

“Keys to Success”

A guide for undergraduate biology students

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On making the transition from high school to college

- It’s an overused metaphor, but if high school is checkers, college is chess. Most people take from this that college is more complicated and difficult to master. Well, it is, to an extent! But the truth is, if you were successful in high school (a good checkers player), you almost certainly have the skills to do well in college (to become a good chess player). The students who struggle are those who don’t realize that the game has changed. Play by the old rules and you will do poorly, even if they worked before. Prepare to learn new strategies, and you will do fine.
 - Note to students with AP or other ‘advanced’ high-school courses: AP courses are often promoted as college-level, and in many cases the course topics will closely match those listed on an introductory-level college course. However, many years of experience (not to mention some entrance tests) have shown us that most are not, in fact the same as taking the introductory college course, and often do not provide the kind of preparation needed to go straight into an upper-level course. This is why we may give you credit for such courses, but not necessarily let you place out of our intro sequence.
- You are an adult who has chosen to attend college. Your instructors are professionals with, in most cases advanced degrees and research programs. So, college isn’t really more ‘school,’ it is a professional environment (another thing that contributes to the ‘checkers vs chess’ metaphor). See below for more on this.
- Either you or your parents are likely paying for some or all of your studies. They are thus an *investment by you or your family* in your future. This should affect how you approach your studies.

On learning in college

- While you may think of college as just another step in the educational ladder, it is a highly significant one. Throughout your schooling to date, you have been taught simplified versions of the truth, carefully curated to your developing mental ability. In some subjects, it seems like every year starts with something

like: “remember what you learned last year: well it’s not really as simple as that.” And then you learn something more sophisticated, which is *still* not as complex as reality. Well, that ends in college. For example, you will be assigned scientific journal articles to read, and these are the same things actual scientists read. *There is no higher level of information.* Congratulations: you have reached the edge of our rapidly expanding corpus of knowledge, and all of it is at your disposal. That should make you excited! If it doesn’t, perhaps this quote from evolutionary biologist Richard Dawkins might help:

“You could give Aristotle a tutorial. And you could thrill him to the core of his being. Aristotle was an encyclopedic polymath, an all time intellect. Yet not only can you know more than him about the world. You also can have a deeper understanding of how everything works. Such is the privilege of living after Newton, Darwin, Einstein, Planck, Watson, Crick and their colleagues.”

- The biggest, and most common, mistake students make is treating their courses as independent hurdles to be overcome. It is a double mistake: they are neither independent, nor simply hurdles.
 - The main symptom of this attitude is ‘binge-and-purge’ learning, in which students cram all the material for one class into their brain just before the final exam, and once it is over, appear to almost deliberately forget it. Instructors are constantly amazed when we mention a topic that we know has been covered at least twice in earlier classes, and students get a panicked look in their eyes that says, “I didn’t know I would need to remember this!”
 - And it’s not just biology material: there are biology classes that require you to recall, for example how to do algebra or basic calculus, or what an ion is. These are some of the most advanced, and interesting courses.
 - Tip from a department with many neuroscientists: your brain is not like a hard drive with fixed capacity. You do not need to delete old files to make space. You will need those files later!
 - Second tip from a department with many neuroscientists: your brain is also not like a hard drive in that *it’s easy to forget!* You have short-term and long-term memory. Last-minute cramming puts all the information into short-term memory, from which it will quickly disappear. Learning as you go, and reviewing that knowledge, moves it to your persistent long-term memory.
- If it makes you feel any better, the US system of a course ‘menu’ from which you construct your degree does encourage the idea of courses as individual hurdles. But you must fight it. Did you know that in many other countries, undergraduate

degrees are tested by a series of exams at the end of the entire degree, covering all the material learned in the previous years?!

- So: think of your time at NJIT as the construction of a building: an 'edifice of knowledge' where your introductory courses provide the foundation and the upper level courses build on top of those. If you do this...
 - You will succeed in your upper level classes, where you are expected to synthesize more basic knowledge.
 - You will enjoy your classes much more. If you have recalled your earlier studies, you will increasingly find that you can make connections between what you already know and what you are studying now. And this in turn will...
 - ...make it easier to remember the new stuff.
- Don't obsess about grades.
 - If you study hard, you will likely get good grades! But...
 - In real life, it matters what you actually know. So, focus on learning. A good GPA will naturally follow.
 - Know that for many careers, a decent GPA is expected, but it doesn't have to be 4.0.
 - For a few careers, GPA is very important. Getting into medical school is one example. But it is still wrong to obsess, because...
 - ...if you obsess over grades, it is likely to affect your course choices. Sometimes students choose the courses that are reputed to be the easiest, so that they can be reasonably assured of getting an "A." But here's the thing: if you get into medical school (or graduate school, or law school, etc.), it's going to be the real deal. There won't be choices like that. All the courses will be challenging. If you have avoided challenging yourself up to that point, you will be in for a horrible surprise. Professional school is not the place to find this out. So, challenge yourself at NJIT. Take the most interesting, rather than the easiest courses. See what you are made of. Apply to your professional school, or your job, with confidence, and have something interesting to say during the interview. (And you'll likely do better on the MCAT anyway!)
 - Tip: never tell an instructor that you 'need' a certain grade in a course. It will just make them angry. Grades are not, in any way, based on 'need.'
- Sleep! Recall and attention is greatly increased by good sleeping habits: most of us need at least 8 hours of continuous sleep per day (helped by a dark, cool and quiet room, reducing the use of screens before going to sleep, etc.). Cramming before an exam (and sleeping little) is worse than sleeping and not studying at all.
- Don't overload. Strangely, the students who are most worried about grades are often the ones who sign up for 22 credits a semester. But know this: graduating

in x years with all A's in your courses is better than graduating one year earlier, but with B's and C's because you overloaded yourself. Many students are in a hurry to finish and move on. We realize it can save you money. And to be honest, it makes NJIT's graduation stats look good if you do. But if you are going into a profession that insists on A grades, rushing could be a disaster. And as your Departmental mentors, we care about your long-term development. Which brings us to the final two tips:

- Explore. Your time as an undergraduate is your biggest opportunity to explore different fields and domains of knowledge. You can take courses in many subjects that you never had in high school. And after you graduate, your opportunities will diminish again as you go into the workforce, or a professional school where you must specialize. So, don't waste the opportunity to find out what you really like to do. And even if you are committed to a profession like medicine, knowing three other languages, or understanding international policy-making, or being able to create network models of contagion, or better still all of these things together, will open many doors for you in the future. It's worth the investment of time and energy, and will likely pay for itself with a job that is better paying *and* more interesting.
- Stay engaged with the world. One purpose of a college education is to give you new ways to engage with the world. It doesn't make sense, then, to seal yourself off from current events during the learning process. Yet many students don't know any of the important news stories of the day. Seeing how your subjects intersect with real-world issues will motivate you and give you something to bring to the classroom (or the dorm room, or the dinner table). So check the headlines!
 - Did you know that as a student, you can [subscribe to the New York Times for free](#)?
 - If you are afraid of misinformation in this highly politicized time, the [BBC website](#) (or app) is one of the most impartial sources of both world and regional news. You can customize it to prioritize US news, and it has loads of interesting science and health stories.

On being in class

- The classroom is arguably the *most* important part of any face-to-face course, yet many students treat it as if it is the least important! Classroom time is the main difference between a degree at a bricks-and-mortar school, and an online degree. You have chosen the former, so make the most of it. Go to class.
 - Empirical fact: students *love* review sessions. They request them before every exam, and everyone shows up. (This is also the time when students go

- to office hours, often for the first time.) Yet strangely, many of these same students will have skipped multiple classes before that. This reveals that these students think a ‘regular’ class is a different beast. But that is to misunderstand what a classroom is for, and how you should approach it.
- In the classroom, you have access to the instructor. He or she is right there in front of you! It’s crazy to doze in the back of the class, assuming that you will ‘get’ the material by studying later in your bedroom or the library (likely in the evening). What if you don’t understand something? The classroom is the place to build understanding, via dialogue with the instructor. In your evening study, read the *next* chapter so that you can have a useful discussion about that in the next class... *when the instructor is there*.
 - The classroom is not meant to be a place where instructors ‘push’ facts into passive students. It is meant to be a place where students actively ‘pull’ understanding from the instructor.
 - Most of the facts you need will be in your class materials (textbook, etc.). The Instructor’s job is not to repeat them at you, but to help you understand and organize them — to help you fit them into your growing body of knowledge.
 - Because each student’s abilities and starting knowledge are different, it is up to *you* to make sure that you get what you need.
 - At the end of every course, you will be asked to evaluate your instructor. While this is certainly valuable, and helps improve instruction quality, it tends to give the impression that the instructor is the most important variable in how much you get out of a course. It isn’t — not even close. The most important variable is *you*, and that applies as much to the classroom as to any other aspect of the course.
 - So, here’s a rule of thumb: treat each class as if it is a review session.
 - Try to look at the material before the class. Make notes (see below) about what you don’t understand, connections to other areas of your knowledge, and any other questions.
 - In the class, *interact with the instructor* to make sure your questions get answered. (They will probably be other people’s questions as well.)
 - Think how well you will do on the final exam if you’ve had 28 review sessions!
 - Tip #1: If you do miss a class, *never* ask your instructor “Did I miss anything in class today”? (Or worse: “Did I miss anything important?”) Just take a minute and think about what that question implies. If you don’t see the problem, check out this poem, entitled “Did I Miss Anything?”, by Tom Wayman: <https://www.loc.gov/poetry/180/013.html>

- Tip #2: The main criterion for getting a good letter of recommendation for medical school, etc., is not your final grade, but whether or not you had a good *interaction* with the instructor. A recommendation is not just a statement about your grade, which is on your transcript anyway, but about *you*. If you missed class often, did not respect the classroom and the instructor, and did not participate or show interest, you will not get a letter that really helps your application.
- Instructional styles vary, and they do so a lot more in college than in high school. This is because your instructors vary more. In one semester, across your different classes, you might be taught by an experienced Lecturer with master teaching credentials, an eager new Assistant Professor, a distinguished senior Professor with a million-dollar-a-year research program, or possibly, in your lab section, a graduate student. Their teaching styles will vary to match. Some might give traditional lectures, some might use the latest active learning techniques, some might do everything on PowerPoint, others might draw on a board or even (gasp) just talk. This variety reflects life, and keeps things interesting. All styles have their pros and cons, and it is part of your broader education to figure out how to get the most out of your instructors. Again, you are most important player.
- Learn to take notes. The most valuable tool you can have — one that is useful in almost any circumstance — is the ability to take concise notes.
 - For hundreds of years until a couple of decades ago, formal face-to-face education occurred by one person speaking, and others making notes. During this time, we went to the moon, discovered DNA, explored the origin and history of life on our planet, and invented computers, among other things. The evidence suggests it works just fine.
 - Notes are not a transcription of a lecture or other presentation — they are *your interpretation of it, made live, as it happens*.
 - Your notes highlight the main points, the connections between ideas, and the things you didn't understand (so you remember to ask about them).
 - Studies strongly suggest that *handwritten* notes are the most effective.
 - Circle, doodle, underline, draw connections, write big question marks.
 - Ask the questions *right then*.
 - “Excuse me Professor, you just said there was a connection between X and Y, but I don't see what it is. Can you explain again?”
 - Keep asking until you are satisfied you understand, then *add it to your notes*.
 - Some students like to record lectures. If this is *instead of* taking notes during the class, it is terrible strategy. When you listen to it later, it's exactly the same material but now you have no-one to ask questions of. And you used up

another precious hour and a half. Listen to your instructor, think, make notes, and ask questions *when it's happening*.

- Recording someone is not an automatic right. Ask you your instructor first.

On communication

- Remember the earlier tip about being professional?
 - Wrong:
 - From: clawman666@yahoo.com
 - To: professorx@njit.edu
 - Subject: stuff
 - yo prof I couldnt make it to class last week can you tell me what we did –
L
 - Right:
 - From: jh29@njit.edu
 - To: professorx@njit.edu
 - Subject: Apologies for missing class
 - Dear Professor X,
I am a student in BIOL 299: Mutant Biology. I'm sorry I missed class earlier today: the X-plane broke down. But I've done the reading and I have asked my friend Marie if I can look over her notes. Are there any other resources or materials that were used in class that I should know about?
Sincerely,
James (Logan) Howlett
 - Tip: one of these e-mails will probably not even get a response. Can you guess which one?
- Treat *all* your instructors, advisors and mentors with equal respect.
- If you make an appointment to meet an instructor or administrator, keep it! Or give plenty of warning if you have to re-schedule.
- Be timely in your communications. A common scenario: a student comes to see his instructor after the final exam, having performed poorly, and explains that he had some 'personal problems' earlier in the semester which affected his studies. The instructor will likely be sympathetic, but at that point, nothing can be done. The time to communicate about difficulties is *when they happen*. If you are suddenly sick, and have to miss an exam, e-mail your instructor *as soon as possible*. Don't just wait for the next class. Personal issues that are significantly impairing your ability to study? Give your instructor a heads up. Be pro-active.

There are many ways in which such problems can be dealt with right when they happen, but fewer and fewer the longer you wait.

On joining a research group

- The Faculty are committed to a comprehensive Biology education for our students, and part of that is providing opportunities for undergraduate students to do research. But here's what you should know:
- While our website may list opportunities in specific labs, we do not provide a comprehensive list of research projects from which you can choose. There are multiple reasons for this.
 - When presented with a list of opportunities, most students will click yes on at least one. But there are over 300 Biology majors, and we can't accommodate that many students in our labs, at least not all at once.
 - Research sounds like fun, and it can be, but it can also be tedious and time-consuming. Experience shows us it is not for everyone.
- We therefore put the responsibility back on the student. If you want to do research, it is up to you show the initiative.
- Realize also that active research labs have commitments (to NJIT, to funding agencies, etc.), and taking on a student is an investment that takes time to pay off. A student joining a project needs instruction – sometimes a lot of instruction – before they can contribute usefully. A lab director must perform a cost-benefit calculation with a number of variables before accepting a new student. And some projects lend themselves easily to undergraduate involvement, others do not.
 - If a student goes through research instruction, and then flakes out and stops participating, it is at a minimum a waste of valuable time, and at worst can derail a research project.
- Given all the above, here's what you need to do:
 - Know that you are interested in doing research, and why. "Because it looks good on my CV" is not a good reason. It likely won't be sufficient to motivate you.
 - Know that you have the time to commit. You can't realistically do useful research for just an hour a week. You need to be able to dedicate a significant chunk of time.
 - If you are taking an Independent Study course to get credit for your research, that is a guide to time commitment. Three credits correspond to something like 6–9 hours a week.

- Know what we do. Go to the Department website and learn about our research. And don't just skim it: read the latest research publications. Never ask about doing research in a lab if you don't know what that lab does.
- Think about your desired career, or (if you are not sure what that will be) the courses you have taken and enjoyed. Use that as your guide to the kind of research you seek out. Also, if you have taken some upper level courses in (for example) neurobiology, you are more likely to be accepted into a neurobiology lab because you already know something about the field.
- Be realistic. If you are a freshman with no courses completed, you can't expect to go straight into advanced research. You *might* be able to help out in a lab and learn the ropes, and in so doing...
- ...prove yourself. Show that you are reliable, that you can show up on time, do repetitious work, and do it independently. (Example: many of our research students started out by helping look after our live fish.)
- Bring something to the table if you can. Can you code? Write? Draw? Make things? Can you, in fact, make yourself useful to the lab, even if it's in an unexpected way?
- Overall, your job is to sway the cost/benefit ratio in your favor.
- Example pitch by upperclassman:
 - Dear Professor X,
I am a Junior in your department who has taken three courses in neuroscience and done well (you might remember me from the one you taught). I really enjoyed them, and I am thinking about neuroscience as a career. Do you have any opportunities for me to find out what neuroscience research is like? I was particularly intrigued by the idea of central pattern generators, and I would like to explore that if possible. I recently took a course that included a lot of MATLAB coding, and am wondering about the possibility of doing computational explorations. I would be available over the summer.
Please let me know,
James Howlett
- Example pitch by lowerclassman:
 - Dear Professor X,
I am a Freshman in my second semester. I am excited by neuroscience, and already registered for the neuroscience concentration. I'll be taking your course next Fall, and although I don't know much neuroscience yet, I'm keen to get started. Is there any way I could contribute you the work in your lab? I would be happy to help look after the crabs, or just help out as needed. I have a couple of aquaria at home, so I know my way around them.
Please let me know,

James Howlett