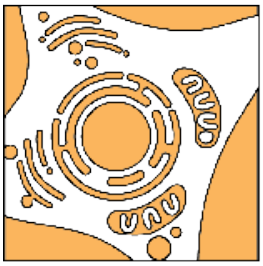
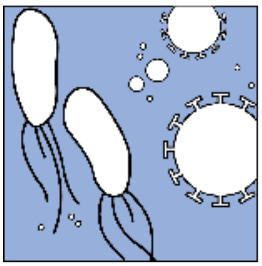




CAMB Student Newsletter

Volume 7 | Issue 1 | February 2022

In this issue

Letter from the Editors

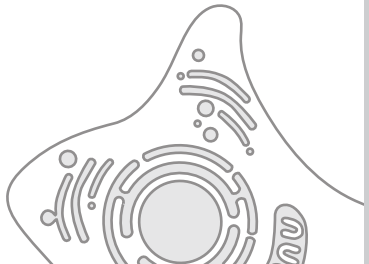
Dear CAMB Students, Faculty, and Alumni,

We are excited to share with you the February installment of the CAMB Student Newsletter! In our first issue of 2022, we dive into the work of **Adam Fenton**, a CAMB Genetics & Epigenetics student whose recent study identifies a role for the TRAK2 motor adapter in regulating bidirectional mitochondrial transport. In a **battle of the non-murine model systems**, we consider the unprecedented value that diverse model organisms bring to biomedical research, and we speak with three PIs to learn why they chose to work with their unique model systems. We chat with **Dr. Jennifer Aleman**, a 2021 alum of the Genetics & Epigenetics program, and learn about her current position as a science grant writer for The College of New Jersey. Finally, we enter the world of **tabletop roleplaying games** and hear from two CAMB students about their first-hand experiences playing Dungeons and Dragons.

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. Current students interested in contributing to the CAMB Student Newsletter can complete our volunteer interest form (here). We hope you enjoy the February 2022 issue!

Sincerely,

Hannah Kolev and James Gesualdi
Editors-in-Chief



Research Spotlight

Mitochondrial Transport: A Two-Way Street

Megan Guerin

Opposing microtubule motors, such as the plus-end-directed kinesin and the minus-end-directed dynein, must work in tandem to actively transport cargo within the cell. Although some cargos are unidirectionally transported by individual motor proteins, a significant portion of cellular cargo is transported in a bidirectional manner by two distinct motor proteins. In the case of bidirectional transport, the opposing motors must precisely coordinate their movements to guarantee efficient transport and localization. Mitochondrial transport is a typical example of bidirectional transport, as organelles are shuttled along the microtubule cytoskeleton by the kinesin-1 (KIF5) family of motor proteins and the dynein-dynactin complex to meet local energy requirements and maintain cellular homeostasis. Bidirectional mitochondrial transport is critical in elongated cells, such as neurons, and transport failures can result in detrimental neurodegenerative disorders like Alzheimer's Disease, Parkinson's Disease, and Amyotrophic Lateral Sclerosis. To date, the exact mechanisms behind opposing motor coordination in mitochondrial transport were unclear.

Under the mentorship of Dr. Erika Holzbaur and Dr. Thomas Jongens, **Adam Fenton**, a CAMB Genetics and Epigenetics student, proposed a novel model to explain the motor coordination behind mitochondrial trafficking, as reported in their recent Nature Communications article. Previous work identified the TRAK/Milton family of proteins as the mitochondrial motor adaptors that connect Miro, the mitochondrial outer membrane protein, to kinesin-1 and the dynein-dynactin complex. Specifically, others have postulated that TRAK1 serves as the motor adaptor that interacts with kinesin-1 and the dynein-dynactin complex in axonal mitochondrial

Adam Fenton, G&E PhD Candidate

transport, whereas TRAK2 serves as the motor adapter that primarily interacts with the dynein-dynactin complex in dendritic mitochondrial transport. However, recent studies have mapped both kinesin-1 and dynein-dynactin binding interfaces to the same coiled-coil region of TRAK2, raising the question of whether TRAK2 can simultaneously coordinate these two opposing motors. Interestingly, neuronal knockdown of kinesin-1, dynein, or dynactin individually is sufficient to inhibit bidirectional mitochondrial transport, suggesting a co-dependent relationship. With these previous observations in mind, Adam Fenton and his mentors aimed to develop a system that allowed them to observe the exact molecular interactions between TRAK proteins and the two opposing motor proteins in question, kinesin-1 and the dynein-dynactin complex.

To examine the functional effects of TRAK2 interaction on kinesin-1 and dynein, the authors devised an *in vitro* single-molecule approach by Halo-tagging TRAK2 in COS-7 cells labeled with a tetramethylrhodamine (TMR)-HaloTag ligand. Next, Fenton and colleagues used total internal reflection fluorescence (TIRF) microscopy to observe the motility of the TRAK2-motor complex in the generated cell lysate. This innovative single-molecule approach allowed the authors to identify three distinct motility patterns: the TRAK2 motor complex exhibited unidirectional movement towards

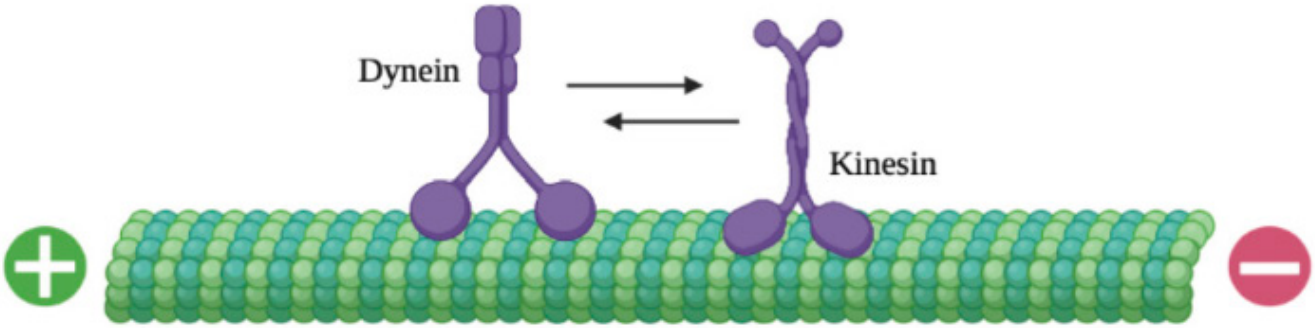


Illustration depicting cytoskeletal movement. Dynein, a motor protein, moves towards the minus-end of the microtubule, whereas the motor protein kinesin moves towards the plus-end of the microtubule. Made with Biorender.com.

the plus-end and minus-end, as well as shorter back-and-forth movements. Despite this variety, the authors recognized that the TRAK2-motor complex favored processive, unidirectional movement towards the microtubule plus-end compared to the short, infrequent, and varied movement towards the microtubule minus-end. Noticing this preference, Adam Fenton hypothesized that TRAK2 was responsible for inducing processive, plus-end-directed transport through kinesin-1 activation.

Aware that minus-end motility was nearly absent in this Halo-tagged TRAK2 motor complex, the authors hypothesized that they were missing a critical component of this motor complex required for dynein activation. One likely candidate for induction of minus-end motility was LIS1, a protein found to activate processive dynein motility in previous studies. Fenton et al. exogenously expressed HA-tagged LIS1 in COS-7 cells with Halo-tagged TRAK2 and used TIRF microscopy to determine what effect LIS1 has on the complex's motility. Adding LIS1 to the Halo-tagged TRAK2-motor complex resulted in increased dynein-mediated processivity and velocity towards the minus-end and no apparent effects on plus-ended movement, suggesting that the TRAK2-motor complex and LIS1 work in conjunction to activate the dynein motor protein.

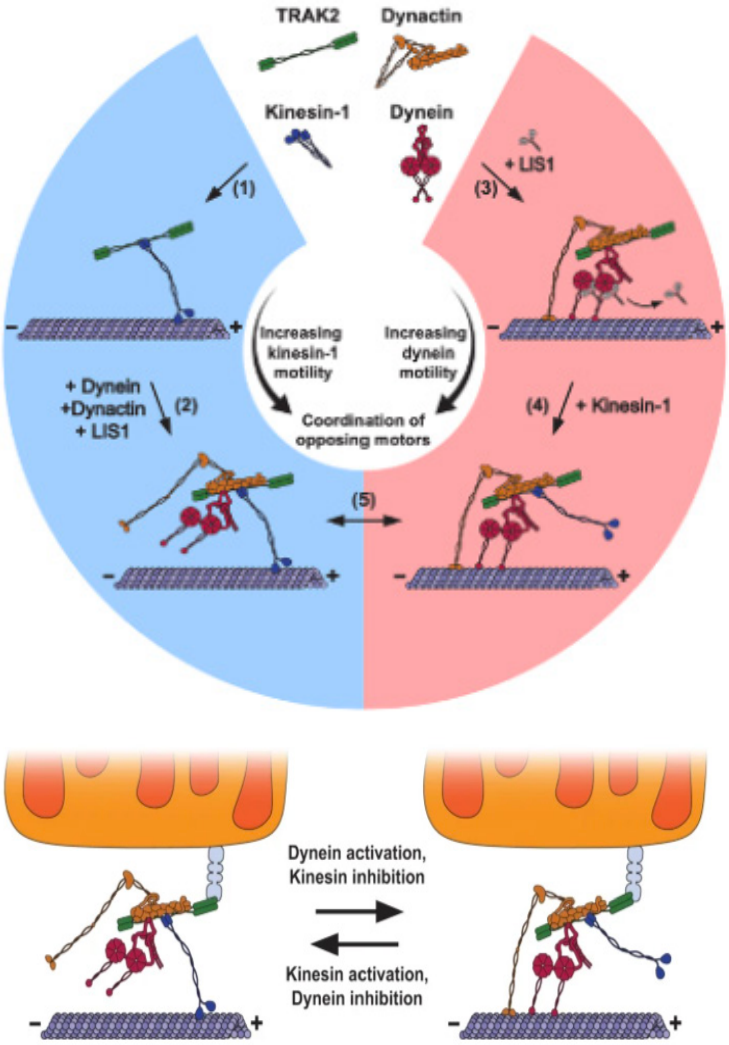
Fenton and colleagues then sought to determine if the TRAK2 CC1-Box, a domain that is conserved amongst dynein activators, is required to activate dynein-dynactin in the TRAK2-motor complex. First, they introduced point mutations within the Halo-tagged TRAK2 and introduced HA-LIS1 back into the system. TIRF microscopy of the co-expressed HA-LIS1 and Halo-TRAK2 in COS-7 cells revealed that mutations within the TRAK2 CC1-Box impaired minus-end motility, suggesting failed activation of the dynein-dynactin complex. Conversely, the plus-end motility remains intact with the point mutations. Furthermore, immunoprecipitation of the mutated Halo-TRAK2 protein, the Myc-tagged kinesin protein KIF5B, and the endogenous dynein heavy chain (DHC) confirmed that the CC1-Box of the TRAK2 protein is ultimately responsible for facilitating its interaction with the dynein-dynactin complex rather than kinesin-1. Taken all together, the authors reasoned that the presence of LIS1 and the TRAK2 CC1-Box domain specifically activates the dynein-dynactin complex.

Fenton then decided to explore further the tandem nature of kinesin-1 and dynein-dynactin in the TRAK2-motor complex. To accomplish this, siRNAs were used against kinesin-1 and dynein in COS-7 cells expressing Halo-TRAK2 alone or co-expressing with HA-LIS1. Interestingly, the authors noticed that siRNA knockdown of kinesin-1, resulted in the near inhibition of plus-ended motility in TRAK2 transport, subsequently confirming kinesin-1 as the primary motor responsible for plus-ended motility in TRAK2 transport. Surprisingly, Fenton et al. also noticed that siRNA knockdown of dynein resulted in a milder plus-ended motility decrease than the kinesin-1 knockdown. It was noted that siRNA knockdown of KIF5B resulted in a decrease of minus-end motility and run length, indicating that kinesin-1 enhances the initiation of dynein in the TRAK2 motor complex. Based on these results, the authors concluded that the presence of an opposing motor protein is beneficial in the initiation of TRAK2 transport by kinesin or dynein, suggesting that the two motor proteins form a co-complex.

Thus far, the field's current understanding of bidirectional transport and the exact role of TRAK proteins were unclear. Previous studies proposed similar but separate functions for the TRAK proteins: TRAK1 was the kinesin-1 motor adaptor responsible for axonal mitochondrial transport, while TRAK2 was thought to be the dynein-dynactin motor adaptor responsible for dendritic mitochondrial transport. However, Adam Fenton's graduate research suggests that this model needs to be adjusted to account for the formation and coordination of a co-complex between two oppositely directed motor proteins. Overall, Fenton et al. proposed a novel model of mitochondrial transport: TRAK2 proteins form complexes with opposing motor proteins and the activities of this complex are tightly regulated to selectively activate kinesin or dynein for transport within the complex.

When asked about what inspires his work, Adam noted, "I'm interested in understanding how mitochondrial homeostasis is maintained in neurons. Mitochondrial transport is an extremely important process in neurons due to their extreme size and shape. We know that TRAK proteins play essential roles as adaptors for both kinesin and dynein on mitochondria during transport, but it was unclear how TRAK proteins could scaffold two motors that move in opposite directions." In the future, Adam Fenton hopes to build a 3D model of the TRAK-motor complexes to better understand mitochondrial transport. To accomplish this goal, he is collaborating with Dr. Yi-Wei Chang of the Biochemistry and Biophysics department to visualize this co-complex *in-vitro* and in neurons with cryo-electron tomography.

Edited by Yee Hoon Foong



Graphical abstract of TRAK-mediated motor protein coordination in bidirectional transport as described by Fenton et al. TRAK2 selectively activates either dynein or kinesin to coordinate plus or minus-ended directionality.

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Claudia Stocker, eLife

Special Interest

Battle of the Non-Murine Model Systems

Yee Hoon Foong and Sylvia Stankov

Model systems are an invaluable tool in the biomedical sciences. They serve as controlled stand-ins when asking questions that would otherwise be impossible to explore in humans. Their vast utility is also matched by their vast diversity. Model organisms range from the humble bacterium *E. coli* to mammals, including mice and non-human primates.

The murine model has traditionally been the preferred model system to study human diseases, while non-murine systems are often underappreciated as less robust counterparts[1,2,3]. A meta-analysis of NIH R01 funding trends from 2008 to 2015 showed a drastic disparity in the award rate between murine and non-murine models: each non-murine model organism makes up only 1-2% of total R01 awards, whilst more than 50% of R01 funding is granted to murine models[4,5]. Dr. Michael Hart in Penn's Department of Genetics agrees that "perceptions can create discrepancies in funding between different organisms."

This article serves to shine a light on the great potential and unprecedented opportunities of non-murine systems in human disease modeling. To this end, we spoke with three Penn PIs on their work using these organisms.

Dr. Michael Hart's (MH) lab "aims to define the role of genes and genetic variants in the generation of behaviors at the molecular, neuronal, and circuit levels." Using a variety of genetic approaches in *C. elegans*, his lab studies the interactions between conserved neurodevelopmental and neuropsychiatric genes, as well as the environment. Ultimately, he hopes to "use *C. elegans* as a system for high throughput screening of genes, variants, and small molecules using behavior as a primary endpoint."

Dr. Eric Joyce (EJ) uses *Drosophila melanogaster* "to determine how chromosomes are functionally organized in 3D space and time." His lab also "[develops] and [utilizes] new technologies that use fluorescent in situ hybridization (FISH) to interrogate chromosome organization at single-allele resolution."

Dr. Guo-Li Ming's (GLM) research "focuses on understanding the molecular mechanisms underlying neurodevelopment and how its dysregulation may contribute to developmental neurological disorders." She uses two complementary model systems: the transgenic mouse system and human induced pluripotent stem cell (hiPSC)-derived 2D neural cells and 3D brain organoids. Dr. Ming is interested in addressing broad topics ranging from neurodevelopment and neuronal maturation to functional regeneration of mature neurons.

Dr. Guo-Li Ming

Dr. Eric Joyce

Dr. Michael Hart

Tell us about your model systems.

MH (*C. elegans*): *Caenorhabditis elegans* (*C. elegans*) is a species of nearly transparent nematode that lives around the globe, eating bacteria in rotting vegetation. Sydney Brenner and colleagues pioneered *C. elegans* in the 1970's as a model organism for research in neurobiology and development. *C. elegans* are primarily hermaphrodites that are ~1mm in length with 959 somatic cells and a ~3 day life cycle; all features that have allowed for pioneering and Nobel prize-awarded discoveries.

EJ (*Drosophila*): The biggest advantage to using *Drosophila* as a model system is its rich history. Decades of reagent and tool building along with a thoughtful community of researchers have made *Drosophila* a super powerful gene discovery tool. As a result, many impactful screens in *Drosophila* have been done over the years, revealing conserved and fundamental pathways governing developmental, cellular and behavioral processes. If the gene has an odd or funny name, it was probably discovered in flies.

GLM (organoids): Organoids are self-assembled three-dimensional cell aggregates generated from stem cells. In the lab, we are using hiPSCs derived from either healthy individuals or patients as the starting material to generate brain region specific organoids (including dorsal forebrain, midbrain, hypothalamus, Arcuate Nucleus, hippocampus and choroid plexus organoids).

Why did you choose to work with these model systems?

MH (*C. elegans*): Of the 959 cells in *C. elegans*, 302 are neurons! C. elegans' small nervous system is the most well-defined of any animal – with every neuron and synapse mapped in complete neuronal connectomes from hatching to adulthood. *C. elegans* generate many quantifiable behaviors that can be defined, in some cases, to the level of single genes functioning in single neurons. This resolution, together with *C. elegans*' adaptability to amazing genetic and neuroscience tools, allows one to ask questions nearly impossible in other organisms.

EJ (*Drosophila*): We mainly use *Drosophila* as part of our research program to identify novel genes implicated in 3D genome organization. Another huge advantage for us is that they only have 3 major chromosomes, allowing us to visualize with imaging tools the entire genome with relative ease. This is virtually impossible in mammalian systems.

GLM (organoids): There are considerable differences in the size, cellular diversity, and synaptic properties of the of the brains between humans and model systems. [Human] brain organoids recapitulate key characteristic features of human fetal nervous system development,

including multiple human-specific features such as human-specific stem cells and astrocytes as well as diverse neuronal types. There are several important caveats, including limited [differentiation] protocol, reproducibility, organoid heterogeneity, and technical challenges in defining cell identity.

How do you see use of this model system changing over time?

MH (*C. elegans*): The biggest changes are in the expanding number of researchers using *C. elegans* and the precision with which researchers can ask questions, permitted by the development of incredible new genetic and neuroscience tools and technologies, including CRISPR/Cas9. These developments have strengthened research in *C. elegans*, where our detailed knowledge of the system allows implementation of the tools at high resolution (i.e. single neurons). The perception of *C. elegans* research seems similar to me over the last decade, with both skeptics and champions of *C. elegans* work across all research communities; I can't count how many times I have been asked if *C. elegans* even have behavior.

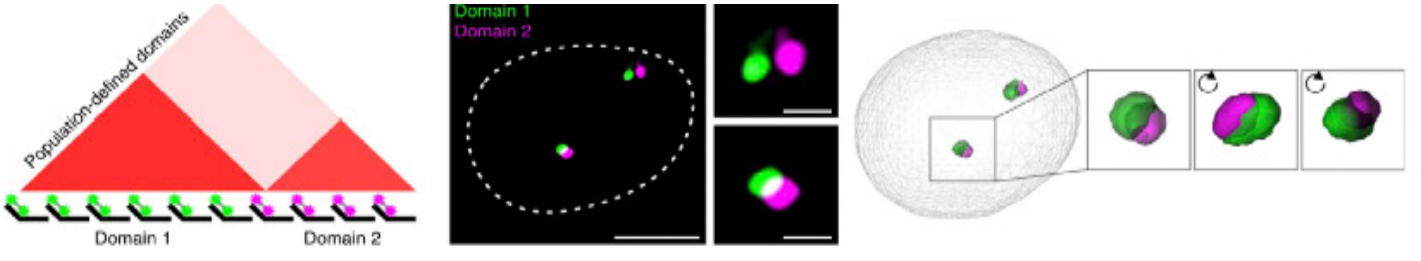
EJ (*Drosophila*): As tools such as CRISPR make genetics research easier and faster in vertebrate systems compared to the past, one perception is that invertebrate systems aren't as necessary. However, invertebrate systems such as *Drosophila* are still the best research bang for your buck for taxpayers money. This, plus the speed at which research can be conducted in a developmental system, means that model system genetics isn't going anywhere for a while.

Instead, we are seeing a trend where labs are moving towards the use of multiple model systems, especially as research becomes more collaborative in general.

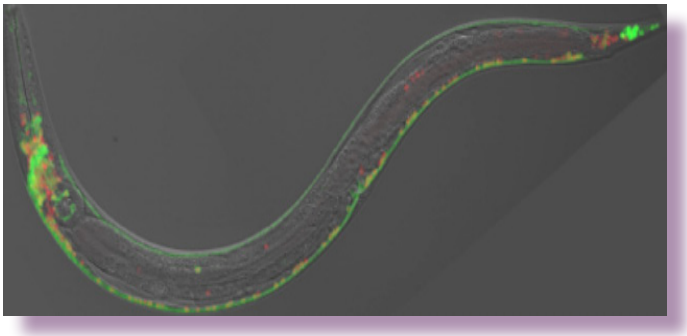
GLM (organoids): The perceptions regarding hiPSC-based 2D cellular and 3D organoid models have changed for sure. I still remember the comments from one reviewer on our first paper using neurons derived from hiPSCs as a model to study mechanisms of schizophrenia. This reviewer basically did not believe that these derived neurons were neurons. Now, it is clear that more and more labs, including [those in] industry, are accepting organoids as models and platforms for basic biology, disease understanding, drug development, and cell replacement therapy.

"Model system genetics isn't going anywhere for a while. Instead, we are seeing a trend where labs are moving towards the use of multiple model systems, especially as research becomes more collaborative in general."

Evidently, these model systems offer unique systems to study basic biology. However, the difficulty in extrapolating findings in model systems to human drug discovery remains a major bottleneck in biomedical research. Only 1 in 5000 drug candidates make it through the discovery stage to the market. This highlights the complexity of human disease and the need for more robust drug screening platforms. The mouse has long been hailed as the gold standard in the drug discovery pipeline due to its evolutionary relationship with humans. However, its size, labor-intensiveness, and relatively slow reproduction have rendered it cost prohibitive for small-molecule screening[1,2,3]. In comparison, non-murine models are more scalable to high-throughput screening as they are low maintenance, fast-growing, and prolific reproducers. In fact, these non-murine models have advanced biomedical research in the neurodegenerative and cardiovascular disease fields[3].



Oligopaint design to label and visualize neighboring TAD domains in Drosophila. Image credit: Luppino et al., 2020



Confocal image of adolescent/late larval stage C. elegans with neurons labeled in green (cholinergic neurons labeled in red).

Years of elegant research have elucidated the familial genes associated with neurodegenerative diseases. However, the signaling pathways and cellular mechanisms underlying the pathophysiology are less well understood, posing a limit on potent drug development.

Since the mid 1970s, *C. elegans* has expanded our knowledge of biological pathways and cell fate decisions. As an evolutionary distant species, *C. elegans* share a surprising 60-80% of gene orthologs and large repertoire of neurotransmitters with humans. *C. elegans* is highly amenable to drug screening for Alzheimer's disease, Parkinson's disease, Huntington's disease, Spinal-Bulbar, and Muscular Atrophy[6,7].

For over a century, *Drosophila* has been instrumental in genetics research due to its anatomical similarity and genomic homology with humans. Like humans, *Drosophila* possess a centralized brain capable of controlling a series of sophisticated behaviors, making them an invaluable compound screening platform for Alzheimer's disease, Parkinson's disease, muscular dystrophy, and Fragile X syndrome.

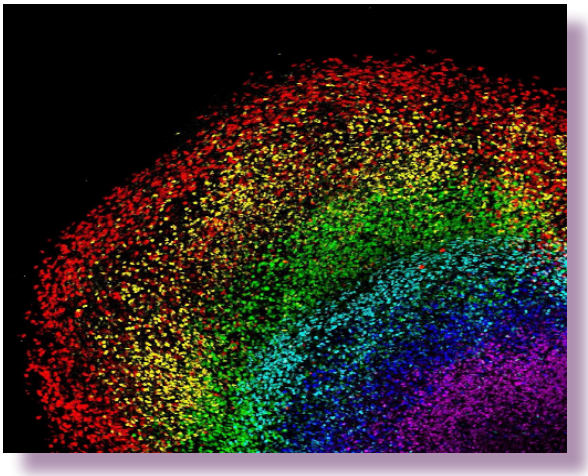
Human organoids were pioneered in the early 2010s in an attempt to bridge the gap between animal models and humans. Human neuronal subtypes and neurodevelopmental processes in the cortex, for example, are profoundly different from animal models.

The advent of technologies to biopsy, differentiate, and culture hiPSCs in 3D organoids allows the generation of personalized models specific to individuals. The organoid provides a milieu that mimics the in vivo developing brain, allowing diverse neuronal cell types to model and assume complex structures.

Furthermore, the methodological exposure to a course of differentiation cues enables the study of various stages of neurodevelopmental and potentially neurodegenerative disease modeling[2].

While mice remain the most preferred model for biomedical research, non-murine models are gaining traction as powerful alternatives to study human diseases. The conservation of key pathways, well-established reagents, and ease of maintenance of non-murine models allow systematic dissection of gene-gene and gene-environment interactions that are otherwise challenging to recapitulate in more complex murine models. We are looking forward to seeing how these model systems continue to progress our understanding of human biology and disease.

If you'd like to read Drs. Michael Hart, Eric Joyce, and Guo-Li Ming's full interview responses, including their takes on the translational value of non-murine model organisms, head to our blog.



The image shows an artificial montage of two confocal microscopy images of a human iPSC-derived organoid with pseudocolored neuronal layers. Image credit: Xuyu Qian

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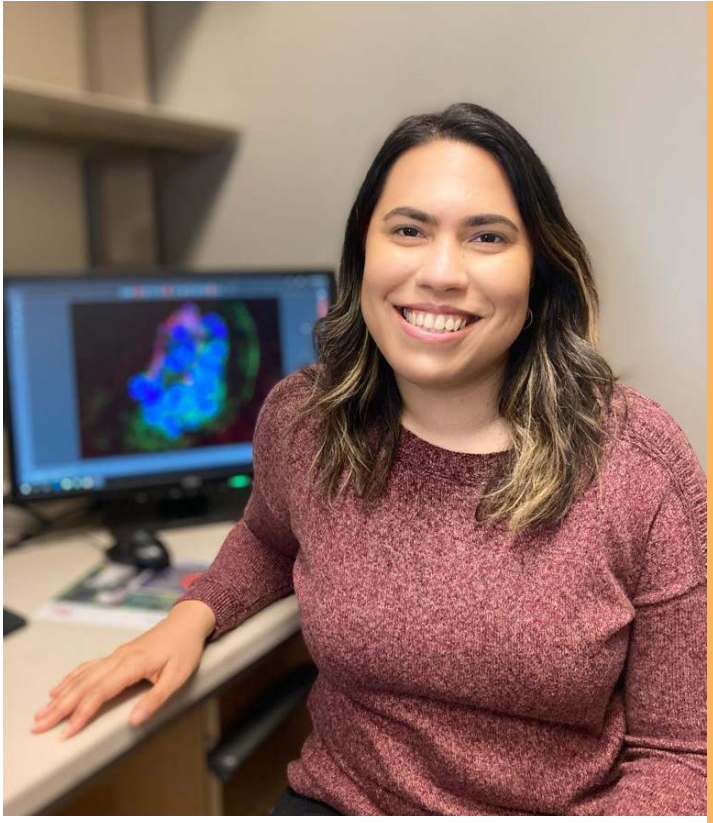
Alumni Spotlight

Jennifer Aleman: Science Grant Writer

Felicia Peng

As STEM graduate students, there are a myriad of non-traditional career paths available to us upon graduation. The problem? It can be hard to know just how broad our options are, and it is entirely possible that jobs well-suited for us can fall under the radar. For Dr. Jennifer Aleman, a 2021 Genetics & Epigenetics graduate from the Capelson lab, science grant writing was not a career path she was aware of throughout graduate school. However, once she learned of a job opportunity in this field through utilizing her network, she realized it would be a good fit for her. As a science grant writer for the School of Science for The College of New Jersey (TCNJ), Jennifer is able to combine her passion for science writing and community engagement in a unique way. We had the pleasure of speaking with Jennifer about her experience as a science grant writer.



Dr. Jennifer Aleman

Can you describe your job as a science grant writer?

My job involves supporting the dean and faculty members in the School of Science (Biology, Chemistry, Physics, Math & Stats and Computer Science) with the development, writing, editing and submission of competitive grant proposals to external funding agencies. I've worked on faculty-based research proposals, collaborative proposals between different institutions, and department/school level proposals focused on Diversity, Equity, and Inclusion (DEI) initiatives.

What does a typical work day look like for you? How would you describe the pace of your job?

The pace of my job ebbs and flows according to grant deadlines and time of year. It's been busier recently as there are many deadlines for grants between NSF and NIH in January and February. A typical day involves answering emails in a timely manner (usually specific grant questions or grant progress check-ins), working on grant documents for faculty members (including the administrative aspects, budget, facilities document, etc.), reviewing faculty member's research description/aims and providing feedback and edits, coordinating/liaising with the College's grant administrators, keeping track of deadlines and always looking ahead to make sure grants are on track for their submission deadlines.

Beyond those day-to-day activities, what else might you be doing any given week?

I hold a weekly faculty writing group meeting, where faculty meet together on Zoom to co-work on writing projects and grants they are working on. This has helped keep a group of us accountable, and a few faculty members have made great progress on grants in this session.

I coordinate NSF GRFP submission for undergrad students by running an application workshop and providing students with feedback on their essays. I have also served on evaluation committees for other scholarships like the Goldwater Scholarship and Fulbright Scholarship. I've worked with these students on their essays as well.

I am in the process of starting up a SACNAS chapter at TCNJ and will be serving as the staff advisor.

SACNAS at Penn was a big part of my graduate experience and being involved in this group really gave me a sense of community as well as support through grad school with their helpful programming. I always wished that I had access to a group like this when I was in undergrad. I am in the process of creating an e-board, and we are planning our first general meeting. We have received a lot of positive interest from students as well as faculty. I hope to keep my connection to Penn SACNAS strong and collaborate with them in the future.

How and when did you find out about this type of job? Was it a career you knew you wanted to pursue early on?

I knew early on in grad school that I'd like to pursue some sort of career in science writing, but I had never heard of or read about this type of position throughout grad school. I actually found out about the position from my undergrad PI (I did my undergrad at TCNJ). Even in my job search I had not come across any opportunities like this, though I think this can be due to the fact that it can be classified by different job titles, such as grants manager or grants administrator.

This position merged many of the job responsibilities/tasks that I was interested in into one role. I get to do science writing and editing and consult with different faculty members about their research; I have administrative grant duties, which I have been learning along the way thanks to the help of some awesome administrators; and I get to interact with students as a mentor, helping them with their writing and now advocating for DEI as their SACNAS mentor. Something that drew me in was the College's openness to have me involved in the community in other ways in addition to science grant writing – helping with other fellowships across campus, involvement with students, and an openness for me to even explore teaching if I am interested.

Is a PhD required for your position? How has your degree helped you in your current work?

A PhD was not required in my role, but I think it was preferred. They were definitely looking for someone with substantial science writing experience. They wanted someone that could interact with PIs to understand their science and provide feedback.

My PhD has given me the prior understanding of how federal agencies like NIH and NSF function, understanding why receiving funding is so competitive and a general understanding of what makes a grant proposal successful. Coming into this role, I was concerned that I didn't have enough grant writing experience, having only been awarded an F31. The process of applying for an F31 has been invaluable to what I do everyday in my job, and I definitely under-valued that experience. Of course, there is always more to learn – I am not an expert in all of the types of grants that I am now helping faculty apply for, and the agencies are often changing rules, guidelines and versions of their forms. But the ability to do research, read directions carefully, and know when to reach out for help has allowed me to successfully navigate this role. There is always something new to learn in the grants world – even when you think you have a handle on the rules and guidelines, something is always changing. I need to stay on top of policies and have fine-tuned attention to detail in this role to make sure mistakes aren't made.

"There is always something new to learn in the grants world – even when you think you have a handle on the rules and guidelines, something is always changing."

What skills are important for being a science grant writer?

Attention to detail: I have to re-read solicitation/RFP/FOA (the many names for "grant instructions") over and over again to make sure I have completed all of the requirements and are staying compliant.

Collaboration: I work with different types of people (PIs) with different types of needs (some want more hands-

on help while others are more independent).

Science writing and storytelling: I help others improve the quality of their writing.

Ability to multitask: I am often working on more than one proposal in a day, so that often means not only switching between grant agencies that a particular grant is for (NIH vs NSF grant guidelines and instructions have distinct formats that are not overlapping), and also switching between different science disciplines entirely (Chemistry vs Biology).

Time management: I have to manage the timing of different submissions, which are sometimes overlapping. I need to make sure all grant documents are completed, compliant and ready to upload the day before submission. Grant submission needs to be coordinated with our institutional grants office, so efficient planning and timing is essential for getting grants submitted on time.

Communication: I am constantly writing emails. You need to keep people updated on your progress, ask questions when you need to, and politely nudge people if you are waiting on a document that's needed.

Any additional advice for students who want to prepare for a job like yours?

I would say the number one piece of advice is to take the opportunity to apply for an F31 fellowship after your preliminary exam. No matter what your career choice ends up being, it is a great opportunity and process to go through. It is especially rewarding and provides great training if you do want to go into some sort of science writing in the future, especially grant writing.

Take other opportunities to write when you can. Write for different audiences if possible (blog posts, CAMB newsletter). Writing for common audiences is a necessary skill in grant writing and science writing in general. I would also say to write as much of your own paper as you can when you are preparing your publication. Ask your PI for feedback and to edit your writing if possible (sometimes they want to re-write for you because it's easier – try to avoid this when you can). This will improve your writing clarity.

Also look for editing opportunities when possible. This may seem futile and not useful to put on a resume, but being able to improve the clarity of someone's writing and to be able to give constructive feedback is a big part of grant writing. Even editing a lab mate's manuscript would be a good editing experience.

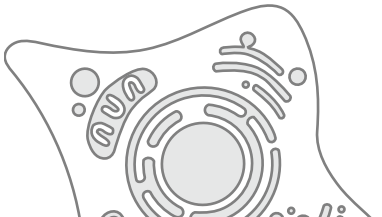
If you are interested in this type of role, I would suggest searching for jobs with different keywords – this job may not always be classified as "grant writer". Search for other terms like "grants manager" and "grants/research administrator". If you are interested in being at a particular institution, go to their career pages and look under staff/administrative roles – these types of positions would be listed there. The job responsibilities I've described in my role fall under "pre-award grants administration". This includes the process of proposal development and budgeting up until proposal submission.

What's the best thing about your job?

Getting to work with faculty that really care about their students' research, training and education. Professors at PUIs are amazing scientists pursuing cool research and they are great educators dedicated to all students' learning. It's been great to see their dedication to their jobs and to the student experience. I am happy that I get to support enhancing PI's research capabilities and also create research experiences for students through the crafting and submission of grants. I benefited both in my undergrad and grad school training with diversity focused grants that impacted my career trajectory and I'm happy to ensure that TCNJ can give the same supportive experience to others.

I've also really enjoyed interacting with students and providing them with feedback on fellowship applications and grad school essays and personal statements. Students are really appreciative of my feedback and I have been impressed to see the improvement in their statements afterwards. I've also been able to make connections with students as a former student and a recent PhD grad and have already become an informal mentor so to speak.

Edited by Amber Abbott



Alperen Yazgı, Unsplash

Special Interest

D&D: Your Turn to Roll

Kay Labella

The tavern door creaks, swinging open before you into a room that glows golden with hearthlight. The clank of mugs and the clink of utensils keeps time for the low, murmuring melody of voices, regulars and wanderers alike enjoying the end of another day. Your party finds an empty table and signals to the barkeep, ordering whatever fare the kitchen's come up with; after all, any hot meal is better than the hardtack, jerky, and dried fruit that comprises your usual trail rations. Before you have a chance to dig in, however, the wall to your right buckles, bows, and bursts, with an explosion that knocks you off your feet and sends your stew flying into a farmer's face with a splat. Through the hole clambers a creature on all fours, red and scaled and belching steam that burns your eyes. Its head swivels in a slow pan across the room, and when it fixes its eyes on you, it hisses, and bristles, and charges.

Let's roll for initiative.

In recent years, Dungeons and Dragons (D&D) and other tabletop roleplaying games (TTRPGs) have experienced a wild surge in popularity, battling their way back into the mainstream after years relegated to the nerdy periphery. 2020 marked the seventh year of monumental growth for the premier TTRPG, with a plethora of new material on the horizon in 2022. With nearly 50 million players worldwide, including many CAMB students (your author amongst them), the questions arise: just what is D&D, and what draws people to it?

Dungeons and Dragons is, at its core, a framework of rules and guidelines through which players collaborate to tell a fantastical story narrated by the Dungeon Master (DM). The DM acts as both a help and a hindrance, guiding players through the world while setting challenges such as puzzles, combat, or tricky situations that they have to navigate their way around. While the D&D rulebooks provide settings in which to play, many games take place in elaborate worlds of the DM's own creation. The hours of time and dedication to create such a rich and robust environment for each game, which might run three to four hours per session, create a unique and engaging experience for the players.

Created in 1974 by Gary Gygax and Dave Arneson, D&D's resurrection nearly 50 years down the line can be attributed to a perfect synergy of circumstances. August 2014 saw the release of the wildly popular Fifth Edition rules (5E), following the widely panned fourth edition; 5E is generally considered friendlier for new players, with a greater focus on fun rather than rules. Shortly thereafter, podcasts such as The Adventure Zone (August 2014), Friends at the Ta-

ble (September 2014), Critical Role (March 2015), and many others provided easily-accessible introductions to the world of tabletop gaming. Around the same time, many celebrities, including Vin Diesel, Jon Favreau, Drew Barrymore, Dwayne Johnson, Stephen Colbert, Anderson Cooper, Ta-Nehisi Coates, Joe Manganiello, and George R.R. Martin began to share their experiences playing D&D, and the game was prominently featured on popular shows such as Futurama and Stranger Things. Altogether, this served to bring D&D to the front of people's minds when looking for a fun new game to play.

Of course, the COVID-19 pandemic has further bolstered D&D's popularity, as players turned to campaigns as a means of staying in touch with friends they can't otherwise see. Enabled by online platforms such as DnDBeyond, Roll20, and Fantasy Grounds, tabletop gaming has drawn players from all walks of life. Tabletop-adjacent hobbies such as dicemaking, mapmaking, drawing character art, and printing and painting miniatures and figures also became popular pick-ups during the early pandemic days.

If you're looking for a game, TTRPGs come in all flavors, from dungeon-crawl to character-driven pirate quest to grand space odyssey to a one-and-done walk in the woods where something isn't quite right. Games are also geared to fit any kind of schedule; some are short, single-session, self-contained stories (oneshots), while others, called campaigns, can have lengthy and complex plots that span multiple sessions over weeks, months, or sometimes even years. CAMB students **Patty C.** (CPM) and **Erin H.** (CB) opened the door to their own games in a short interview, giving insight into the draw of tabletop gaming and the expansive adventure to be had therein.

How long have you been playing D&D? What caused you to start?

Patty (P): I've been playing D&D since high school! About 15 years now. I started because I was already pretty entrenched in the text-based roleplaying community (thanks, Neopets) and I wanted to branch out to play with my non-internet friends. Not all of them were comfortable with writing, but we were all pretty comfortable talking, so tabletop roleplaying games made sense.

Erin (E): Three and a half years; I started playing in the summer of 2018. In medical school, there was a group of us who got really into playing board games together. We would have board game nights every few weeks. The host, a good friend of mine, wanted to introduce the group to D&D and organized a summer campaign with ten of us joining. We had a fabulous time, so much so that every member has kept playing in some capacity since.

What makes it appealing? Why do you play?

P: Escapism, if I'm being totally honest. I really enjoy the character creation process. It's nice to think about being someone else for a few hours. And I like a good story.

E: For me as DM, I was drawn initially to the world-building and creative writing aspects. I began writing the campaign while I was working in the hospital during medical school, as it helped me to relax after the intense days. Beyond that, it's just a ton of fun to hang out with your friends, chow down on snacks, talk in weird voices, and create a dramatic and often hilarious story together.

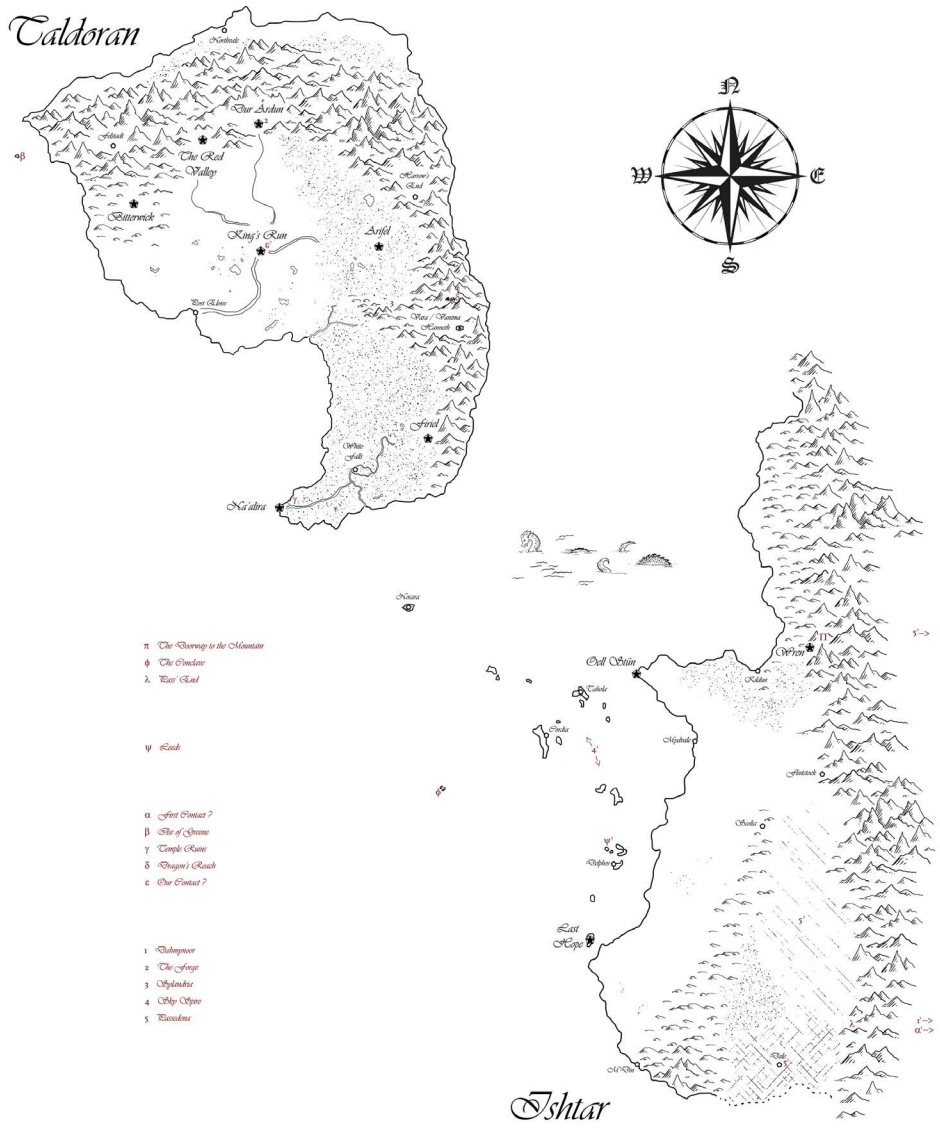
Who do you play with? How often do you play?

P: I play with my partner, my sister-in-law, and my close friends. We all have jobs and school and [other responsibilities] so we don't play as often as we'd like, but when things are nice and calm, we play every other Sunday.

E: We are all science-related; my current group is made up of four MD/PhD students, a lab manager, a postdoc, and a pre-medical student. We always have an hour before we play where we just eat dinner and chat, and a surprising amount of experiment ideas and potential collaborations have been generated during that time. Weekly is the general plan, with time off during holidays, if everyone is particularly busy, or if I simply need more time to plan.

Does your scientific knowledge and background ever come in handy during games?

P: Maybe, only when I'm playing a character that's scientifically inclined. Metagaming* is frowned



Patty's Dungeons & Dragons campaign map.

upon, after all! There are monsters and plants and lore and things that my character wouldn't necessarily know given their background. Right now, one of my characters is an elf warlock that formerly worked as a diplomat. He didn't do much science or nature until he was out adventuring, so there's not a lot of my own technical knowledge that he'd actually have or benefit from. Perhaps the diplomacy skills I've developed from life in academia aid me when my character needs to talk his way out of sticky situations.

E: In playing with a group of science-minded folk, it absolutely comes in handy. I use science as an inspiration for items and plot lines, and my players use it to try and convince me to let them do such things as invent guns and overpower a steam engine.

Do skills you learn in D&D ever come into play in the lab?

P: I'd like to think that D&D has made me a more creative problem-solver. And, maybe, more patient. DMing has certainly taught me about organization and telling a compelling story. Those are helpful skills for planning experiments and writing papers!

E: Absolutely. DMing requires strong communication, organization, and interpersonal skills, as well as the ability to think quickly on your feet. These are all skills which are important for the lab, especially in presenting data during lab meetings and conferences. If you are used to being caught off guard by your players deciding to suddenly go through a dangerous portal, an unex-

pected question about your research seems much more manageable.

What do you think draws CAMB students towards tabletop?

P: That's a hard question. Everyone is different and there are [many] options for tabletop roleplaying games. There is something for everyone, and I think that versatility might be attractive to students. There's no one way to play D&D, for example. A campaign can take on any genre or tone. It depends on the design of the DM and the wants of the players. Tabletop gaming also rewards players for playing – I certainly feel a sense of accomplishment when the party successfully solves puzzles or defeats foes. I cannot always say science rewards me for playing, no matter how clever and creative I think I'm being.

E: It's a social and creative escape from the rigors of working towards a PhD, all wrapped up in the fantasy stories a lot of us grew up reading. What's not to love?

Can you give a brief summary of what your campaign is about?

P: The Harvest Festival is the annual celebration of an accord between the humans of the Rexland, the diverse Free People of the North, the three elf clans, and the dwarves. On the eve of the [Festival], three travelers are unwittingly drawn into a plot to assassinate the leader of the Free People of the North, John Barristone. Blamed for the murder, the travelers must try to prove their innocence and prevent a war between the kingdoms.

E: The campaign started with a simple job offer: a farmer whose wife disappeared ten years ago asked the players to help him find her. Her last known destination was Vaal, her country of origin and a very isolationist nation. After conniving their way in, the players found out that Vaal is a much stranger place than they realized – and that in their search for the missing wife, they may have unleashed forces of an apocalyptic nature.

What has been your favorite in-game moment to date?

P: The party was investigating a location touched by the Shadowfell. Magical despair was leaking into the Material Plane and they were all at risk of succumbing to it. The warlock, able to enter the minds of his companions while they slept, visited his druid friend as she lay in the darkness of her dreams. He asked that she walk with him so that they might find a place to watch the sunrise together. They sat on a hill and waited for the light to break. When it did, she was able to wake up and continue on. It was a poignant moment that none of us expected. There were tears. I think those are the best kinds of moments.

E: The time I was caught off guard by my players deciding to suddenly go through a dangerous portal. One of their allies was trapped through the portal, the plane beyond it poisoning her and anyone else who went through. I expected a fight; I had detailed notes on the enemies and a battle map drawn up and everything. Instead, half my players decided to jump through the portal, and the other half immediately surrendered. I love times like that, when all my preparation goes out the window and suddenly, I'm having to design a new plane of existence and a jailbreak simultaneously.

Do you have any advice for those looking to start playing with a group but don't know how to go about it?

P: I think one of the best ways to begin is to buy a Player's Handbook (for D&D) and explore the lore and game mechanics. I like to know a little about the things I'm doing before I do them (probably other scientists can relate) so do some research! Then check out a local gaming lounge, store, or cafe and ask if there are groups looking for new players. If that sounds scary, try Discord servers or Roll20.com. I hear there are also Facebook groups for players looking to join a party. I'm also certainly happy to speak with anyone interested in trying tabletop gaming!

E: Ask around! There are more of us than you think; you might be surprised which of your friends has played in the past and would be more than happy to do so again. There are also a few board game cafés in town which offer drop-in D&D sessions if you want to try it out in a low-pressure situation.

Edited by Hannah Kolev

D&D Terms Defined

Tabletop Roleplaying Game (TTRPG): A form of improvisational storytelling-based gameplay where a player assumes the role of a fictional character and proceeds through the story by describing their character's actions aloud. Success and failure is determined according to a predefined set of mechanics, often rolling dice.

Dungeons and Dragons (D&D): A fantasy-themed TTRPG first published in 1974. It remains the most well-known and best-selling TTRPG in the United States.

Dungeon Master (DM): The narrator and referee of any game of D&D. The DM determines what story beats will happen and when, what foes or friends characters encounter, and acts as the final authority where the rules are concerned. Also called a game master (GM).

Session: Individual units of gameplay, usually lasting anywhere from 3 – 6 hours. A single adventure may take one to several sessions.

Campaign: A series of related adventures spanning many sessions.

Player Character (PC): The fictional person a player creates and inhabits during their time in the game.

Non-player character (NPC): The inhabitants of the game world who are not the players. NPCs are usually narrated by the DM.

The Party: The collective group of PCs who have gathered to adventure together.

Metagaming: Times when a player uses real-life knowledge about the game or game mechanics to decide how their character will respond to a scenario, despite their character having no reasonable way to have obtained this knowledge.

Encounter: A scene in which the party comes across a source of difficulty that they must use their smarts and skills to solve – be it combat, exploration, or a social matter.

Initiative: The order in which a fight happens.

Caster: A spellcaster.

Tank: A more hale and hearty fighter who can take more damage.

Melee: A character who fights up close and personal.

Ranged: A character who fights from a distance.

Dungeon Crawl: A form of session or campaign in which PCs navigate a labyrinth containing many an encounter – ferocious beasts, puzzles, traps, and, of course, treasure.

D4, D6, D8, D10,D12, D20: Your dice! The number denotes how many sides it has. The D20 is the most commonly rolled.

Crit/Natural 20: Rolling a 20, the highest possible number, on a D20.

Crit Fail/Natural 1: Rolling a 1, the lowest possible number, on a D20.

Thank you for reading.

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camb.studentnews@gmail.com

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