Backlund Group Expectations Document

Updated 1/27/2025

I. INTRODUCTION

Breadth of Research: Our interdisciplinary research effort combines elements of physical chemistry, molecular and optical physics, quantum information science, materials science, and biophysics. We develop quantum-science-based microscopy platforms and apply them to study various complex nanoscale systems. Current research thrusts include 1) nanoscale magnetic resonance microscopy using quantum defects in diamond; and 2) exploring the quantum limits of single-molecule metrology. The projects of interest are subject to change over time, and the PI encourages new ideas from students and postdocs.

Mentoring Statement: The PI recognizes the importance of mentoring a diverse group of scientists in interdisciplinary research that will enter industry, academia, and other professional pathways. He meets regularly with students during group and subgroup meetings to foster problem solving and analytical skills, critical evaluation of research data and literature, and ethical issues related to research. Senior graduate students and postdoctoral scholars are expected to contribute to the mentoring of younger graduate undergraduate students. Training in the lab mainly focuses on research progress but also includes broader topics such as maintaining a safe working environment, well-documented research notes, and ethical conduct. The PI strongly encourages students to attend seminar series on campus, and to collaborate with students in other groups and across other departments.

II. WORKPLACE EXPECTATIONS

Responsibilities of the PI: The PI aims to tailor the degree of individualized attention given to each student according to their personal needs and wishes. It is always acceptable to knock on Mikael's office door, send him an email, or contact him via Slack (see contact information below). In fact it's expected that every group member comes by to chat with me at least once every couple days. In addition to these impromptu exchanges, we hold weekly subgroup meetings and weekly group meetings. Mikael is also generally available for scheduled one-on-one meetings, which can be initiated by any lab member. Depending on funding, some students may be given RA beginning in their 2nd year; all students are guaranteed RA positions in their 3rd and higher years. Mikael will help students apply for external fellowships, though it will usually be left to the students/postdocs to identify these opportunities. Each student/postdoc may go to at least one conference, but may attend several depending on research progress. Mikael will provide all support necessary when it comes time for the student/postdoc to search for a job.

Mikael's contact information:

Office: CLSL A129B

Email: mikaelb@illinois.edu

Slack channel: Backlund lab

Expectations of Students:

Students and postdocs are expected to work on average ~50 hours per week. Depending on the stage of experiments, etc. this number may fluctuate week-to-week. Working 70 hours or more on a given week is strongly discouraged for reasons related to mental and physical health and safety. There are no fixed hours for students and postdocs, but it's generally expected that they will work at least 8 hours on each of Monday through Friday, plus parts of most weekends. Most of these hours should occur during the normal business day (i.e. 9 am – 5 pm) so that regular interactions with other group members are maintained. At least one full day should be taken off from work each week to rest and recharge. In general, Mikael will not keep close tabs on the hours each student works as long as research progresses at the level of expectation. While a student is still taking classes or TAing it is fair to factor hours spent on these responsibilities as part of the student's work week. There will also be times when it is acceptable for the student to work from home or elsewhere, for example if they are analyzing data, working on a calculation/simulation, or writing a manuscript. In such cases the group member is asked to let Mikael know, e.g. via Slack. It is expected that students become increasingly independent as they gain more experience.

There is no general prescription for how many papers earns a PhD. This depends on many factors, including relative difficulty of projects and career goals of the student. It is generally expected that the average PhD will take 5-6 years with a relatively narrow variance. More quantitative statistics will be provided as the group matures. At minimum, a student is expected to produce at least one high-quality first-author publication on a project primarily and independently *driven by the* student before graduating. Co-authored papers that result from at least a 50% contribution from Mikael to the research content itself (i.e. Mikael providing theory, computations, or experimental data) do not satisfy this minimum requirement, though such papers can be considered in evaluating the student's overall body of work.

Time away from the Laboratory:

- *Personal time off:* the overall vacation policy of the Backlund lab follows the official guidelines of the Department of Chemistry. Lab members are not required to work on campus holidays listed on the UIUC Human Resources site (https://humanresources.illinois.edu/campus-holiday-schedule/). In addition to campus holidays, lab members are entitled to 24 PTO days per year. PTO days can be distributed at the discretion of the lab member, subject to a few boundary conditions (vide infra). It is preferred that domestic students do not take more than two weeks off at one time so that experimental continuity is not lost. It is understood that international students may take fewer, more extended blocks of time off to accommodate greater travel distances. Lab members are asked to give Mikael notice of planned PTO equal to at least twice the duration to be taken off (i.e. let me know 2 or more weeks before taking off a week).
- *Sick days:* If illness or mental health is interfering with research, time off is expected. Sick days do not count as vacation days. If mental or overall health is significantly

affecting the student's research progress, a leave of absence should be discussed with the PI. If you feel that you need a mental health day, please let someone in the group know that you will be out (Mikael or another labmate).

- *Avoiding burnout:* Mikael believes that regular time off is essential to maintain a healthy attitude toward work and to avoid burnout.
- *Emergency situations:* Family and personal emergencies are covered under the same policy as sick days. Please notify Mikael if you must miss work time for such a situation.
- *Adverse weather:* If classes are cancelled then students should not come to lab.
- *Conferences:* do not count against days off from work.

III. PERSONAL WELL-BEING

Well-Being: We are committed to being great scientists and healthy well-rounded individuals. Therefore, we value a positive well-being inside and outside of the lab. We also encourage labmates to look out for each other. We encourage participation in self-care activities.

- Looking out for your lab mates
    - If you notice a person is out for several days, check in with that person (without calling them out to others)
    - No judgement, just checking in (e.g. "Just wanted to make sure you are doing okay" or "Do you need help with anything?")
    - Might be most effective to check in with your office mates.
- "Self-Care Activities"
    - Includes doctor appointments, counseling, exercising
    - Don't need to report to Mikael
    - Make-up time? No, as long as productive in lab
    - Agreed as a group to not abuse this policy
    - RSO database (https://union.illinois.edu/get-involved/office-of-registered-organizations)
    - ARC group fitness schedule (https://campusrec.illinois.edu/programs/group-fitness/group-fitness-class-schedule/)

Mental and Physical Health Concerns: If you are not feeling well, either physically or mentally, take the time off you need to seek out help and take care of yourself.

Resources:
Counseling Center (https://counselingcenter.illinois.edu/)
McKinley Health Center (https://mckinley.illinois.edu/)
Women's Resource Center (https://oiir.illinois.edu/womens-center)
Cultural Houses (https://oiir.illinois.edu/our-centers)

Work-Life Integration: We encourage activities outside of lab that explore the passions you have besides research, as long as they do not interfere with your research progress.

IV. LAB RESOURCES/GENERAL POLICIES

Meetings

- *Group meetings* (GMs) are held most weeks on Fridays at 11:30 am unless there is a need for rescheduling. The GM schedule is set in advance by the lab member tasked with that group job. The schedule is available in the group Box folder. The format varies from week to week—lab members will alternate giving seminars on their own research and on the literature. All students are expected to listen attentively, think critically, and actively engage when another student is presenting their work.
- *Subgroup meetings* are held weekly for both the NV subgroup and the SM subgroup. This should be the time for the most in-depth technical discussions about ongoing research. It is expected that every lab member bring something to discuss at their respective subgroup meetings. This very much includes negative results ("this experiment didn't work…let's figure out why").
- *Weekly reports* are solicited one per week from each lab member. It is expected that this will be submitted unless the lab member has been away for most of the week. The purpose of the weekly reports is to keep a succinct, written record of your research progress for the benefit of yourself, Mikael, and other group members.

Literature

Students are expected to independently read literature in relevant areas to obtain the broad knowledge base necessary for our interdisciplinary science. Our favorite journals include various outputs from Nature (*Nature, Nature Photonics, Nature Nanotechnology, Nature Physics, Nature Materials, Nature Chemistry, Nature Communications, NPJ Quantum*), Science (*Science* and *Science Advances*), *PNAS*, APS journals (*Physical Review Letters, PRA, PRB, PRX, PRE, PRResearch, PRApplied, PRXQuantum*), ACS journals (*Nano Letters, J Phys Chem, ACS Nano, JACS*), OSA journals (*JOSA, Optics Letters, Optica, Optics Express, Biomedical Optics Express*), and AIP journals (*J Chem Phys, Applied Physics Letters, J Applied Phys*). In addition, depending on an individual student's research focus, it is expected that they also stay up-to-date on the relevant literature in specific topics in, e.g., biophysics or materials science.

Students are expected to acquire expertise in a specific area. A suggested starting point is described below.

a) Students interested primarily in quantum limits of single-molecule measurement should alert themselves to papers citing:
   - https://journals.aps.org/prx/abstract/10.1103/PhysRevX.6.031033
   - https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.121.023904

b) Students interested primarily in applications of NV centers should alert themselves to papers citing:
   - https://science.sciencemag.org/content/351/6275/836.abstract
   - https://science.sciencemag.org/content/357/6346/67.abstract

It is expected that each student spends at least a couple hours per week looking through abstracts and reading through the most relevant papers. More than a single morning or afternoon per week is probably too much unless preparing to write a manuscript or proposal. Papers of general

interest and importance to the group should be linked to the whole group via email and may become the subject of future literature seminars.

Record Keeping

- *Lab notes:* Students are expected to maintain a daily record of their research. Some days it may make sense to handwrite notes in a physical notebook, while other days the most efficient record keeping method might be to take typed notes with interleaved screenshots. Students should maintain both a dedicated physical notebook for written record keeping and a dedicated Box folder to store digital notes (save, e.g., as Word documents). These notes must be sufficiently well-organized such that a future lab member can reasonably follow your prior work.
- *Raw data:* should be saved locally in the appropriate folders on lab computers. Each lab computer a particular student accesses should contain a separate folder dedicated to their own research, with subfolders therein dedicated to specific projects.
- *Lab Logs:* Occasionally Mikael will ask a student or postdoc to write a Lab Log for the benefit of the whole group, current and future. These are stored on the Box folder. If a lab member thinks it would be helpful to the group they are always welcome to write a Lab Log without Mikael's initiating.
- *Group Box folder:* certain items of importance to the entire group should be stored in our communal Box folder (https://uofi.app.box.com/folder/129998691849). Each student will be invited to the shared folder upon joining the group. Items to be stored here include Lab Logs, code of interest to the rest of the group, protocols and tutorials on specific pieces of equipment, slide presentations, and general administrative resources (such as this very Group Manual). Within each subfolder there should be a separate subfolder for each student, within which there is a separate subfolder for each project.
- *File naming:* for the purposes of sorting and uniformity, files stored in the group's Box folder or on group computers should begin with the date in the form YYYYMMDD.

Group Jobs

Most lab members (except perhaps for those new to the group or who will soon be departing) will be assigned a group job on a yearly basis. New group job assignments typically are made in July. The list of group jobs may evolve over time, but currently consists of:

- Lab safety officer (LSO)
- Group website upkeep
- Group GitHub upkeep
- Weekly reports administration
- Maintaining the group meeting schedule
- Initiating and scheduling lab cleanups
- Leading the maintenance of chemical inventory
- Leading the maintenance of non-chemical inventory

V. CONFLICT RESOLUTION

Authorship: Authorship should be discussed at the beginning of projects with all potential authors and should be agreed upon unanimously. Frequently, authorship can change as projects progress,

but any changes should be discussed with all authors. The order of authorship is impacted by many factors, but the final order should be determined by PI. Students cannot promise authorship orders (e.g., "If you do this, you'll be second author").

Student-to-Student Conflicts: Start person-to-person – attempt to resolve the conflict in a gentle, non-accusatory tone. If the conflict escalates beyond what can be solved between the people involved, go to an agreed upon mediator(s) to be determined on a case-by-case basis. It is expected that most conflicts will be able to be solved through the first two steps. If the conflict still has not been resolved, or if the situation is affecting one of the students' ability to work or mental/personal health, the conflict should be taken up to Mikael. If the conflict is threatening to one's life, call 911 and then notify Mikael when it is safe to do so. All ethics and scientific integrity issues should be reported to Mikael.

Student-to-PI Conflicts: We recognize that there is a power difference involved in the resolution of such a conflict. If possible, such conflict resolution should proceed first via an email to Mikael, another graduate student's or postdoc's mediation, or a meeting with the Mikael. Students should let Mikael know if they feel that his response was inadequate and could do so via email. If the student still feels that the conflict has not been resolved, the student should let Mikael know and address the issue with another mediator. Mediators/resources for graduate students include the director of graduate studies, and the department head.

Reporting: Sex-based misconduct should be reported to the Title IX Office (https://ovcdei-illinois-advocate.symplicity.com/collections/title_ix/01826e494f757db2b76ab28506825280).

Be aware that as a responsible employee, Mikael is required to notify the Title IX Coordinator when informed about conduct that reasonably may constitute Prohibited Conduct under the Sex-Based Misconduct Policy

VI. SAFETY

For detailed information on campus lab safety policies refer to the Division of Research Safety website (https://www.drs.illinois.edu/).

Mandatory Training Modules: upon joining the group, students must complete the following safety training modules before lab work can begin. These modules are available online at the DRS website (link above).

- Laboratory Safety
- Laser Safety
- Chemical Safety
- Chemical Spills
- Electrical Safety: Fundamentals
- Fire Extinguisher Training

Laser Safety: In addition to completing the online DRS Laser Safety training module, all students must maintain responsible laser safety habits at all times.

- Laser alignment should always be done with the laser set to the lowest possible power setting.
- Appropriate laser goggles should be worn whenever there is a risk for exposure
- When working with a laser, students should always be aware of the Maximum Permissible Exposure
- Care should be taken to wholly cordon off lab spaces in which lasers are currently operating such that risk to those outside the area is minimized.
- The following table gives a catalog of the Backlund lab's lasers and vital information thereof

Make	**Model**	**Wavelength**	**Max output power**	**Class**	**Requisite Protective Eyeware**
Lighthouse Photonics	Sprout-H-8W	532 nm	8 W	IV	Thorlabs LG10 (amber lenses) – OD 7+ @532
Coherent	OBIS 640nm LX	640 nm	100 mW	IIIb	Thorlabs LG4 (blue lenses) – OD 4+ @640
Coherent	Sapphire 488-200 CW	488 nm	200 mW	IIIb	Thorlabs LG10 (amber lenses) – OD 7+ @488
Coherent	Sapphire 561-200 CW	561 nm	200 mW	IIIb	Edmund Optics LS03 (dark red lenses) – OD 6+ @561