ASDRP
Aspiring Scholars Directed Research Program

[NewsBytes]

Week of July 26 - August 1, 2025

Announcements, Shoutouts, and Accolades

12th Grade & ASDRP Alumni Panel (part 4) - Sunday, July 27 @ 3:00-5:00 PM in person and via zoom

Panelists:

- Ajla Trumic, UC Berkeley '28 (Computer Science / Downing Lab)
- Srishti Venkatesan, MIT ‘28 (Bioengineering / Njoo Lab)
- Pratyush Singh, Caltech ‘27 (Chem E / Njoo Lab)
- Megan Jacab, UCLA ‘26 (Computer Science / Mui Lab)
- Udbhav Avadhani, UCLA ‘25 (Biochemistry, Njoo Lab)
- Anushree Marimuthu, University of Washington ‘28 (Biochemistry, Njoo Lab)
- Grace Zang, UCLA (Biology / Cunha Lab)

The final Sunday Senior Seminars finishes up this weekend with an ASDRP Alumni Panel. Alumni attending UCLA, CalTech, Stanford, Johns Hopkins, Berkeley and more will be on campus and zoom to answer questions, share their successes and tell you about how ASDRP prepared them for research at an R1 University. ASDRP Alumni share honest experiences about college, career paths, research, internships, and life after high school—things students may not hear elsewhere.

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[Link to Public ASDRP Events Calendar]

New Publication from the Wang Lab!

Congratulations to students in the Wang Lab with their latest publication in Journal of Immunological Methods - https://www.sciencedirect.com/science/article/abs/pii/S0022175925000833

Congrats to Shivika Srivastava, Mark Beliaev, Sophie Tan, Vienna Li, Mihika Prabhu, Andy Zhang and Wang Lab Alumni Maitreyi Bharath, Anh Le, Vaishnavi Konda, Anand George, Eben Ginto, and Kushagra Bahuguna and to Dr. Wang's collaborators at Stanford Medical School!

Journal of Immunological Methods 542 (2025) 113883

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Quantitative flow cytometry using quantitative streptavidin-protein G-biotin beads (qBeads)

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qFCM beads
Streptavidin-protein G-biotin

ABSTRACT

Quantitative flow cytometry (qFCM) is a powerful approach for the precise measurement of cellular and molecular characteristics, offering significant advantages in biomedical research, clinical diagnostics, and therapeutic applications. However, current qFCM beads, relying on chemical conjugation face several limitations. This study explored the use of streptavidin-coated beads with a defined quantity of Protein G-biotin for quantitative flow cytometry, demonstrating that these quantitative streptavidin-Protein G-biotin beads (qBeads) can be used for qFCM analysis through both direct and indirect methods, enabling the development of standardized assays for a wide range of applications.

1. Introduction

Flow cytometry is a powerful analytical technique used to measure the physical and chemical properties of cells or particles as they flow through a laser beam. It provides valuable insights into cell surface or intracellular protein expression, as well as cellular changes at the single-cell level by detecting light scatter and fluorescence signals emitted from cells or particles labeled with specific antibodies or dyes. Due to its versatility and high-throughput capabilities, flow cytometry has been widely adopted in biological assays, particularly in studying the functions and identity of cancer cells, stem cells, and immune cells (Cattin et al., 2022; Davis et al., 1998).

Although most flow cytometry applications remain qualitative, quantitative flow cytometry (qFCM) has emerged as a critical tool in both research and clinical diagnostics, enabling the absolute quantification of molecules at the single-cell level (Davis et al., 1998; Fairhead and Howarth, 2015; Hengel and Nicholson, 2001; Manohar et al., 2021; McKinnon, 2018). This quantification is achieved by using calibrated beads with known quantities of antibodies or fluorophores, expressed as binding capacity (ABC) (Manohar et al., 2021; McKinnon, 2018; Maecker et al., 2012; Mittag and Tarnok, 2009). Unlike conventional flow cytometry, which typically provides qualitative or semi-quantitative data, qFCM measures the absolute number of surface or intracellular molecules. This capability offers valuable insights into cellular dynamics, signaling pathways, and therapeutic responses, making qFCM an essential tool for biological analysis. As a result, qFCM has been actively developed for biomedical research, particularly in the fields of hematological malignancies, immune deficiencies, and cancer diagnostics (Maecker et al., 2012; Mittag and Tarnok, 2009). For example, qFCM plays a critical role in monitoring CD4 counts in HIV patients and assessing minimal residual disease (MRD) in leukemia (Mizrahi et al., 2018; National Institute of Standards and Technology, 2016; Wang et al., 2016; Wang et al., 2008; Wang et al., 2014; Gerber et al., 2009).

Current quantitative flow cytometry techniques often rely on chemical conjugation methods to label fluorophores or antibodies onto beads. Several commercial kits, such as Quantibrite™, Quantum Simply Cellular®, and Quantum™, have been broadly used for qFCM. In this

A Few Notes about Attending and Participating in Conferences

1. Students should discuss plans with advisors *early* rather than *late.*
2. Science and continued progress is key…
3. Conference registrations and abstract submissions are typically submitted 5-8 months in advance.

From time to time, faculty at ASDRP may bring their students to a conference outside of the organization to present their work. Typically, it is students who have been working on research for several months to a year who can generate data of sufficient quality to present at a conference, whose abstracts still undergo a review process by the conference, wherein a student's work is measured against the bar in that field of study.

Some conferences, such as IEEE conferences, the American Chemical Society National Meeting, Society for Neuroscience, or ASBMB, are conferences that are meant for industry professionals, postdocs, or postgraduate students. These are quite intense experiences for students to engage in, and every year we have a half dozen or so faculty who elect to bring their students to a conference of this caliber.

Some of these conferences are more student-friendly, and perhaps are catered for undergraduates. For example,

each year, over a dozen faculty bring students to the Southern California Conferences for Undergraduate Research (SCCUR). Typically, conference submissions are due months in advance of the actual conference. For example, the ACS National Meeting, which students from some of our chemistry labs go to every year, is a big national level conference where abstracts must be submitted six to nine months in advance to be considered for the conference that year. This means that kids who go with their advisor to such a conference have been at ASDRP for a year or more.

As is true in publishing work, it is ultimately each advisor's prerogative to identify and decide when a project has reached a sufficient level to present at a conference, which conferences (if any) they will bring students to, etc.

Parent Volunteer Opportunities

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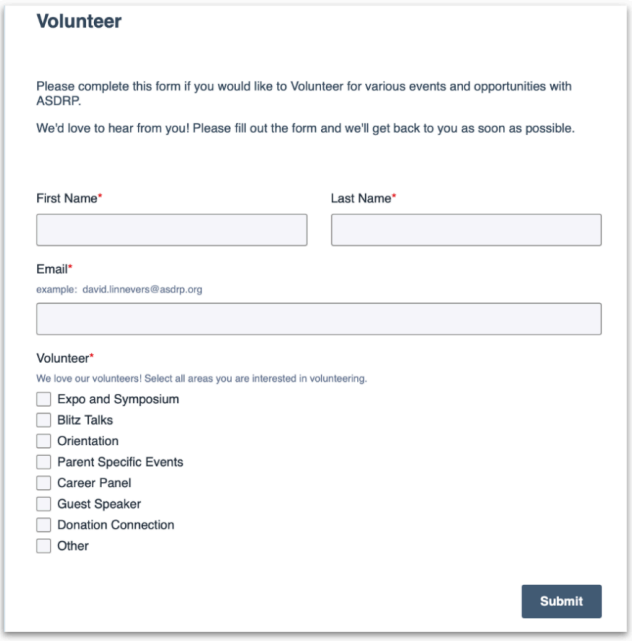
Sept 13:

ASDRP Expo & Symposium

@ Mission College

8:30am - 1:30PM



Volunteer

Please complete this form if you would like to Volunteer for various events and opportunities with ASDRP.

We'd love to hear from you! Please fill out the form and we'll get back to you as soon as possible.

First Name* Last Name*

Email*
example: david.linnevers@asdrp.org

Volunteer*
We love our volunteers! Select all areas you are interested in volunteering.

- [ ] Expo and Symposium
- [ ] Blitz Talks
- [ ] Orientation
- [ ] Parent Specific Events
- [ ] Career Panel
- [ ] Guest Speaker
- [ ] Donation Connection
- [ ] Other

Submit

Parent Volunteers…sign up today! Parent Volunteer Form link - click here.

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In our fifth week of R101 and R201

Last week, both of our flagship research core courses launched officially for the summer semester. Research 101, which is our **"Introduction to Research"** Pre-Work course for first semester students, began with a blast at 9:30 AM with a packed room of our rising freshmen coming together for 101 and donuts. This summer, Dr. Edward Njoo and Prof. Clinton Cunha are our co-instructors for R101, and have spent much time redeveloping the course content with the aim of driving student engagement in connection to other aspects of ASDRP life.

[Research 101 Summary] *This week, Dr. Njoo introduced Module 8, with the aim of describing to new researchers the importance of effective communication skills. The course started with an exercise on catering one's elevator pitch to both a lay and technical audience, and the importance of understanding one's audience in describing one's research aims and goals. The students in 101 have a homework assignment of giving their elevator pitch to their parents. Next, Dr. Njoo shared guidelines and tips for effective slide deck-making, including how to efficiently and coherently structure a slide deck and run in-slide referencing.*

This summer, Research 201, which is mandatory for all second-semester students, launched earlier this month, this time with Dr. Larry McMahan and Dr. Harrison Rahn at the helm. The intention of 201 is to continue the development of hard-core research skills, such as rigorous referencing, literature reviews, and preparing high quality figures, for our second semester students who are now deep in the thicket of research.

[Research 201 Summary] *This week, we launched our third module - Project Planning and De-risking research strategies. This week, the instructional team discussed the importance of pre-planning resource and task-management in research, related to both identification of necessary capital resources, skill sets, and or capabilities to effectively conduct one's research. The team also discussed the importance of "proof of concept" / or "Go / No Go" experiments to determine initial feasibility plans on executing research. A key reading for students is Rzhetsky, et al. Proc. Natl. Acad. Sci.* **2015 -** "Choosing Experiments to Accelerate Collective Discovery". This week, students will be developing a feasibility plan in connection to the aims described in last week's module.

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July 26, 2025 Rising Freshmen @ 9:30 - 10:00 AM on campus - Be there!

For our Summer 2025 Rising Freshmen…

Starting Fresh with Donuts at Dawn for Rising Freshmen

When?
9:30 - 11:30 AM, every Saturday morning **(beginning June 7)**

Where?
In-Person Only, leads directly into in-person R101 each weekend.

Rising freshmen should plan on attending Research 101 in person after
We will be serving breakfast items to our 9th graders at 9:30 AM - 10:00 AM while engaging in freshmen-specific discussions about what they are learning and how they are progressing.
Parents please have them come in person at 9:30 AM
Creating a sense of community, belonging, and collective engagement is all the more important in our youngest students.
Informed by years' worth of data indicating that our freshmen function best in a collective, concentrated environment rather than on Zoom, and also enables our leadership team to create and foster unique community with the youngest members of the ASDRP community.

August 1, 2025 is the kick off date for the ASDRP annual giving and donation drive.

More information about the annual giving and donation drive will be provided closer to the end of July.

Our giving drive goal is $250,000.

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On the Horizon: Upcoming Events

Saturday, July 26

9:30 - 10:00 AM For our Summer 2025 Rising 9th Graders
Starting Fresh with Donuts at Dawn for Rising Freshmen. Be here an enjoy time learning about ASDRP, developing your confidence and skills, and becoming active members of the ADSRP community.

10:00 - 12:30 PM: Summer 2025 Research 101 week 7 (Led by Clinton Cunha) held via zoom.
This week the course will be discussing **Presenting your Research.** *All new student researchers are required to attend.*

11:00 AM - 1:00 PM: Summer 2025 Mini Course: "Protein Folding, Structure and Function" (Dr. Zane Chen).
The structure type determines the function of a protein. A protein's shape is determined by its primary structure (the amino acid sequence). The amino acid sequence within a protein is determined by the encoding sequence of nucleotides in the gene (DNA).

1:00 - 4:00 PM: Tier 2 [Practical] Core Training: High Performance Liquid Chromatography (Prof. Yamamoto)
Prerequisites: Must have completed Tier 1 (Theory) HPLC core training and general safety training. Only open to 2nd+ semester students. No first semester students permitted. Mandatory for all students who wish to be eligible to take Tier 3 (Advanced) HPLC training in the Autumn 2025 semester. ***In person only.*** *Core trainings are offered once per semester in a tiered system. In order to participate in the next tier, students must first complete the previous tier in a previous semester. Sign-ups are available for eligible students on the Laboratory Practicum Canvas Course.*

Sunday, July 27

11:00 AM - Noon: Summer 2025 Mini Course: "Lipid and Fatty Acid Metabolism" (Dr. Joey Pazzi).
Lipids are available to the body from three sources. They can be ingested in the diet, stored in the adipose tissue of the body, or synthesized in the liver. Fats ingested in the diet are digested in the small intestine. The triglycerides are broken down into monoglycerides and free fatty acids, then imported across the intestinal mucosa. Once across, the triglycerides are resynthesized and transported to the liver or adipose tissue. Fatty acids are oxidized through fatty acid or β-oxidation into two-carbon acetyl CoA molecules, which can then enter the Krebs cycle to generate ATP.

3:00 - 5:00 PM: 12th Grade & ASDRP Alumni Panel (part 4)
The final Sunday Senior Seminars finishes up this weekend with an ASDRP Alumni Panel. Alumni attending UCLA, CalTech, MIT, Stanford, Johns Hopkins, Berkeley and more will be on campus to answer questions, share their successes and tell you about how ASDRP prepared them for research at an R1 University.

6:00 - 7:30 PM: Summer 2025 Mini Course: "Statistics and Probability for Data Science" (Prof. Clinton Cunha).
This course provides a rigorous yet practical foundation in probability theory and statistical inference, tailored for data science applications. Students will explore key topics such as random variables, distributions, conditional probability, Bayes theorem, expectation, estimation, A/B testing, bootstrapping, cross validation, hypothesis testing, regression, data variability and much more.

Monday, July 28

10:00 - 11:30 AM: Summer 2025 Mini Course: "Absolutely Small" - an introduction to Quantum (Dr. McMahan).
The purpose of this course is to give an overview of Quantum Physics and how it differs from the classical view of the

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physical world. An historic account of the discoveries leading to Quantum Theory will be presented, along with the equations used to prove those concepts. The results will be used to show how the internal structure of the atom was discovered, and how this affects everything from physics to chemistry to biology. You will not be required to have taken Calculus, but a few tenets of calculus will be presented to explain how the quantum equations were achieved.

10:00 - 11:00 AM: Summer 2025 Mini-Course: "Hit Identification to Lead Optimization in Medicinal Chemistry" (Dr. Edward Njoo). *The success of synthetic chemistry in the identification and development of therapeutic leads is predicated on strategic design of target-driven small molecule programs in approaching molecular mechanisms of disease. In this series we will explore different strategies that have demonstrated clinical success.*

12:00 - 2:00 PM: Tier 1 [Theory] Liquid Chromatography - Mass Spectrometry (LC-MS) training (Dr. Edward Njoo)
Prerequisites: None. Mandatory for all students who wish to independently operate LC-MS systems, and will cover basic operations of single quadrupole and linear ion trap LCMS systems on campus. ***In person only.***

Core trainings are offered once per semester in a tiered system. In order to participate in the next tier, students must first complete the previous tier in a previous semester. Sign-ups are available for eligible students on the Laboratory Practicum Canvas Course.

2:30 - 3:30 PM: Summer 2025 Mini-Course: "Data Analytics and ML with Python" (Dr. Viktoriia Liu). *In this 8-week hands-on course students will learn the basics of Python programming, data manipulation with Pandas and NumPy, and how to create impactful data visualizations using Matplotlib and Seaborn. The course will guide students through building their first machine learning models using Scikit-learn, and dive into deep learning with simple Convolutional Neural Networks (CNNs) using TensorFlow and PyTorch. In the final week, students will explore Explainable AI (XAI) tools to understand how machine learning models make decisions—especially in medical and health-related contexts.*

4:45 - 5:45 PM: Summer 2025 Mini-Course: "Intro to MATLAB" (Prof. Laurienzo) *MATLAB and Data Visualization*
Collecting data is necessary for any type of research, but without the proper computational skills, it can be challenging to see patterns and draw conclusions. In this 8 week course, students will be introduced to the MATLAB language and computing environment, with a goal of making publication-worthy figures for a variety of datasets. From simple functional plotting to high-dimensional data representations, students may expect to elevate themselves from no programming experience whatsoever to having the practical skills necessary to contribute to their research project.

6:00 - 7:00 PM: Summer 2025 Mini Course: "Statistics and Probability for Data Science" (Prof. Clinton Cunha). *In this 8-week hands-on course students will learn the basics of Python programming, data manipulation with Pandas and NumPy, and how to create impactful data visualizations using Matplotlib and Seaborn. The course will guide students through building their first machine learning models using Scikit-learn, and dive into deep learning with simple Convolutional Neural Networks (CNNs) using TensorFlow and PyTorch. In the final week, students will explore Explainable AI (XAI) tools to understand how machine learning models make decisions—especially in medical and health-related contexts.*

8:00 - 10:00 PM Software Training: Docking with AutoDock Vina
AutoDock Vina is a popular molecular docking method used in computational drug discovery to predict how small molecules (ligands) bind to a receptor (typically a protein).

Tuesday, July 29

10:30 - 12:00 PM: Tier 1 [Theory] UV-vis and plate reader training.
Prerequisites: *Mandatory for all students who wish to be eligible to take Tier 2 (Practical) UV-vis and Plate reader training in the Autumn 2025 semester. In person only.*

3:30 - 4:45 PM: Summer 2025 Mini Course: "Creativity Meets AI: The Future of Design Thinking in the Age of

Innovation" (Prof. Sahar Jahanikia).
By the end of this 8-week course, students will understand the intersection of artificial intelligence and creativity, apply design thinking methodologies enhanced by AI tools, and critically assess the ethical and human-centered implications of innovation in research.

7:00 - 8:30 PM: Weekly Colloquia for all ASDRP Student Researchers via zoom. Visit the ASDRP Colloquia Webpage for details & zoom link.

- Department of Computer Science & Engineering
  "*AVY - Aerial surveillance of power lines for vegetation*"
  Nirupama Balaji, Lucas Su, McMahan Lab
- Department of Chemistry, Biochemistry & Physics
  "Synthesis of Carmofur Analogs with Picomolar-Range GUV Rupture Abilities."
  Mansha Gupta, Diya Devendiran, Lillian Chang, Njoo / Pazzi Lab
- Department of Computer Science & Engineering
  "QCY Using machine learning to diagnose spinal defects, injuries and illnesses."
  Mahika Reddy, Avni Saxena, McMahan Lab
- Department of Biological, Human and Life Sciences
  "*Design Thinking and its Application to Healthcare Innovation: an AI-enhanced Framework for Drug Discovery*"
  Jennifer Li, Divya Raghuraman, Ava George, Neha Nagpal, Jahanikia Lab

Wednesday, July 30

9:00 - 11:00 AM: Tier 2 [Practical] Core Training: Microscopy
Prerequisites: Must have completed Tier 1 (Theory) Training and Lab Safety Training, open to 2nd+ semester students ONLY. No first semester students permitted. Mandatory for all students who wish to independently operate high resolution fluorescence or confocal microscopy systems. ***In person only.*** *Core trainings are offered once per semester in a tiered system. In order to participate in the next tier, students must first complete the previous tier in a previous semester. Sign-ups are available for eligible students on the Laboratory Practicum Canvas Course.*

10:00 - 11:30 AM: Summer 2025 Mini Course: "Techniques in the Quantification of Biological Phenomena" (Dr. John Wang / Dr. Edward Njoo).
Remarkably, nearly all measurement of biological function takes place through an optical readout that exists as a proxy for the otherwise unobservable biological phenomena that is being studied. But, what exactly are we measuring? And, how do we go about measuring such things? From cell signaling pathways to surface marker expression, to proximity effects between intracellular agents, this mini course takes a survey of contemporary techniques in how molecular biologists and chemical biologists take precise measurements of biological phenomena, whether at the cellular, genetic, or molecular in scope.

11:30 AM - 12:30 PM, In person only: Summer 2025 Mini Course: "Soft Matter Physics" (Dr. Joseph Pazzi).

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This mini-course will teach you the fundamental physics behind different soft materials we commonly see in everyday life and industry. What gives materials their properties and what are the different models to explain these properties. The course will demonstrate the link between microscopic structure and bulk properties in a variety of soft condensed matter systems including liquid crystals, polymers, colloidal systems and surfactants including biologicals like lipids. This course will have a focus on teaching macromolecular self assembly processes and understanding the physical structures that result. The course will also prepare you to carry out research and read cutting edge scientific articles in the field of biophysics and to write on a scientific topic.

1:00 - 2:00 PM, Zoom: Summer 2025 Mini Course: "Social Minds: An Introduction to Social Psychology" (Prof. Sahar Jahanikia).
This course introduces students to the foundational concepts, theories, and real-world applications of social psychology. Through the exploration of classic experiments and contemporary research, students will develop a critical understanding of how individuals think about, influence, and relate to one another in social contexts. By the end of the course, students will be able to analyze social behavior through the lenses of cognition, persuasion, conformity, group dynamics, prejudice, altruism, and practical application in everyday life.

6:30 - 7:15 PM, via Zoom: Parent Fireside Chat via zoom
This week we will be discussing more about conference attendance and requirements, new guidelines for Drone projects, Expo/Blitz Talks requirements and participation, and getting ready for the school year/how to manage the demands of being in school and being successful at ASDRP.

8:00 - 9:00 PM, Google Meet: Summer 2025 Mini Course: "Introduction to Project Management in Research" (Prof. Clinton Cunha).
As we grow in our lives, we have to find better ways to manage and deal with data, time, and other urgent tasks. In this mini-course, we will focus on the principles of project management and how they can be applied to improve your research project. We will talk about the following: The Project Life Cycle, Frameworks for Project Management, Working with Others, Project Management Software, Project Time Management, Project Planning, Project Implementation, Assessing Project Quality, Project Completion, Applying Project Management in your Research and Beyond. Each week, we will talk about important project management skills that will help you in your research project and beyond. Each class, there will be activities based on the principles of that topic and will have questions which could involve group work. At the end of the course, you will learn how to self-learn and continuously update your knowledge in Project Management.

Thursday, July 31

10:00 AM - 11:00 AM, In person only: Summer 2025 Mini Course: "Theory and Practice in Separation Science" (Dr. Harrison Rahn).
Separation is a key part of how scientists uncover new materials, medicines, and discoveries. In this course, students will dive into the art and science of separating mixtures, from pulling apart differently-sized molecules to isolating substances based on how they interact with their surrounding solvents. They'll explore how changes in phase, like dissolution or crystallization, help scientists create pure compounds, and how tools like chromatography and electrophoresis can sort complex mixtures with incredible precision. Along the way, students will see how mastering separation techniques is essential for planning experiments, solving real-world problems, and pushing the boundaries of chemical and biological research.

12:30 PM - 2:30 PM: ASDRP Summer Soccer Cup @ Warm Springs Community Park

3:00 PM - 4:00 PM, Google Meet: Summer 2025 Mini Course: "Evolution of Astrophysics" (Professor Robert Downing).

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The evolution of Astronomy & Astrophysics over the Millenia, & how they have not only led to the incredible precision today, but also to untold opportunity in Data Mining the immense repositories of observations warehoused by contributing Nations. Periodic exercises will be offered, to be completed at the discretion of the attendee. Practical application of varying types of Machine Learning will be demonstrated using current topics of interest: exoplanets, black holes, other civilizations…

3:00 PM - 4:45 PM, Zoom: Research 201, Week 8, Module 3, Practical three.: (Dr. Larry McMahan / Dr. Harrison Rahn).
Developing and Delivering a Research Plan.
Pitch the final proposal / research summary constructed in Module 2. Students will have developed a rigorous ability to articulate: The general and specific goals of their advisor's research in which they are working, the collective of background information related to their field, including precedent and prior art in the field, the competitive landscape within a project area, as well as a justification for the approach, the specific aims and sub-aims of research within the project, specific audiences for which the proposal might be given to, Actionable plans for accomplishing the goals of research, including a justification for the techniques employed, both short-term and long-term.

9:00 - 10:00 PM: Summer 2025 Mini-Course: "Hit Identification to Lead Optimization in Medicinal Chemistry" (Dr. Edward Njoo).
The success of synthetic chemistry in the identification and development of therapeutic leads is predicated on strategic design of target-driven small molecule programs in approaching molecular mechanisms of disease. In this series we will explore different strategies that have demonstrated clinical success.

Friday, Aug 1

11:00 AM - 12:15 PM: SCCUR Information Session, In Person Only.
Mandatory meeting for students who are interested in presenting research at SCCUR (Southern California Conferences for Undergraduate Research) happening in November this year, who have not previously attended a conference. Primarily for 2nd+ semester students. https://www.sccur.org/.

Saturday, Aug 2

9:30 - 10:00 AM For our Summer 2025 Rising 9th Graders
Starting Fresh with Donuts at Dawn for Rising Freshmen. Be here an enjoy time learning about ASDRP, developing your confidence and skills, and becoming active members of the ADSRP community.

10:00 - 12:30 PM: Summer 2025 Research 101 week 9 (Led by Clinton Cunha/Edward Njoo).
This week's R101 is on scientific and technical writing. Dr. Njoo will be leading this module on how scientists communicate in written form in effective and concise ways.

11:00 AM - 1:00 PM: Summer 2025 Mini Course: "Protein Folding, Structure and Function" (Dr. Zane Chen).
The structure type determines the function of a protein. A protein's shape is determined by its primary structure (the amino acid sequence). The amino acid sequence within a protein is determined by the encoding sequence of nucleotides in the gene (DNA).

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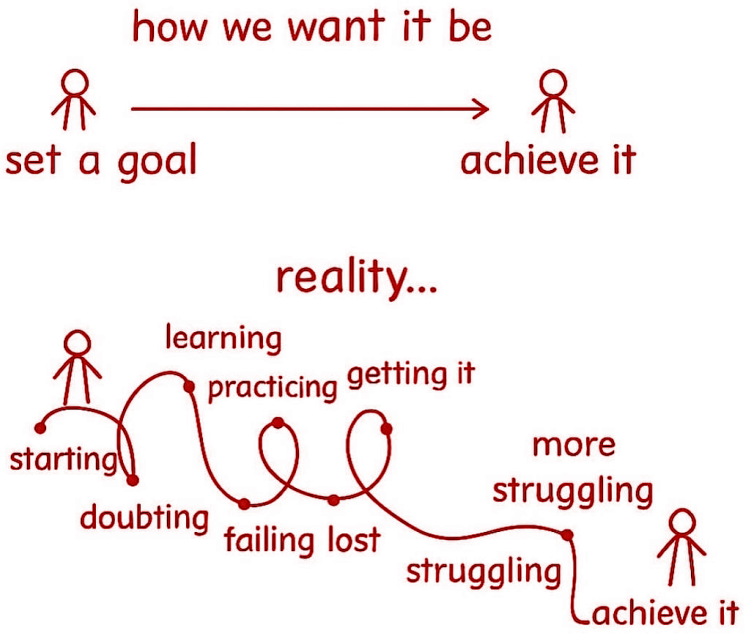
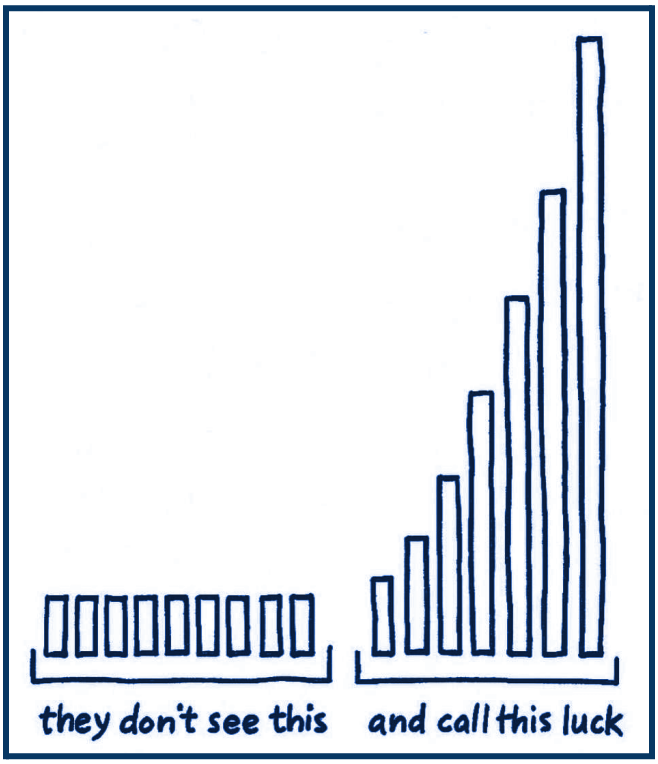
End Note

Growth is rarely instant, success takes longer than we expect and the first step always matters more than we realize….





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