



Food Safety Lab and Milk Quality Improvement Program

General Laboratory Manual



Welcome to the Food Safety Lab and Milk Quality Improvement Program! Our overall aim is to conduct basic and applied research on the microorganisms responsible for foodborne diseases and food spoilage. Results from these research programs are translated into practical applications through close interactions with extension programs in the Department of Food Science and throughout the broader scientific community. Our lab is committed to conducting research at the highest level and to allow our mentees and staff to experience the excitement of research.

This manual is intended to give an outline of the working environment, expectations, and duties for laboratory members. The policies outlined here are in line with our overall vision and mission:

Vision - We strive to create a world with a safer and more high-quality food supply

Mission - Through innovative research, education and outreach, positively impact the long-term microbial safety and quality of the global food supply

Diversity Statement – We value the perspectives and contributions of a diverse representation of scientists, inclusive of race, ethnicity, gender identity, sexual orientation, age, neurodiversity, religion, class, nationality, and disability status. We are committed to actively cultivating a climate in which all of our faculty, students and staff are given an equitable opportunity to pursue scientific discovery in an inclusive and supportive environment.

Core Values –

- Continuous Improvement – we all accept that we are here to learn and improve
- Team Work – we are committed to fostering an environment where we work together to reach shared goals, where individual successes are celebrated, and collaboration is a priority
- You see it, you own it – we believe in taking accountability and ownership when situations are encountered that require an intervention, even if you aren't the person who is ultimately responsible for interceding, if you identified the issue, then you are responsible for seeing it through to a resolution
- Take responsibility for your project(s) – we want you to get the full benefit of your time in the lab, which means fully immersing yourself in your project, and taking responsibility for the progression of your research and all aspects that go along with it

I. Laboratory Safety

We take lab safety seriously. Every day we work with bacterial pathogens (known and unknown) and chemicals that may be harmful to your health. The following are a minimum list of guidelines; additional guidelines are available in each SOP. If you ever have questions about how to safely perform a task, please ask a senior lab

member. Non-compliance with safety protocols is grounds for disciplinary action.

- General Laboratory Safety: Conducting research in a safe manner is a must. All laboratory members are responsible for familiarizing themselves with the “Safety Manuals and the General Safety, Handling, and Disposal Procedures” SOP prior to beginning work in the lab. Additionally, all lab members are required to complete a Cornell Environmental Health & Safety session entitled “Chemical Safety for Laboratory Workers” and complete the mandatory lab orientation with Rachel Weachock and Cris Resendiz-Moctezuma.
- Emergency Contact Information: Campus emergency personnel can be reached by dialing 911 from a lab phone, or 607-255-1111 from a personal phone, or by pushing the button underneath the blue light in the hallway outside of Martin’s office. Martin (607-227-5903) and Nicole (607-346-6893) should also be informed
- Accident or Injury: In case of an accident or injury, you must notify Martin (607-227-5903) or Nicole (607-346-6893). Accidents must be reported to the Cornell [Risk Management and Insurance](#) office.
- Personal Protective Equipment: Lab coats, nitrile gloves and safety glasses are required regardless of the work you are performing in the lab (the one exception to this rule is if you are working at the computer station in the central lab, you do not need to wear PPE). Please refer to the lab’s Chemical Inventory on the lab network drive and read the MSDS sheets of all chemicals prior to working with chemicals. Should your work require you to use a respirator such as an N95 mask, please contact Alan as these PPE are regulated by the state of New York and require additional measures before use.
- Safety glasses: Safety glasses must be worn at all times. The only exception to this rule is if you are working at the two computers in the center of the lab, facing the wall, you may choose to not wear safety glasses. If you wear prescription glasses and do not feel comfortable wearing the safety glasses over your prescription glasses, please talk to Martin or Nicole about acquiring prescription safety glasses.
- Biosafety: The FSL-MQIP lab space is a BSL-2 facility, and therefore we must comply with the [Cornell University Biosafety Level 1&2 Written Program](#). A copy of this is kept with the Chemical Hygiene Plan, and MSDS sheets on the shelf in room 352. Eating and drinking in the laboratory is prohibited. Waste contaminated with infectious material needs to be disposed of in accordance with the Cornell Environmental Health and Safety and will be reviewed in further detail during the lab safety orientation.
- Chemical Safety: The lab follows the EH&S [Chemical Hygiene Plan](#). Experiments in the laboratory sometimes involve the use of chemicals and reagents that might represent a possible hazard to human health. Hardcopies of the Material Safety Data Sheets (MSDS) for all chemicals used in the lab are located in a black binder on the shelf in 352; links are also available in the [Chemwatch Database](#) or in our Lab’s Chemical Inventory document. You are responsible for looking up the PPE required, safety considerations, and proper waste disposal for all chemicals that you use.
- If you are ever unsure about proper safety procedures in the laboratory, please ask!

II. General Laboratory Practices

- Clean Workspace: Lab members will be assigned both a lab bench and a desk to work at based on their individual work expectations; all members are expected to maintain workspaces (i.e. lab bench and desk) that are free of clutter. This is important for safety as well as how we are perceived by visitors.
- Lab Notebooks: Graduate students and staff will be required to maintain an electronic lab notebook on the Lab Archives platform. You must review the FSL/MQIP Template Notebook, which contains thorough instructions and expectations for setting up and maintaining your electronic laboratory notebook. All laboratory personnel conducting research are expected to read Chapter 5, “Laboratory Notebooks”, in *At the Bench: a Laboratory Navigator* by Kathy Barker, paying particular attention to the “Content” section on p. 92. Laboratory notebooks are the property of the FSL and are kept on file after you leave the lab. Other things to remember about lab notebooks: (i) provide a sufficient level of detail so that you or another scientist could replicate what you did, and (ii) update your lab notebook *regularly* (at least every couple of days but ideally at the end of every day).
- Schedules: Hours should be posted on the Schedules Teams channel, where you will find a tab called Working Hours, and therein an app you may use to document your normal working hours. Normal working hours should be updated as regularly as needed to accurately reflect your schedule. If you will not be in (i.e. you have an appointment, etc.) please utilize the Schedule Teams channel to communicate this with everyone.
- Lab Responsibilities: In addition to the specific projects that you work on, each lab member will be assigned tasks by senior lab personnel. A list of the current lab responsibilities can be found on the Lab’s network drive and on the Teams General channel.
- Remote Work Policy: Working in the office/lab has the advantage of allowing you to more easily communicate and learn from your colleagues. With that being said, there are occasions when you may need to work remotely, and you should feel free to do so if given permission by your direct supervisor. Should you need or want to work from home, you need to first discuss this with your supervisor and come up with a plan for tasks/projects that you will work on and how you will communicate with others if you need help. Individuals working from home are expected to still attend lab meetings and other one-on-one meetings as their specific situation allows.
- Lab Meetings: FSL-MQIP will hold weekly laboratory meetings, the purposes of which are to: (i) give updates for ongoing research projects, (ii) practice giving a scientific presentation, (iii) troubleshoot any challenges that you might be facing with a given experiment or manuscript, and/or (iv) teach other lab members a new skill as a sort of “workshop.” All lab members are expected to attend lab meetings. Lab meetings will be scheduled before the start of each semester. Please refrain from bringing laptops to any lab meetings unless explicitly required to do so.
- Lab Standard Operating Procedures: All lab SOPs are located on the [Food Safety Wiki](#). Prior to performing any experiment in the lab, you are required to be trained by a senior lab member for each SOP that you intend to use. Records of training will be maintained in the files located in the “Lab

Cleanliness, Safety Audits, Cold Room Space” channel on FSL/MQIP Teams.

In general, if you need to perform a protocol multiple times (i.e. not just a single PCR to amplify a target sequence that is specific to your project) you should [convert the protocol](#) into a SOP so that future lab members can replicate the procedure for future experiments. Any time you are being trained in a lab procedure you need to make sure you are also provided with an up-to-date SOP; if you feel an SOP does not contain sufficient detail, you should not develop your own version of the SOP, but rather work with the person responsible for the SOP (and/or the person that trained you) to improve the SOP. If you need to use a SOP without being trained on the SOP you need to confirm with a senior lab member familiar with the procedure that the SOP is up-to-date.

- Strain Collections and Databases: Many of the projects in the FSL-MQIP are dependent on our large collection of bacterial isolates, as well as on the generation of new recombinant bacterial strains and plasmids. Therefore, our ability to maintain viable, pure cultures in long term storage (usually frozen at -80°C) and to keep track of the identity and location (via our strain database) of these cultures is crucial. The importance of maintaining strict aseptic technique in the preparation of frozen stock cultures and of accurately recording strain information in the Food Microbe Tracker database cannot be overemphasized. Experienced lab members are responsible for instructing and overseeing new members in these activities. And, just as important, all metadata associated with isolates should be entered into the lab’s online database [Food Microbe Tracker](#). All isolates will receive an FSL ID (e.g., FSL X1-0001); FSL isolate numbers will be assigned by Sam Reichler. Please refer to the [SOP](#) for more details.
- Ordering Lab Supplies/Reagents: Sam Reichler (sjr267) is responsible for placing all orders. If he is unavailable, Sean Guo (xg47) will assist with placing orders. Please refer to the [SOP](#) for more details on how to order items. Please refer to this [SOP](#) for details on naming and ordering primers.
- Lab Computers: The lab maintains a number of computers. Please note that these computers are to be used only for laboratory-related activities.
- Data Storage and Maintenance: All lab-related material (data, manuscript files, photos of experiments, etc.) should be stored on either the lab network drive or the lab GitHub account so that the data are backed up and are stored in a secure location. Data should not be stored on personal computers only. This will ensure that data will not be lost. Information for connecting to the lab network drive can be found in this [SOP](#).
- Telephone Use: When using your cell phone to make a personal call, please be mindful and refrain from making phone calls in the office or lab space.
- A Note About Funding: Research in FSL-MQIP is funded through a variety of sources, including federal funds (i.e., taxpayers’ money), funds from private companies and funds from different organizations (e.g., National Dairy Council, which is funded through contributions from US dairy farmers). Most of these are competitive funds, meaning that we must write proposals that are judged against proposals from other laboratories. Our ability to secure funding for research projects depends hugely on our record of sound research (generally measured as publications in peer-reviewed journals) and on a good reputation for the laboratory and its members. Without obtaining these funds, we cannot maintain a research program, pay salaries for

technicians and undergraduates, support graduate students, and buy necessary supplies and equipment. It is hence essential that all of us take responsibility for maintaining a record of high-quality research for our team.

- Mental Health Awareness: Graduate school, research, and life in general, can be stressful at times. If you or someone you know in the lab needs support, do reach out for [help](#) and notify your advisor or supervisor. Our goal is to provide a supportive environment in which you can learn and grow.
- We Encourage Collaboration, not Competition: Our lab covers a wide variety of research topics, and, as such, we have a wealth of expertise in the lab. We encourage you to learn from each other. Also keep in mind that every project is different, some are easier to carry out than others, and this is dependent on the questions asked and the nature of the project, and are not necessarily reflective of the individual working on the project.
- Accessibility – Your access to the lab materials is important to us. If additional accommodations would help you to complete your work, please let us know so that we can work with you to make sure that you get the support that you need. A list of accommodations that are available, as well as where to get additional support can be accessed [here](#).
- We Take Research Integrity Seriously: All lab members should familiarize themselves with the University's [policy](#) on research integrity. Any lab members that witness another lab member not complying with these guidelines should confront the individual and tell a supervisor.
- Transparency and Reproducibility in Research: The lack of reproducibility in research is an ongoing crisis in research. We want to do our part by being transparent about what we do. This is why we strive to make our data and code available for every publication that we can.
- A Note About Authorship: We believe in the age-old adage “give credit where credit is due.” Please carefully read the author guidelines for each journal (an example can be found [here](#) to make sure that credit (via authorship) is appropriately attributed to individuals.
- Use of AI tools for paper writing: The definition of appropriate and inappropriate use of AI in scientific writing is rapidly evolving. For the time being, we will follow the guidance provided by Science for use of AI in scientific writing; the core of their policy is reproduced below:
AI-assisted technologies [such as large language models (LLMs), chatbots, and image creators] do not meet the Science journals' criteria for authorship and therefore may not be listed as authors or co-authors, nor may sources cited in Science journal content be authored or coauthored by AI tools. Authors who use AI-assisted technologies as components of their research study or as aids in the writing or presentation of the manuscript should note this in the cover letter and in the acknowledgments section of the manuscript. Detailed information should be provided in the methods section: The full prompt used in the production of the work, as well as the AI tool and its version, should be disclosed. Authors are accountable for the accuracy of the work and for ensuring that there is no plagiarism. They must also ensure that all sources are appropriately cited and should carefully review the work to guard against bias that may be introduced by AI. Editors may decline to move forward with manuscripts if AI is used inappropriately. Reviewers may not use AI technology in generating or writing their reviews because this could breach the confidentiality of the manuscript.

AI-generated images and other multimedia are not permitted in the Science journals without explicit permission from the editors. Exceptions may be granted in certain situations—e.g., for images and/or videos in manuscripts specifically about AI and/or machine learning. Such exceptions will be evaluated on a case-by-case basis and should be disclosed at the time of submission. The Science journals recognize that this area is rapidly developing, and our position on AI-generated multimedia may change with the evolution of copyright law and industry standards on ethical use.

<https://www.science.org/content/blog-post/change-policy-use-generative-ai-and-large-language-models#:~:text=The%20adoption%20of%20ChatGPT%20and,appears%20in%20the%20methods%20section.>

- Confidentiality: Our team can get access to confidential and sensitive data through a variety of means (such as industry collaborations). Everyone exposed to information that could be considered confidential or sensitive cannot share this information outside the lab. In addition, if you have access to confidential information try to minimize sharing it with others in the lab, unless necessary for research and outreach as well as training of lab members. If any questions arise whether specific information should be considered confidential, please discuss this with Nicole and Martin.
- Required Readings: The manual *At the Bench: a Laboratory Navigator* by Kathy Barker is an extremely useful “guide” to life in a research lab. The first section (General Lab Organization and Procedures) covers topics related to getting oriented in the lab; the second section (Laboratory Setup and Procedures) discusses the rationale and organization involved in setting up experiments, recording results, and presenting data; and the third (Getting Started and Staying Organized) presents details on various common lab protocols. All lab members conducting research are expected to read all resources listed in the [5.1.2 List of Required and Suggested Readings Document](#).

III. Expectations and Responsibilities

Graduate Students

The basic requirements for obtaining graduate degrees (M.P.S, M.S., and Ph.D.) are outlined by both the [Cornell Graduate School](#) and the [Field of Food Science](#). It is every graduate student’s individual responsibility to be familiar with the rules and requirements laid out by the Graduate School and the Department.

- Time to degree completion: There is no specific upper time limit for finishing a MS or PhD degree. The length of time required will depend on a number of factors: completion of the class work required by the student’s thesis committee, the nature of the project, the student’s productivity, and TA responsibilities, to name a few!
- Research Requirements: Graduate students are expected to complete a significant amount of independent research that will be presented in a thesis. Students are encouraged to begin conducting experiments soon after joining the lab. Don’t wait – the sooner you get your feet wet the better!
- Hours: Graduate school (and research in general) is rarely a Monday to

Friday, 9 - 5 job. Successful completion of experiments often requires long, unpredictable, and irregular hours. The advantage of being a graduate student is the great deal of flexibility in choosing your hours. However, working hours dissimilar to those of your fellow lab members may prevent you from getting to know people and from getting the help you need. In general, graduate students are expected to work 20 - 40 hours per week. This will depend on your project, the number of classes you are taking, if you are a TA, etc. You should discuss your workload with your advisor.

- Vacation Time: We will adhere to the [Cornell University's policy](#) on vacation time. In addition to the [University Holidays](#), graduate students are entitled to 10 working days off per year. You must communicate that you are taking vacation days with your advisor, and you also need to send out a message on the Schedule channel on Teams.
- Writing Obligations: In addition to writing a thesis, graduate students are also expected to contribute to the publication of papers in peer-reviewed journals. In general, MS students conduct sufficient research to publish 1-2 papers and PhD students ≥ 3 papers. The number of papers will depend on the nature of the projects that the student works on.
- Scientific Meeting Attendance: Graduate students will be funded to present research at 1 meeting per academic year; you hence must submit an abstract that is accepted for presentation to be able to attend a meeting with funding from the lab. Please keep in mind that you must apply for [funding](#) from the graduate school. Members of our lab commonly attend annual meetings for ASM Microbe, the International Association for Food Protection (IAFP), American Dairy Science Association (ADSA), and Gordon Research Conferences. These meetings are great places to network with other students and professionals in our field, learn about employment opportunities, and, most importantly, to broaden your scientific background and understanding. Students are encouraged to suggest meetings that they would like to attend, but all meetings must be approved by Martin or Nicole. "Submission ready" abstracts must be provided to the appropriate PI (usually Nicole or Martin) for review at least 5 work days before the abstract deadline.
- Knowledge of Scientific Literature: Receipt of a graduate degree implies a certain level of expertise in your chosen area of research. An important component of conducting good research is remaining up-to-date on the current scientific literature. For students in FSL-MQIP this includes the areas of food microbiology, molecular microbiology, infectious diseases, dairy science and general microbiology, although additional areas may be relevant to a particular project. Graduate students are expected to closely follow the pertinent scientific literature. This means regularly reviewing the tables of contents and reading pertinent articles from primary scientific journals (e.g., Applied and Environmental Microbiology, Journal of Dairy Science, Journal of Bacteriology, Molecular Microbiology, Infection and Immunity, Science, Nature or PNAS). In addition, key-word literature searches should be conducted on a regular basis against databases such as PubMed Central and Google Scholar. Setting up a [Google Alert](#) may also be helpful. As a rule of thumb, you should routinely read 3 to 5 papers a week (outside of papers assigned in classes); when you are actively writing a paper this number often increases to 15 to 20 or more papers a week.

Undergraduate Students

Working in a lab while earning your graduate degree can be a very rewarding experience that will help you gain valuable skills and professional connections. Undergraduate students will typically assist with research projects, cleaning of glassware, and conducting independent research projects.

- **Working for Research Credits:** Undergraduate students may perform research for credit. Credit is earned per Cornell University [standards](#). Typically, this consists of 2-3 credits, or 6-9 hours of research per week. All undergraduates working for credit must devote three hours of their time to helping with lab support in our media room. Undergraduate students who are interested in turning their research into an [Honors Thesis](#) should work with their mentor and the Undergraduate Research Advisor for their College.
- Undergraduate students may also work in the lab for pay, when there is work and funding available. We realize that your academic requirements come first, however you are expected to post a schedule and adhere to it. If you are unable to come into the lab when you are scheduled, please notify your supervisor.

Postdoctoral and Research Associates

Postdoctoral and Research Associates are expected to carry out independent research projects with limited supervision. This is an opportunity to get mentored training in research, mentoring students, and the administrative logistics of running a lab. This is considered to be a leadership role in the lab, and you will be required to assist with a number of administrative tasks in addition to carrying out your own research.

- **Hours:** As with graduate school, this is typically not a “9-5” job. While you have flexibility with regards to your hours, please be aware that as you are in a leadership position, you should be available during normal working hours. While the overall number of hours that you work will vary by project, if a deadline is approaching, etc., a general rule of thumb is at least 40 hours per week. Any questions and concerns regarding workload and hours should be discussed with your supervisor.
- **Time Off:** In addition to staff holidays, as per [University Policy](#), Postdoctoral and Research Associates are also provided with a generous number of vacation, health and sick leave, and personal days. Please remember to inform Martin or Nicole before taking leave, and track your paid time off in [Workday](#).
- **Scientific Meeting Attendance:** The FSL-MQIP will fund Postdoctoral and Research Associates to present at up to one scientific conference per year. Please work with Martin or Nicole to identify an appropriate scientific meeting to attend.
- **Mentoring Undergraduate and Graduate Students:** Postdoctoral and Research Associates are expected to mentor Undergraduate and Graduate Students and coordinate large projects.

Technicians

Technicians provide valuable support for all of the research, teaching and extension activities that the lab conducts. You may also serve a leadership role in the lab and are expected to assist other lab members.

- **Hours:** You will have some flexibility in choosing your working hours, but

please coordinate this with your supervisor. You will be expected to enter and keep track of your hours in [Workday](#). Please note that some projects may require you to come into the lab on evenings or weekends, depending on the nature of the project. In general, over time (i.e., working >40 hours per week) is not allowed, unless specifically approved by your immediate supervisor.

- Time Off: In addition to staff holidays, staff will also accrue paid vacation, health and sick leave, and personal days. You are required to inform your immediate supervisor before taking leave, and you must track your vacation days in [Workday](#).
- Scientific Meeting Attendance: The FSL-MQIP may have funds available to support staff members to present at up to one scientific conference per year. Please work with Martin or Nicole to identify an appropriate scientific meeting to attend.

IV. Additional Resources

There are a variety of additional resources and books, which can provide important background information on your experiments, experimental procedures, etc. Please consult them regularly to gain a thorough understanding of the experimental procedures you are using. The following is a list of selected resources. Please let Martin or Nicole know if you know of other resources which you think should be listed here:

- Bergey's Manual of Systematic Bacteriology. This is a reference text for bacteriology. It tells you a great deal about the characteristics of the different bacterial species and genera. Microbiologists refer to it lovingly as "Bergey's". This is a 4 volume set which is located in room 352.
- Molecular Cloning: A Laboratory Manual (by Sambrook, Fritsch, and Maniatis). This is a reference text for molecular biology. Microbiologists refer to it lovingly as "Maniatis". This manual not only provides detailed protocols for many molecular biology techniques, but also gives information as to *why* we do certain things the way we do them. If a protocol you use is very different from what's outlined here, ask Martin for a reason (always remember that protocols you get from someone who got them from someone, etc., might not always be correct). This is a 3 volume set which is located in room 352. The most recent edition, which does not have Maniatis' name on it, is also located there.
- Current Protocols in Molecular Biology (by Ausubel et al.). Similar to Maniatis, this is a protocol book that provides detailed protocols for various molecular biology experiments and procedures. This is a 4 volume work, which receives regular updates. Please consult this book for any new molecular biology procedures you will be using in your experiments or to learn more about techniques you are using. More up to date copies of Current Protocols can be found in Mann Library.
- Listeria, Listeriosis, and Food Safety (by E. T. Ryser and E. H. Marth). This book will tell you everything you ever wanted to know about *Listeria*. A good resource if you are working with *Listeria*. Located in Martin's office.
- Genetic Analysis of Pathogenic Bacteria: A Laboratory Manual (by S. R. Maloy, V. J. Stewart, and R.K. Taylor). This lab manual provides some outstanding information on different techniques used in the genetic analysis of bacterial pathogens. It is not as comprehensive as Maniatis, but generally provides more details and more background information.

- Microbial Genetics (by S. Maloy, J. E. Cronan, and D. Freifelder). This is a textbook and a good resource to look up things. Located in Martin's office.
- The New England Biolabs Catalogue. This catalogue provides valuable information on use of different restriction enzymes, buffers, etc. Useful resources are located in the beginning and the end of this catalogue.
- Lab Math: A Handbook of Measurements, Calculations, and Other Quantitative Skills for Use at the Bench (by D.S. Adams). Describes basic mathematical principles and various tasks involving numbers, including how to calibrate lab equipment, how to make solutions, and the numbers involved in various methods for quantifying DNA, RNA, and proteins, and an all-new section on quantitative polymerase chain reaction. Basic statistical ideas and methods and the proper reporting of uncertainty are described in simple-to-understand language.

By signing and dating, you are confirming that you have:

(i) read and understood this lab manual and agree to adhere to its directives

(ii) completed the required readings

Name (Printed): _____

Signature: _____

Date: _____