scientists have not only found diatoms (tiny algae) moving across the microplastics and breaking them apart, but also small bite marks on some of microplastics, indicating that organisms may be consuming these toxic substances. Researchers believe that these microbes may even be slowing down the growth of the island and in turn help solve an important part of the larger problem of marine pollution.



Art Credit: Heeba Kariapper



Hax: Our Noble Pursuit

written and illustrated by
Joe Emm

I suppose I should begin by explaining what a "lab hack" is since, even by that name, it has not been immediately clear to people what it means. I was reluctant to use the term because of the association with that internet buzz phrase and the hundreds of unduly aggrandized suggestions to put our phones in dry grains, in bowls, in hollowed and halved melons, in every component of the "balanced breakfast" still life at the end of cereal commercials. A "lab hack" is a creative solution, in an environment of scientific inquiry, to a problem resultant of the limitations of available tools or resultant of the unavailability of needed tools. From my conversations with the "hackers," it was often the case that since they were in new technological and scientific territories, nobody had yet considered the specific challenges of the work. No one had yet created the specific equipment suited to overcoming those challenges. It was often the case, too, that what sent them reaching for everyday implements was a wanting for funds (big wink to parties responsible).

Cotton Candy of Rubber Arms

I met first with Phil Schneider (15 minutes late and sweating from having done a kind of low-key jog through the summer heat and then by all the brushed metals and natural wood grains of UB's Davis Hall leading up to the lab room). Phil is a PhD candidate in the University's electrical engineering program whose experience with his advisor has been in microfluidics, making devices that separate blood, that trap and sort molecules, etc., by channels thinner than a human hair. He indicated a tray of complicatedly and compactly lined transparency masks on one of the lab tables. What Phil himself does, with the help of two undergraduates, is construct test phantoms — forgeries of parts of the body close enough to the real thing — to be used to calibrate and improve medical and biometric instruments such as ultrasound units and fingerprint sensors. There was an array of rubbery clenched fists whose wrists weren't long enough to cover the 3D-printed ulnae, radii, and discontinued blood vessels; disembodied and wearable digits, some terrifically unnaturally colored (Halloween-bob-wig blue); and patches of glossy and multilayered skin to be put atop other strata of synthetic anatomy. Phil asserted his mock arm is "electrically, acoustically and optically equivalent to a human arm," and said, "If you gave me your cellphone, I could lift the fingerprint off your cellphone, I could print it out, I could fold it, I could make it conductive and I could make a finger that could get into your cellphone ... It's easy. Takes me less than a day." He did not know, though, that I have a slider phone with the diabolically difficult to guess passcode Call Button — Select.

Where the "lab hack" enters and where Phil makes his full circle is his artificial capillaries and Nostalgia cotton candy machine. "For $40 — he could have spent less with coupons, I'm sure — we got a cotton candy machine. For $50, we got some silicon rubber. Now, it turns out, these candy fibers, we can get these in 10μm diameter. We can spin our own capillary network." The cotton candy is encased in a kind of polyurethane-modified epoxy resin, and after it is cured, the sugar is rinsed out with acetone, which easily dissolves the sugar without destroying the microscopic tunnels in the resin. An artificial blood is flowed through the network to simulate the action of our capillaries. It was easy to see, with the thin, see-through bars whose wandering inner cavities gave them the appearance of being Bert Hickman "captured lightning" sculptures laid out in front of me, that Phil was creating a more chaotic and three-dimensional analogue of the microfluidic devices that were the focus of his advisor. I was told that his team deliberately made more cotton candy than could be used for any given casting so that they would have some to eat. Phil also informed me that the grape flavored sugar that had come with the machine was reserved for the epoxy encasing since it was the team's least liked flavor. I asked Phil if he could spin some up, but I suppose he did not hear me, because I was never able to sample the stuff.

Power Drill of Remotely Controlled Brains

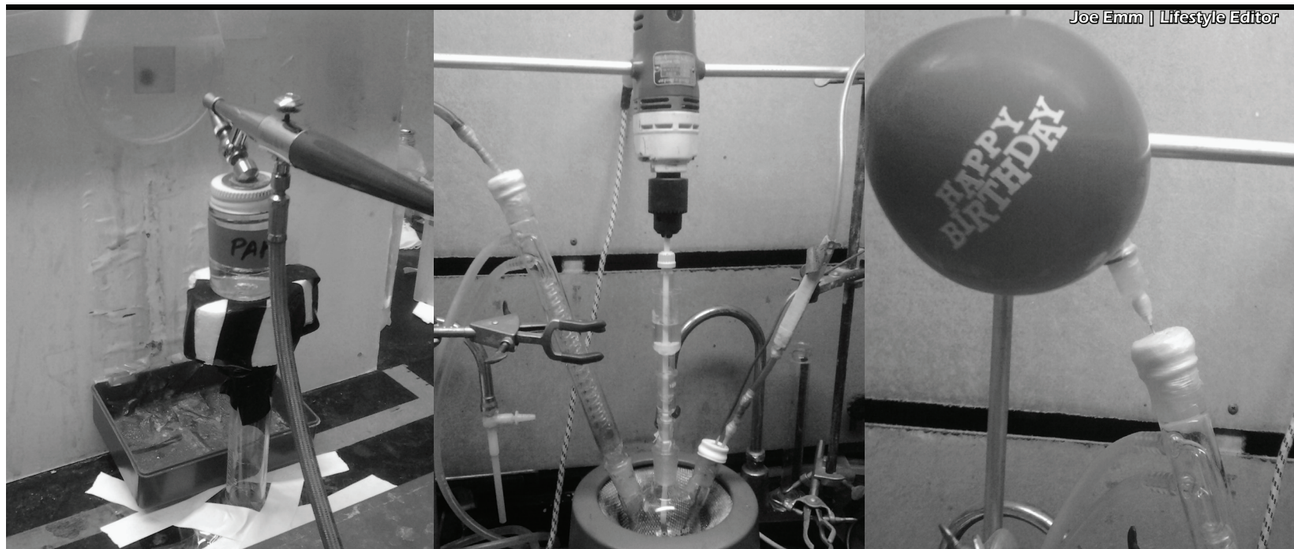
Dr. Idoia Rubio met me in the Pralle lab (15 minutes late and a little windblown in manner maybe from having speed-walked through all the harmonizing refrigerator-buzz of the physics instruments on Fronczak's floor one). Idoia's a fellowshipped post-doctorate from the Basque Country working at this particular university, not exactly because her dart landed here, but because it chanced to be promptest in reply to the résumé she sent to many research institutions around the world. Her primary focus is the synthesis of magnetic nanoparticles. The Pralle team binds these nanoparticles to neuronal ion channels and exposes them to electromagnetic radiation. This causes their proteins to heat and deform, causing an influx of neurologically important cations — Na^+, K^+, Mg^{2+} or Ca^{2+} — increasing the neuron's membrane potential to the point of triggering the firing of the neuron. This allows the cell functions to be remotely controlled. TRPV1 — the proteinaceous cation entryway at least partly responsible for our frantic gulping of liquids that are never satisfactorily cool after having eaten hot peppers (because by the analogy, capsaicin is a key) and at least partly responsible for our thermoception — was the channel the team targeted previously. The team decided to test other channels and discovered similar heat responses, which broadened their scope.

Idoia rummaged through several hardbound lab notebooks looking for a specific image, stacking the opened ones. She turned to a picture of microscopic pillars that looked a bit like silent film of the broad and flat pieces in a Lego set, and she said (not for the first time), "I don't want to drive you crazy with this," to preface a whirlwind explanation that followed my admission that I was crazy before the meeting. These pillars were photoresists onto which Idoia alternatingly applied positively and negatively charged layers of polymers that sandwiched her magnetic nanoparticles to create a microscopic disk — after the dissolution of the substrate — she called a "cellular backpack." The backpacks are attached to antibodies or another vehicle for cellular binding. An advantage of this indirect binding of nanoparticles is the decreased likelihood of neural death. The rig for the application of the polymeric layers was in a fume hood we'd been buzzing around. Each layer was sprayed onto the sheet of pillars with the kind of airbrush the guy at the county fair uses to bubble-letter your name in bright colors on an oversized t-shirt. The paint gun was steadied by a whatever's-tall-enough plinth made from some foam and a graduated cylinder. Each spray was timed and followed by rinsing away the excess electrically non-neutral polymer with water. Idoia briskly cleared this equipment from the hood and still spoke over her back — kneeling, tugging at cords, wrenching glassware fittings, etc. — to clear up points of my confusion, which she was able to detect even when I was silent.

> "The paint gun itself was steadied by a whatever's-tall-enough plinth made from some foam and a graduated cylinder."

She put together her apparatus for the synthesis of the magnetic nanoparticles: three-neck flask, reflux condenser, thermocouple, needle-tipped tubes piercing membranes for the inflow and outflow of nitrogen gas. Since the magnetic stirring commonly used to mix reagents and solvents in reaction flasks would interfere with the formation of her nanoparticles — the size of which she scrupulously tries to control — the mixtures have to be sloshed around mechanically. There are "certified" options (electric motors with dials and digital displays and the word "lab" in the model names that will turn a paddle put into the reaction), but they cost upwards of a thousand dollars (a "certified" absurd amount of money considering the simplicity). The option Idoia chose however was a Spanish power drill — that might have turned screws and a bucket or two of Quikrete® por construcción — sent by a friend and faculty member of her last school, costing her just the fees for shipping. Teflon rods were cut to about a foot and some circle tops of the material were fixed at their ends. With these rod-and-paddles tightened into the drill's head and passed into the flask, the mixtures were easily made into vortices. I had been to Dr. Pralle's lab before and to Dr. Rubios's hood, so I knew what to ask her to show me: "What about the balloon?" "You understand about the balloon though?" she asked back in a way that suggested she hoped I'd see its usefulness before being amused by it. I said that I did understand, but didn't, and she explained anyway, filling up a green party balloon as she did so. Before her syntheses, Idoia inflated a balloon with nitrogen, banded its opening to a needle fixture and pierced it into the septum on her apparatus. With the gas's exit to the bubbler taken out, any shrinking of the balloon indicates that the inert inner atmosphere of the apparatus is leaking and thus that the more reactive outer atmosphere can leak in. Somewhere in the middle of her setting this straight, the balloon popped. We laughed as I picked up the shreds and Idoia fished in a messy desk drawer for a replacement, which I was perfected to see had "Happy Birthday!" printed on it. She wished it to me in a put on voice like I'd just blown out the candles. I took a good 30 minutes after the meeting to let the whole experience settle in my head, so maybe she was right to warn me about my sanity. Maybe I was crazier afterward.

Or something.



Beneath the Screens

an essay by
Roshaan Surendhran

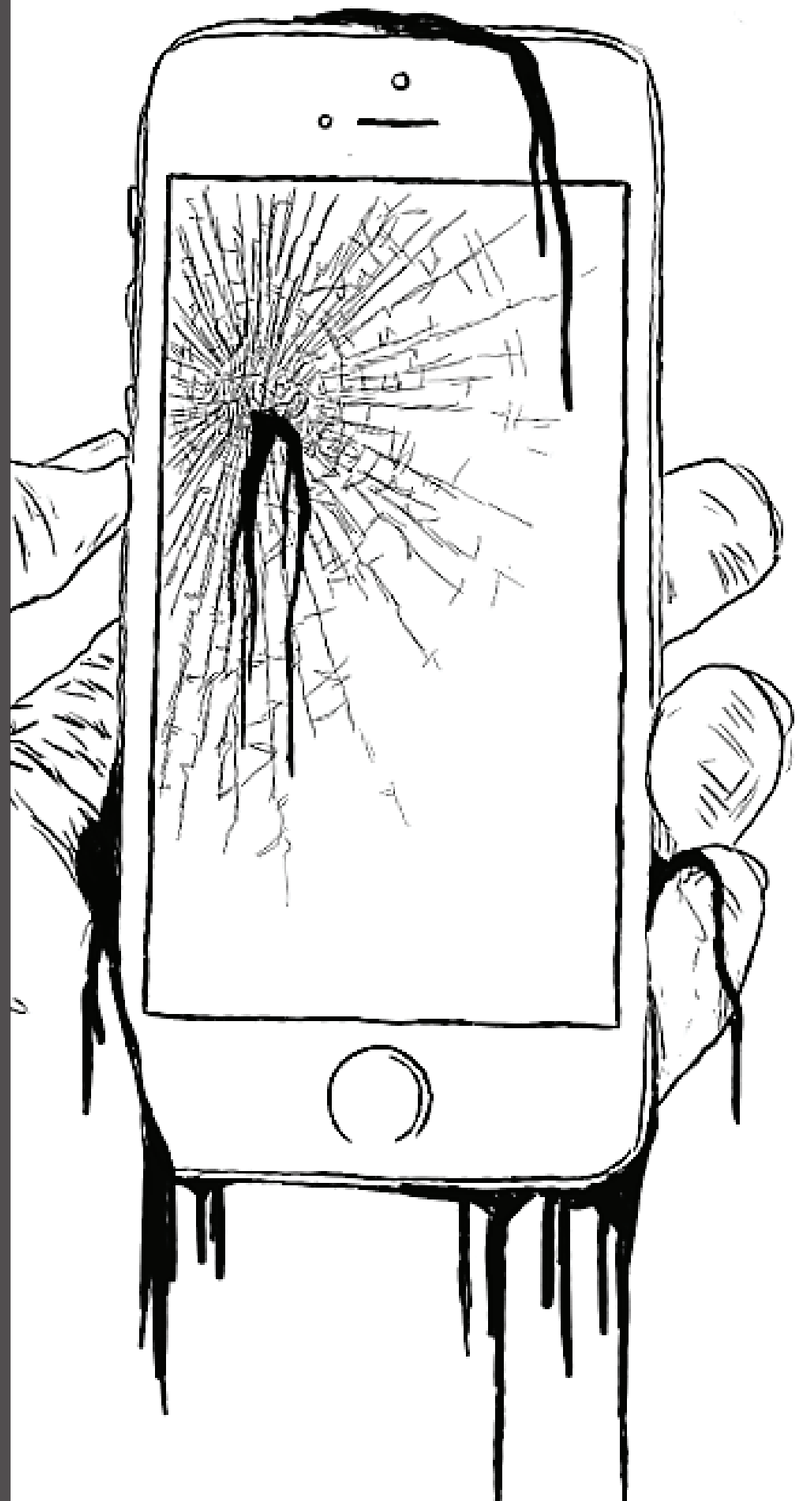
In 1926, Nikola Tesla said, "When wireless is perfectly applied, the whole earth will be converted into a huge brain ... We shall be able to communicate with one another instantly irrespective of distance ... and the instruments through which we shall be able to do this will be amazingly simple compared with our present telephone. A man will be able to carry one in his vest pocket."

Needless to say, Tesla was spot-on with his prediction for wireless communication. However, there are some concerns with cellphones in recent times that could not have been prophesized by Tesla and it is those concerns that shall be elucidated here. As of 2014, nearly 92% of Americans have cellphones and 68% own smartphones. Only considering the US, the immense magnitude of the cellphone market is clearly evident and it is only expanded when considering the whole world. Today, most cellphone, primarily smartphone, owners are prone to replacing their phone every 18 months. This is due to the fact that network companies typically offer contracts that last two years and then allow for their customers to upgrade their devices at a cheaper cost. In addition to this, cellphone manufacturing companies have built their products to have a lifetime of about two to three years. As a result, smartphones and cellphones have the shortest lifespan among modern electronic devices. With phones being replaced every two years, a large amount of electronic waste is generated by this market. Herein lies one of the biggest concerns of modern wireless communication — the disposal of cellphones.

In order to understand the methodology for disposing cellphone waste, the manufacturing process and the materials used must be known. Most conventional phones comprise of components made from heavy metals, metal alloys, and a variety of polymers. A lot of the materials used to make the components — copper, gold, lead, nickel, zinc, beryllium, tantalum, coltan, mercury — are harmful and classified as persistent toxins that harm the environment. In addition, there are harmful chemicals in these devices' batteries. All these materials are processed from their naturally occurring forms and then are used to build each device. After the device makes it to the hands of a consumer, it is used for about two years. The cycle perpetually repeats. During disposal, the reverse of the manufacturing process occurs. This is where the device is disassembled and each component is disposed of in a manner consistent with the properties of the materials used to make it. A few decades ago, the primary disposal solution for electronic waste was to store it in landfills. While there exists an extensive process to dispose of a cell phone, it is crucial to note that, in recent times, many companies across the world have begun to recycle and reuse old phones — or at least some parts of it — to be more environmentally friendly and cost-effective. In Australia, Malaysia, and other parts of the developed world, there are authorized locations to recycle used phones.

Cell phones have been, in many ways, a boon to mankind, but in some cases they have also been a bane. An iconic case is the recent explosive tendency of the Samsung Galaxy Note 7. This particular incident comes as a consequence of companies trying to push the limitations and boundaries of existing technology to gain an advantage over the competition. The exploding Note 7 is a result of an attempt to cater to the demand for an extended battery life in new devices. The explosion occurs when the flawed lithium-ion battery is charged. In an ideal battery, the electrodes are separated and there is an electrolyte between them to allow for movement of ions — and hence a flow of current. In the case of the Note 7, it is possible that the separation was flawed in that it allowed for an accumulation of chemicals from the electrode in the electrolyte, eventually leading to an explosion. While the exact cause of the explosions is not clear, the threat that these devices pose to its users is significant and obvious. There have been many concerns with the effect of phones on the human body in the past and most of these concerns had only been exposed after they were experienced by someone.

The technological demands of society exerts an understandable pressure on many companies, but it is the responsibility of these companies to ensure that — in the process of pushing the limits and boundaries of existing technology — the ethics of the industry are maintained regarding physical and digital safety and privacy. Safety must not be compromised as technology improves.



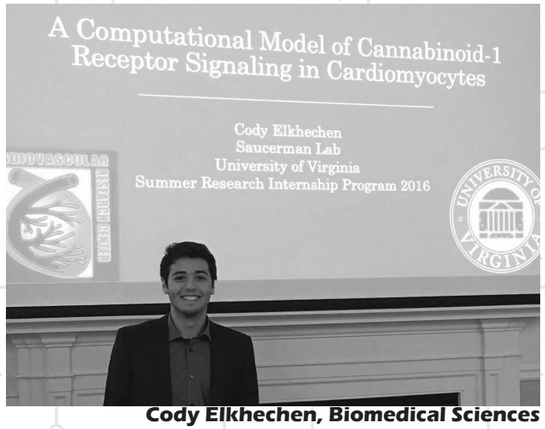
"Bleeding Phone"
by Heeba Kariapper

Summer Beyond Buffalo

Ask any high school or college student today and you will find that they're all doing something outside of school. These activities can range from paid jobs with hourly wages to volunteer positions at hospitals and pharmacies. This necessity for students to engage in extra-curricular activities is driven by a belief that it is beneficial for their future; a belief instilled in them by countless advisors, professors and peers. Professional experience in any field is extremely crucial to a person's growth. While academic prowess is necessary, technical and soft-skill experience is the most crucial criteria for development and progress in any field. Not only does it showcase a person's technical abilities but also serves as a measure for personal satisfaction. Stepping in the shoes of the actual engineer or doctor will tell any potential employee-to-be if he or she is fit for the job. They learn the ropes and familiarize themselves to the work that is expected of them and also gauge if they can truly be content and committed to working in that field.

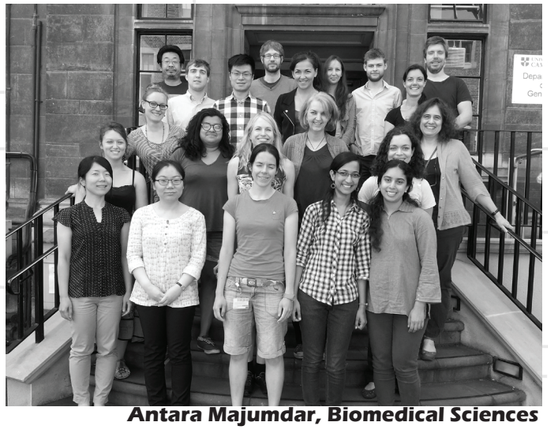
The people whose stories we have shared in Summer Beyond Buffalo have all participated in some form of experience outside their schools, cities and even countries. These stories of our classmates and friends inspire us to step out and experience.

Roshaan Surendhran
Managing Editor



Cody Elkhechen, Biomedical Sciences

"A lot of the [UVA Lab] is super computational ... which was cool because it was kind of an uncharted area for me. I was able to discover a new realm of research."



Antara Majumdar, Biomedical Sciences

"...spending two summers at the University of Cambridge has been a huge part of the development of my desire to become a biomedical scientist."

Marietta Fernandez Lopez, Transnational Studies

"I've been in DC a couple times and visited some of the Smithsonian ... and that's how I became aware of their Latino-American studies program."

University at Buffalo

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To learn more about summer internship and fellowship opportunities, contact the Career Services Center:
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Shayan Waseh | Alumni Writer

The following piece was written by Shayan Waseh, a Buffalo-born poet, who moved to Philadelphia after graduating from the University of New York at Buffalo in Biology and Medicine in 2015. While in Philadelphia, he was part of an intensive outreach project, where youth from all around North Philadelphia's many neighborhoods came together to systematically empower their communities through united and selfless service. This piece is an exposition of the thoughts and words of the countless people who shaped the unfoldment of the Ruhi Institute process in North Philadelphia.

Why are you here? A little girl was shot in the head. You know the saying, "If you can't handle the heat, get out of the kitchen?" I been in the heat for twenty-three years. It is hard out here. It's stifling hot.

A little girl died. She was four. I'm not trying to die at a young age, so I'll do whatever I can to help the community. The people who put people down are the darkness, the drug dealers. They beat it into your freaky little mind. You see it once and you can fight it, but they beat it into you a hundred times and you start to believe it. I hate where I live. It's a war zone. We kill each other over pennies and crumbs.

If everyone's not on the same page, then we cannot progress. I want my son to become something, do something. You don't know how much you grow by yourself; you need help. It has to be the kids, the adults, everybody. The kids bring everybody together.

Out of all the cities in this country, Philadelphia is the most spiritual. Philadelphia is a spiritual place. Soon this group will be running. It's phase two bro. I'll definitely be there.