

CAMB

Student Newsletter

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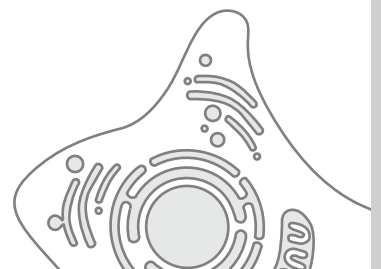
Dear CAMB Students, Faculty, and Alumni,

We are thrilled to share our final installment of the year! In this issue of the CAMB student newsletter, we chat with Dr. Bushra Raj, an assistant professor of Cell and Developmental Biology who investigates cell fate decisions in vertebrate brain development. We review a new publication by **Dr. Qin Zhu**, a recent graduate from the Genomics and Computational Biology program, on the molecular mechanisms of endothelial-to-hematopoietic transition during embryonic development. We also review **the history and importance of gender-neutral pronouns**. Finally, we check in with CAMB students **Karen Wong, Bailey Nance, and S. Fallacaro** about their extracurricular art work and the challenges of maintaining a creative hobby as researchers. Check out this last article for some incredible samples of their work!

For additional articles, past publications, and to learn more about the CAMB Student Newsletter team, visit our blog at cambnewsletter.wix.com/blog or follow us on Twitter at [@CambNewsletter](https://twitter.com/CambNewsletter). Current students interested in contributing to the CAMB Student Newsletter can contact us at camb.studentnews@gmail.com. We hope you enjoy the November 2021 issue!

Sincerely,

Hannah Kolev and James Gesualdi
Editors-in-Chief



Faculty Spotlight

Dr. Bushra Raj of the Cell and Developmental Biology Department

Megan Guerin

I recently had the opportunity to interview Dr. Bushra Raj, a newly minted assistant professor in the Cell and Developmental Biology Department. In a short time period, she has quickly established a lab that ambitiously aims to map vertebrate brain development through single-cell lineage tracing technology in zebrafish. This interview serves to highlight Dr. Raj's influential work, as well as extend a warm welcome from the Penn community.

Could you tell us a bit about your doctoral and post-doctoral training?

I did my Ph.D. at the University of Toronto in Professor Ben Blencowe's lab. My thesis focused on investigating the mechanistic regulation and functional impacts of alternative splicing during neural development. For my post-doc, I worked with Professor Alex Schier at Harvard University. My research was focused on characterizing cell diversity in the zebrafish brain and developing new technology to track the lineage histories of thousands of cells during development.

Congratulations on establishing your laboratory! Can you briefly describe your future area of research?

I'm very excited to be at Penn! Our big vision is to paint a molecular picture of vertebrate brain development. The main questions we plan to ask are: what cell types are generated at various stages of brain development? What are the fates and or the origins of these cells? What are the molecular cascades that underlie their specification? We plan to



Dr. Bushra Raj

answer these questions using genomics and genetic tools, as well as zebrafish as our model system.

What initially sparked your interest in vertebrate brain development? What influenced your decision to tackle it from a computational genomics perspective?

Honestly, I think I was initially drawn to the innately complex nature of the brain. The complexity is simultaneously frustrating, as it's challenging to study, but exciting because it's unlikely that one would run out of ideas or areas to explore. The genomics aspect comes from my doctoral training, so I was very interested in answering these questions through large data sets. Genomic-scale data sets allow you to observe molecular changes over long periods and help establish simultaneous measurements of different inputs and paradigms. However, it can also be quite challenging to make sense of big data. But once you crack the code, it can be very gratifying.

Based on your experience, what are some essential characteristics of a successful graduate student?

Success looks different for different people, and I believe there are many ways to achieve your vision of success. What worked for me was to be self-motivated, and

that's definitely a hard one. Additionally, don't be afraid to ask questions and be open to feedback from others. Finally, be able to adapt and pivot when needed.

Do you have any advice for students progressing through their Ph.D. or MD/Ph.D. training?

You know, there comes a time in your training where things are just not working and, in those moments, it's good to be proactive. Ask your colleagues about what you can do to change and read up on old papers because sometimes, the old school methods are better than the new-age ones. You can also work on a side project for a little bit, and if all else fails, be open to asking a different set of questions.

Looking back, what is one thing you wish you knew about graduate school ahead of time?

I wish I had known that a graduate degree does not limit you to academia. Personally, I love academia, and I've always wanted to be a professor. Still, sometimes I wonder if I had known that there were so many other options, would I have considered pursuing them? Perhaps. Right now, the climate is much better, and people are more aware of their options. As a new PI, it's my responsibility to ensure that graduate students get the experience and support for whatever they wish to do in the future.

What do you think has been the most important lesson that you've learned as a scientist? This can range anywhere from personal to moral, or technical to theoretical?

The most important thing that I've learned is that, often, there are many explanations for the data. Sometimes we are so focused on proving our theories correct that confirmation bias becomes an issue. I'd say that it would be wise to pause for a moment and consider other alternatives as well.

As an assistant professor in the Cell and Developmental Biology department, do you have a favorite gene? If so, which one would you choose and why?

I love this question. My favorite gene is DSCAM, which stands for Down Syndrome Cell Adhesion Molecule. I'm referring to the *Drosophila melanogaster* homolog. The human version is not nearly as interesting, but the fly gene can generate over 38,000 alternatively spliced isoforms that are important for neuronal circuit development. It's incredibly fascinating that the fly has figured out a means to compact so much regulatory information into one gene.

How are you enjoying your time in Philadelphia? Have you found any hidden gems that you would like to share?

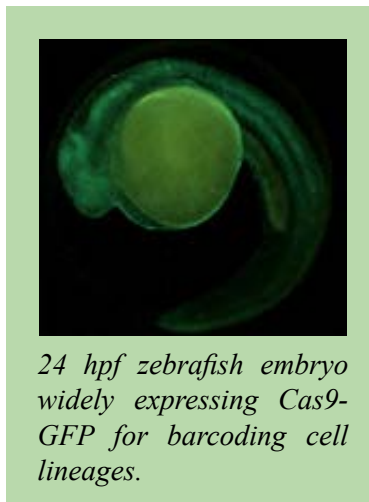
You know, being in Philly reminds me of living in the big city again after spending some time in the Boston and Cambridge area. It reminds me of all the things that I loved about living in Toronto. There's a diverse and expansive dining scene, people of many different backgrounds, and a thriving arts and culture scene. Also, I love outdoor activities and Philly, plus the surrounding areas, has several options to satisfy my biking, climbing, and skiing urges. One hidden gem is QU Japan Bistro & Bar. It was one of the first restaurants I tried after moving to Philly, and it was really good.

And finally, are you currently accepting rotation students? If so, do you have any exciting projects in mind?

I am accepting rotation students! I officially started my lab in the summer, and we're excited to establish a fun and supportive lab culture for new students. One of the projects we're working on is developing some new sensors to detect signaling pathways during development. We're planning to use CRISPR technology to record the signaling histories of cells during

brain development. These histories are recorded in the animal's genome as barcodes that we can later recover and analyze through sequencing.

Edited by Amber Abbott



Research Spotlight

Controlling the traffic flow in Endothelial-to-Hematopoietic Transition

Yee Hoon Foong

In the developing embryos, definitive hematopoiesis arises from precursor endothelial cells in a highly conserved process termed endothelial-to-hematopoietic transition (EHT). During this conversion, a subset of hemogenic endothelial (HE) cells in the aortic region undergo waves of transcriptional, epigenetic, and pathway remodeling to adopt a hematopoietic lineage. This is accompanied by a morphological shift in which the HEs adopt a rounded shape and break away from the tight junction of neighboring cells to form an intra-arterial cluster (IAC). The IACs are endowed with hematopoietic stem cell (HSC)-potential and upon migration to the fetal liver niche, they mature and expand to sustain the adult HSC pool.

Dr. Qin Zhu is a recent graduate from the Genomics and Computational Biology graduate program who lately published his seminal thesis work on elucidating the molecular underpinnings of EHT in the journal *Blood*¹. Zhu's work revolves around the emerging trend in the field of regenerative medicine: using patient-derived HSCs for the treatment of hematologic disorders. "It remains a critical challenge to find matched healthy bone marrow donors for hematologic malignancies, and this issue is accentuated in patient minorities of mixed ethnicity. One of the ultimate goals of regenerative medicine is to derive patient-specific HSCs from a patient's own cells, such as blood vessel cells and induced pluripotent stem cells (iPSCs). Even though significant efforts have been made, there are so far no robust methods for production of HSCs outside the human body," explains Qin. Indeed, although



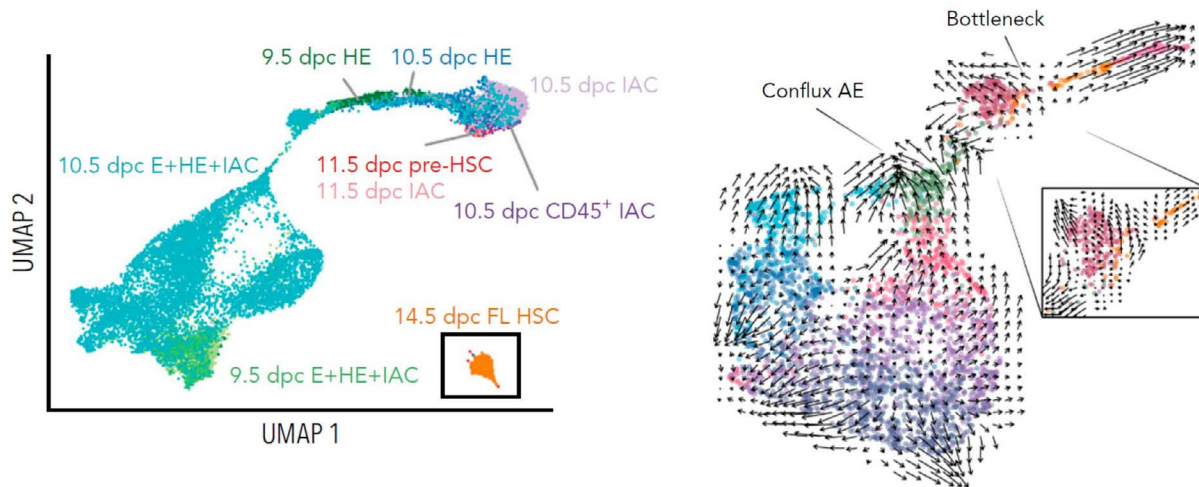
Dr. Qin Zhu

Acronyms:

E= endothelial
EHT= endothelial-to-hematopoietic transition
HE= hemogenic endothelial
HSC= hematopoietic stem cell
HSPC= hematopoietic stem and progenitor cell
IAC= intra-arterial cluster
LMP= lymphomyeloid-biased progenitor

the ontogeny of the hematopoietic system has been well mapped out, the spatiotemporal dynamics of key transcription factors and signaling pathways driving EHT remain understudied, largely hampered by low cell numbers in developing embryos that precludes bulk sequencing technologies.

To tackle this, Zhu et al. leveraged single cell RNA-sequencing (scRNA-Seq) and single-cell assay for transposable-accessible chromatin sequencing (scATAC-Seq) on endothelial (E), HE, and IAC cells. By profiling 40,000 cells from the caudal arteries of mouse embryos aged 9.5 days post coitus (dpc) to 11.5dpc, they delineated the developmental trajectory from E to HE to IAC cells. Through this analysis, they identified the rate-limiting step of developmental trajectory



UMAP of continuous EHT trajectory from E to HSC cells (Left). RNA velocity plot reflecting differentiation dynamics along the EHT trajectory, with inset enlargement showing pre-HE cells accumulating at the “developmental bottleneck” (Right).

(“developmental bottleneck”) which is regulated by a key regulator Runx1, providing an entry point for potential therapeutic interventions.

By applying uniform manifold approximation and projection (UMAP) on their scRNA-seq datasets, Zhu et al. showed a continuous trajectory from E to IAC cells that could be further categorized into seven distinct subpopulations based on their transcriptomic signatures. At the base of the UMAP were two streams of arterial E cells with distinct Wnt signaling levels that eventually converge towards the HE and IAC lineages. Interestingly, E cells from vitelline and umbilical arteries contribute to one of the streams, whereas cells from dorsal aorta contributes to both streams, suggesting E cells with different molecular signature and loci may converge towards a common developmental fate.

Layering their UMAP with pseudotime trajectories and RNA velocity, Zhu et al. discovered that the RNA velocity was markedly reduced before the HE stage, potentially suggesting a differentiation barrier that limits a cell’s progression towards HE. This was mirrored by an accumulation of a distinct cluster of endothelial termed as pre-HE at the developmental bottleneck. Analysis of key marker genes suggested Runx1 as the predominant factor that regulates the passage of cells through the developmental bottleneck. To test the effects of Runx1 dosage level on cell fate

determination, Zhu et al. performed scRNA-Seq of AE, pre-HE, HE, and IAC derived from Runx1 haploinsufficient embryos (Runx1 +/-) and their wildtype littermates (Runx+/+). They found that Runx1 haploinsufficiency increased the proportion of pre-HE while reducing the fraction of HE and IAC cells. The opposite trend was observed when they ectopically overexpressed Runx1. The findings validated their speculation of Runx1 as a gatekeeper that controls the flux of pre-HE cells through the bottleneck to become HE cells. Along with studies from other labs, Zhu et al. highlighted how the spatiotemporal expression of Runx1 are intimately tied to the EHT process.

To unbiasedly identify the transcription factors that modulate Runx1 expression, the authors performed tandem scRNA-Seq and scATAC-Seq on 10.5dpc CD44+ E, HE, and IAC cells. By assessing the differential transcription factor motif patterns on open chromatin, they discovered that the binding sites of HSC-specific transcription factors, including Runx1, become more accessible in pre-HE stage, indicating the concerted action of HSC-specific transcription factors in driving pre-HE to HE transition.

By integrating their scATAC-Seq data with a novel computational approach, the authors further

Penn Genetics Awards of Excellence

Tom Kadesch Prize in Genetics - recognizing graduate student excellence in research and citizenship



Qin Zhu

Kai Tan & Junhyong Kim Labs

Graduate Group in Genomics and
Computational Biology

“Understanding gene regulation in
development and differentiation using
single cell multi-omics”



Dr. Qin Zhu was awarded the 2021 Tom Kadesch Prize in Genetics in recognition of his excellence in research achievement and citizenship.

mapped out enhancers whose chromatin accessibility significantly correlated with Runx1 expression. They identified one candidate enhancer located 371kb upstream that may potentially drive Runx1 expression during the pre-HE to HE transition. Interestingly, this candidate enhancer harbored GATA, STAT, and JUN transcription factor motifs, suggesting that these factors may orchestrate Runx1 expression.

Lastly, Zhu et al. investigated the derivation of IAC from HE cells, and the composition of IAC cells. Principal component analysis (PCA) overlaid with scRNA-seq expression showed that the cells repress the arterial E gene signature and activate hematopoietic genes during the HE to IAC transition. The authors further discovered that IACs are composed of at least two distinct hematopoietic stem and progenitor cell (HSPC) subtypes, committed lymphomyeloid-biased progenitors (LMPs) and pre-HSCs. These two subtypes arise sequentially, with LMPs enriched on 10.5dpc and pre-HSCs enriched on 11.5dpc. However, the LMPs appear to be more developmentally “mature” as compared to the type II pre-HSCs, suggesting that they are more driven towards terminal differentiation.

“This work would not be possible without the joint efforts of Dr. Kai Tan’s team, who pioneers in systems

biology and single-cell genomics, and Dr. Nancy Speck’s team, who specializes in HSC formation and function,” Qin remarks.

Commenting on future experiments, Qin states, “One future direction is to figure out the exact function of the distal enhancer of Runx1. Previous literature suggests that this enhancer is capable of driving reporter gene expression in the intermediate cell mass and posterior blood island of zebrafish embryos, but it remains to be shown that the enhancer directly regulates Runx1 expression in pre-HE and HE cells.”

Together, this groundbreaking work by Zhu et al. provides new insights into the process by which endothelial cells differentiate into pre-HSCs and pinpoints the rate-limiting step, which could be exploited to potentially render autologous HSC transplant a more viable and scalable therapeutic plan.

Edited by Kay Labella

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they

them

Katie Rainbow, Unsplash

Special Interest

Gender-neutral pronouns and their journey: Renaissance of ‘They’

Kanika Jain

Merriam-Webster recognized ‘they’ as its 2019 Word of the Year based on the number of dictionary look-ups, and introduced the gender-neutral honorific ‘Mx.’ to their unabridged dictionary. Singular ‘they’ was added to its online dictionary in September of 2019, with the definition - ‘used to refer to a single person whose gender identity is nonbinary (does not conform as either male or female)’ added to the previous description.

A landmark achievement in the recognition and acceptance of non-binary identities in our society; this was long overdue.

Acknowledgement of genders beyond the binary and the fluidity of gender expression is becoming increasingly normalized with multiple people including their pronouns in public-facing identifications such as email signatures, Twitter bios, and conference name-tags. For many, recognition of gender neutrality is another righteous fruit of the modern era. For others, it has been the culmination of a long-drawn battle spanning decades. On March 27 2017, Time magazine’s cover page read: ‘Beyond He or She’. In June 2017, the District of Columbia’s residents became the first people in the United

States to be able to choose X as their gender marker instead of male or female on driver’s licenses and identification cards. This year, on June 30, 2021, the State Department announced that it will be updating its procedures to allow applicants to self-select their gender marker for passports and that it “will no longer require medical certification” if an applicant’s self-selected gender marker does not match the gender listed on other official identity documents. Recently, popular singers Sam Smith and Demi Lovato publicly came out as nonbinary, and stated that they should be referred to using ‘they/them’ pronouns.

To understand the concept of gender fluidity and the significance of commonly recognized gender neutral pronouns, one needs to understand the difference between the terms ‘sex’ and ‘gender’, which are neither the same nor interchangeable. Sex is a biological characteristic based on chromosomal factors and sex characteristics such as genitals. **Body parts don’t dictate gender.** Gender is a social construct and refers to how an individual perceives themselves, navigates the world through identity (pronouns, names, etc.), their dressing style, and mannerisms (feminine, masculine). While some people identify with binary

identities (male or female), some individuals identify as both or neither. Genderqueer individuals may experience identity in a way that does not exclusively conform to the concepts of masculine or feminine, while gender-fluid people may experience their gender as ever-shifting rather than being static.

Pronouns are the words used by others to address someone in place of their proper name. Common examples include he/him/his, she/her/hers, and they/them/theirs. Pronouns often reflect society's perception of one's gender. Many people are cisgender (*cis* means "on the same side as"); that is, their gender aligns with the sex assigned to them at birth. For example, a cis-female is someone whose self-identified female gender is the same as her birth-assigned female sex. Hence, cisgender individuals do not have to think twice about how others refer to them. However, for people who are transgender (*trans* means "on the opposite side of") or genderfluid, their gender identity does not match their sex assigned at birth, and pronouns are a reflection of their identity in society.

Gender neutral pronouns like 'they/them/their' can be adopted by transgender, genderqueer, or gender-fluid individuals. Examples of the singular 'they' being used to describe someone whose gender is not known dates back as early as 1386 in Geoffrey Chaucer's *The Canterbury Tales* and Shakespeare's *Hamlet* in 1599. However, what makes the singular 'they' special in modern use is that it is now accepted as a pronoun of choice for someone who does not identify as either male or female intentionally (*of note, not every nonbinary person may use they/them or otherwise 'nontraditional' pronouns*). Perhaps not unexpectedly, some traditionalists in the field of language are not fully on board with this idea. Although the *Chicago Manual of Style* (one of the most esteemed style guides in use at US academic institutions) acknowledges the use of

they/them as an individual's chosen pronouns, it is still hesitant to accept their use in formal writing.

Historically, there have been multiple attempts to find and recognize gender-neutral pronouns for the English language. From *thon*, *ip*, and *hiser* to *hem*, *ons*, and *lers*, these discarded terms have piled up since the mid-19th

century. Pronouns *ne*, *nis*, *nir*, and *hiser* were proposed and briefly used around 1850. *Thon* was coined by the Philadelphia lawyer and hymn writer Charles Crozat Converse in 1884. Unlike most epicene (of indeterminate sex) pronouns, *thon* was recognized and accepted by two major dictionaries and adopted by a few writers (*Thon - a blend of that and one*). Soon after, in 1886 a writer in the *New York Evening Post* offered *his-her* as 'a hermaphrodite pronoun'. In 1890, a report in the *Rocky Mountain News* recommended *hi*, *hes*, *hem*, none of which saw

widespread use afterward. And so, the saga has continued into the present. Variants like *xie/xir/xem* or *ey/em/eir* have been in use by some people. Acceptance of singular 'they' by Merriam-Webster is therefore an important milestone even in the evolution of the English language.

At the dawn of the 19th century, the search for gender-neutral pronouns became pertinent to the women's suffrage movement. 'He' had been in circulation as the gender-neutral pronoun of choice since 1745. Words like 'mankind' and 'citizen' were meant to imply 'everyone'. However, the reality, as per law, hit everyone after the Civil War. The language of the Fourteenth Amendment, which granted citizenship and voting rights to the newly freed slaves, defined voters as 'males over 21', stripping black women of any voting rights until 1920. In 1872, Susan B. Anthony and fifty other women were jailed for registering to vote in Rochester. In response, Ms. Anthony took to lecture halls to create awareness about the lack of 'she/her/hers' in the tax and criminal laws. She pointed out 'I insist if government

“When one is addressed with the incorrect pronouns, it can make them feel disrespected, invalidated, dismissed, alienated, or dysphoric, and often, all of the above. It is a privilege not to worry about the pronouns used by society to address you.”

officials may thus manipulate the pronouns to tax, fine, imprison, and hang women, women may take the same liberty with them to secure to themselves their right to a voice in the government'. Discounting her plea, Ms. Anthony was pronounced guilty by the court and lost the case. In 1869, Myra Bradwell, who, having passed the state bar examination, was refused a license because she was a woman, petitioned the Supreme Court of Illinois. Bradwell cited the state's interpretation rule: "When any party or person is described or referred to by words importing the masculine gender, females as well as males shall be deemed to be included." However, the Illinois court denied Ms. Bradwell's petition, simply stating that the state's interpretation rule did not apply.

Just like any language or legal laws, our socialized assumptions about appearance and gender identity also need to change and grow. Expectations for gender expression are often based on gender stereotypes like 'girls wear skirts'. The validity or lack thereof of these stereotypes is something we are all navigating together, that is shifting to a mindset of, 'just because someone wears a skirt does not mean they are a girl'. **Physical appearance should not be the yardstick used to estimate a person's pronouns.** Asking about and correctly using the specified pronouns is pertinent to showing respect for them as a human being. **When one is addressed with the incorrect pronouns, it can make them feel disrespected, invalidated, dismissed, alienated, or dysphoric, and often, all of the above. It is a privilege not to worry about the pronouns used by society to address you.** If you share this privilege, yet fail to respect someone else's gender identity, it may not only be disrespectful and hurtful, but oppressive.

And so, the question is, do we as a society still underestimate the importance of inclusive pronouns? Do we finally recognize their use as a symbol of equal rights for women, LGBTQ+ individuals, and any other demographic of the society? Have we learnt our lesson?

Unfortunately, when it comes to STEM fields, recent data shows that LGBTQ+ individuals are 17-21% less represented. According to a study conducted by the American Physical Society, approximately 15% LGBT men, 25% LGBT women and 30% gender-nonconforming individuals feel uncomfortable within their department. The study also revealed that trans- and gender-nonbinary individuals often face a hostile environment and exclusionary behavior at work. At Penn, a dated survey from all 12 schools indicated that only 3% of the faculty identify as LGBTQ+. These mortifying numbers are a call for each one of us to

widen our understanding of gender-neutrality, and make our workplace a safe and inclusive environment for everyone. Change begins within!

Edited by Kay Labella and Patricia Colosi

“According to a study conducted by the American Physical Society, approximately 15% LGBT men, 25% LGBT women and 30% gender-nonconforming individuals feel uncomfortable within their department.”

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Special Interest

Creative CAMB-ers: Catching up with our Artistic CAMB Students

Aishwarya Pawar & Hannah Kolev

We have long suspected that there is more to CAMB students than their scientific expertise and research acumen. To test out our hypothesis, we set out to investigate CAMB scientists and their accomplishments beyond science. We interviewed three brilliant CAMB students about their artistic pursuits. Here are the results of our investigation.

Karen Wong (K.W.), a fifth-year DSRB candidate, is a traditional media artist who uses a variety of art media to create her pieces and displays them on Instagram.

Bailey Nance (B.N.), a fourth-year CB candidate, is an artist and a painter who also likes to doodle.

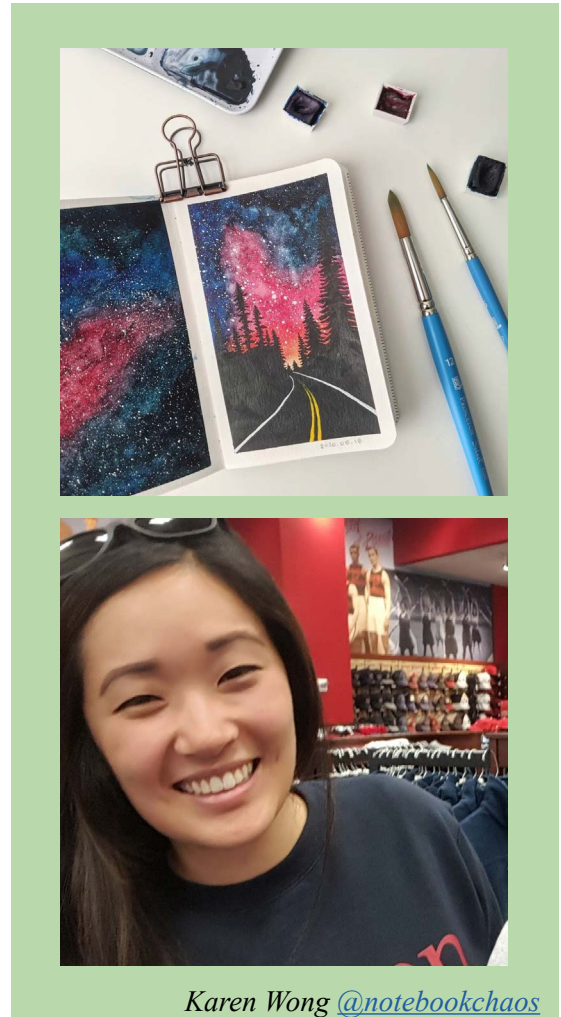
S Fallacaro (S.F.), a first-year DSRB student, is one of the talented founders of *AtticArcana* where they mold handmade resin dice sets.

How would you describe your creative hobby?

K.W. One of my creative hobbies is making art using traditional media like watercolor, gouache, colored pencils, markers, and ink. I started out painting landscapes but have enjoyed trying out many other media as well.

B.N. My creative hobby is painting and drawing.

S.F. I would describe my hobby as crafting innovative handmade resin dice. I started out pouring resin dice sets for Dungeons & Dragons which have 7 dice with varying numbers of sides (4, 6, 10, 10, 12, and 20) with my best friend. Recently, we've branched out to create jewelry from our dice. We've affectionately called our dice studio Attic Arcana, since we started in our attic, and we like to say that we make eldritch magic that you can hold and roll!



Karen Wong @notebookchaos

How did you first get involved with this activity? When did you start and how did it evolve over time?

K.W. As a kid, I was not very artistically inclined, but after college, I worked a 9-5 job which gave me time to explore new hobbies and I got into painting. Over time, I became exposed to other media and styles. During the lockdown, I got into urban sketching since it's a COVID-friendly activity that also encouraged me to leave the house and spend time outside.

B.N. I have been drawing and doodling for as long as I can remember. Over time, I was able to evolve by drawing inspiration from different artists and [from] my teachers who taught me how to create more meaningful and thematic pieces. By remaining passionate about my art and remaining consistent, I evolved my skill set and found my style.

S.F. My best friend and I started getting into resin crafting back in July of 2020 when the world was shut down, and since we were and still are roommates, we wanted to pick up a new hobby together. As avid D&D enthusiasts and dice collectors, we started getting curious as to how dice are made. This curiosity eventually turned into us creating our own unique dice creations. Our craft space in our attic quickly became a substitute lab bench for me. We started out slowly first just making replicas of dice we already had to get used to the craft. Eventually, we started designing our own dice and symbols to put on the dice and rendering them on our laptops to 3D print. From our 3D prints, we're able to make our own silicone molds and pour epoxy resin to create a dice set that we can polish and ink in the numbers. Our dice have really evolved over time since we've been able to keep designing new dice and have been perfecting and reinventing resin techniques to really make our dice a piece of art. Very recently, we have taken a new direction and have started incorporating our dice into jewelry. This is still very much a work in progress, but we've had a wonderful time trying to innovate our existing hobby as much as possible.

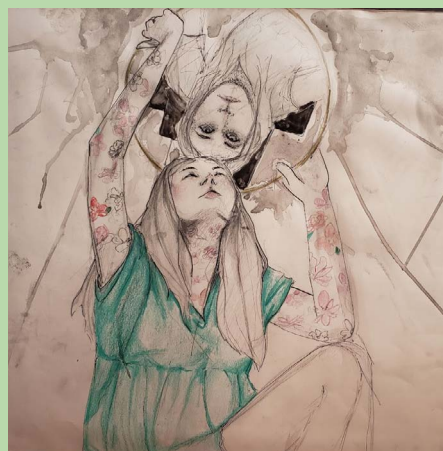
How do you balance your creative hobby with graduate school and research? Are there any parallels you see between your creative process and your scientific method?

K.W. I try to carve out time during the week for art, whether it's 20 minutes in the evenings to draw or 2 hours on the weekend to paint. I'm not always successful at making time, especially during the busier swings of grad school, but I've found that maintaining consistency is key. If I take even 10 minutes to sketch before bed, my mind usually feels more settled.

B.N. With grad school being so all-consuming, it's really hard to separate me from my science and pick up a paintbrush or a pencil. Although I may not balance my art with my science as well as I'd like, I think being a sci-

entist is inherently creative. Having a flexible mind-set and being innovative while solving problems with experiments is the same thing that I do when I create or draw.

S.F. There are many parallels between my creative process and the scientific method. This hobby started out as a craft to do during quarantine as a substitute for lab bench work. Each time something failed in my crafts whether it be the resin not curing, too many air bubbles, or coloring techniques going wrong, I would try to reverse my process and create a hypothesis as to why a craft failed. I found myself experimenting on proper ratios of epoxy resin, how to pressurize resin in order to compress microbubbles, [and] how water content within dyes can change how the resin is cured. I also keep notes on what works and doesn't work when I'm experimenting with new techniques. It's very similar to working in a lab and learning through experimentation and failures.



Bailey Nance [@bnance.art](https://www.instagram.com/bnance.art)



S Fallacaro [AtticArcana](#)

What inspires you to make new pieces? Is there a piece of your art that you are extremely proud of? How did you get inspired to make it? Can you share a picture/link?

K.W. Nature is a huge source of inspiration for my art – I love using photos from past hikes and camping trips as reference photos for landscapes. A few months ago I challenged myself to draw an entire month of birds, so I asked my birder lab-mate to suggest the strangest and most unique-looking birds to use as references. I try to keep my art-making low pressure since it's meant to be a relaxing hobby, so if I no longer enjoy making a piece or participating in a multi-day challenge, I'll stop doing it.

B.N. I feel like I draw inspiration from my experiences and from the world around me. When I get inspiration, it usually comes unexpectedly. Sometimes being reflective, mindful, and looking at your surroundings can be so striking that you just need to create something to celebrate how beautiful or horrifying the world can be. [The piece shown here] is one of the ones I am most proud of. I don't consider it my

best, but when I made it all those years ago, I think I finally discovered how to channel my experiences, emotions, and thoughts into a piece.

S.F. Inspiration can strike at any time. Sometimes I'm really drawn to a color scheme after listening to a song or sometimes I'm really inspired by a particular character from a game that I want to embody in dice. This set imaged here is one of my favorite sets. I had found a collection of dried flowers that inspired me to make this rainbow set of dice.

What advice do you have for other CAMB students interested in starting or maintaining a creative hobby?

K.W. Schedule it into your calendar. Consistency doesn't have to mean a large portion of your time – it can be 10 minutes every other day, or 1 hour every two weeks, so long as you maintain the rhythm. Also, all art goes through an ugly phase.

B.N. For other students interested in starting and maintaining a creative hobby, I encourage you to physically take the time in your schedule and block it off for your creative pursuits. Being a scientist takes a lot of time, but doing something that you really care about (whether it be for your mental or physical wellness) needs to be treated the same as you do for experiments or class. That being said, maintaining a creative hobby is difficult. It takes a lot of practice, a lot of inspiration, and a lot of frustration. But finding a community that also encourages your creative hobby will drive you to become whatever kind of creative that you'd like to be.

S.F. Stick with it! Failures when experimenting - even with creative hobbies – are bound to happen but sticking with it can lead to beautiful results and a wonderful hobby.

We send a huge thank you to Karen, Bailey, and S for sharing with us their art and creative process! Check out more of Karen's artwork at [@notebookchaos](#)! Bailey's art can be found at [@bnance.art](#), and learn more about S's resin dice [here](#)! To find out more about the artists' inspiration and their future plans concerning their hobbies check out an extended version of this interview on our [blog](#).

Edited by Angela Corrigan

Thank you for reading.

For any questions, comments, concerns, or if you're interested in joining our team, please feel free to contact us at:

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