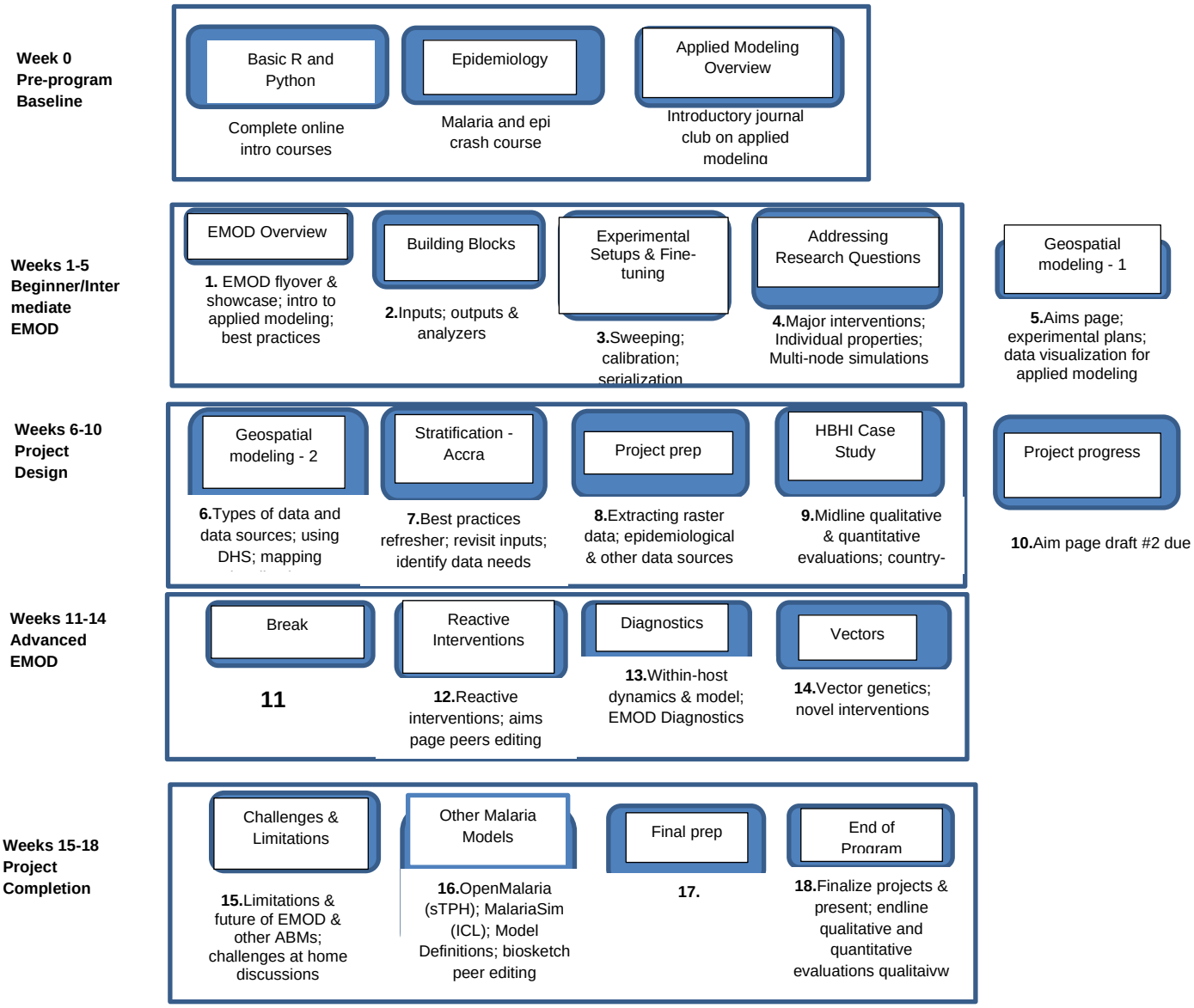
2025 Faculty Enrichment Program Handbook

Program Overview

Curriculum Outline

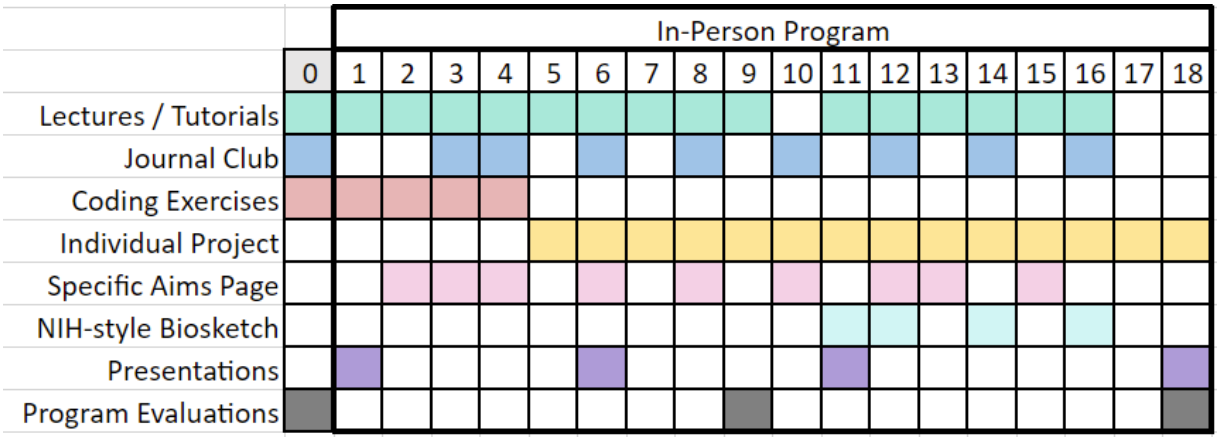


Weekly calendar at a glance

Week	Module	Format	Topics	Notes
0: April 07 -11h, 2025	Pre-program	Virtual lectures; journal clubs	1. Epidemiology crash course 2. Coding & data visualization basics 3. Introductory journal clubs (applied modeling overview) 4. Alumni roundtable	Participants travel to Hohoe at end of week
1: April14-18th, 2025	Welcome to Hohoe	In-person lectures, tutorials	1. Intro to EMOD 2. Intro to Hohoe 3. Baseline evaluations 4. Intro to GitHub & QUEST 5. EMOD setup & simple run 5. Team Best Practices 6. Participant research talks	Time set aside for logistics and getting settled
2: April 21 -25th, 2025	Building Blocks	In-person lectures, tutorials	1. EMOD inputs 2. EMOD outputs 3. Analyzers	Initial specific aims ideas outline due 25th April
3: April 28th – May 02nd, 2025	Experiment Setups & Fine-tuning	In-person lectures, tutorials, journal club	1. Calibration 2. Serialization 3. Sweeping over parameters	Specific aims outline draft #1 due 2 May
4: May 05 – 09th, 2025	Addressing Research Questions	In-person lectures, tutorials, journal club	1. Adding interventions 2. Individual properties 3. Multi-node simulations	Specific aims outline draft #2 due 9 May
5: May 12 – 16th, 2025	Geospatial Modeling	In-person lecture	1. Crafting a Biosketch 2. Intro to geospatial mapping	
6: May19 -23rd, 2025	Geospatial Modeling cont.	In-person lectures, tutorials, journal club, participant presentations	1. Participant present specific aims 2. DHS data and survey design 3. Data types and sources 4. Advanced Geospatial modeling	Specific aims full draft #2 and presentation due 23 May and 28 respectively
7: May 26th – 30th, 2025	Stratification workshop in Accra	In-person tutorials		
8: June 02 -06th, 2025	Project Preparation	In-person lectures, tutorials, journal club	1. Project setup 2. Entomology data and vectors in EMOD 2. MAP rasters 3. Peer editing hour 4. Best practices refresher	Specific aims full draft #2 due June 06

Week	Module	Format	Topics	Notes
9: June 09 – 13th, 2025	HBHI Case Study	In-person discussion	1. Vector genetics 2. HBHI modeling use case - country TBD 3. Project setup refresher 4. Midline evaluations	
10: June 16th – 20th, 2025	Project Progress	In-person journal club	1. Presentation and aims prep	Specific aims draft #3 due June 20
11: June 23 – 27th, 2025	BREAK	BREAK	BREAK	BREAK
12: June 30 – July 04th, 2025	Advanced EMOD: Reactive Interventions	In-person tutorial, journal club, aims review	1. Peer editing of aims pages 2. Conditionally-triggered interventions	Biosketch draft #1 due July 04
13: July 07 – 11th, 2025	Advanced EMOD: Diagnostics	Hybrid lectures	1. Within-host dynamics & model 2. EMOD diagnostics 3. Peer Editing Hour	Specific aims draft #4 due July 11
14: July 14th– 18th, 2025	Advanced EMOD: Vectors	Hybrid guest lectures, journal club	1. Novel vector control interventions	Biosketch draft #2 due July 18
15: July 21 – 25th, 2025	Limitations of Modeling & Challenges at Home	In-person roundtables	1. Limitations and future of EMOD and agent-based modeling 2. Technical difficulties and challenges at home 3. Start final presentation prep	Specific aims final draft due July 25
16: July 28th – August 01st, 2025	Other Malaria Models	Hybrid guest lecture/discussion; in-person journal club; peer editing	1. OpenMalaria (Swiss TPH) 2. Malariasim (IC London) 3. Prepare final project talks 4. Biosketch peer editing hour	
17: August 04 – 08th, 2025	Preparation for final presentation	In-person conferences		
18: August 11 – 15th, 2025	End of Program	Final participant presentations, endline evaluations	1. Final participant project presentations 2. Endline evaluations	

Session Chart



Assignment Due Dates

Week	Milestone	Due
0	Pre-Program Coding Assignment	**April 11, 2025**
2	Introductory Research Talk	**April 17, 2025**
2	Specific Aims Ideas	**April 25, 2025**
3	Specific Aims Outline #1	**May 02, 2025**
4	Specific Aims Outline #2	**May 09, 2025**
6	Specific Aims Full Draft #1	**May 23, 2025**
6	Specific Aims Presentation	**May 28, 2025**
8	Specific Aims Full Draft #2	**June 06, 2025**
10	Specific Aims Full Draft #3	**June 20, 2025**
11	Work-in-Progress Presentation	**July 2, 2025**
12	Specific Aims Peer Editing Hour	**July 4, 2025**
12	Biosketch Draft #1	**July 4, 2025**
13	Specific Aims Full Draft #4	**July 11, 2025**
14	Biosketch Draft #2	**July 18, 2025**
15	Specific Aims Final Draft	**July 25, 2025**
16	Biosketch Peer Editing Hour	**July 28,2025**
18	Final Project Presentation	**August 14, 2025**

Aims Page Expectations

Ideas List

- A list of at least 3 topics or research ideas for your EMOD project in applied malaria modeling
- **Who will review:** Buddies

Outline Draft 1

- Draft 2-3 specific aims for two of your applied malaria modeling ideas, along with the appropriate context and motivation as bullet points
- **Who will review:** Buddies

Outline Draft 2

- Pick one of your applied malaria modeling ideas
- Complete the "structure of an aims page" outline for this idea, addressing each element: Rhetorical pattern of introductions in aims pages (From Rick McGee, CLIMB)
    - General significance: What is the "big picture" for the research? Why is it important?
    - Narrowing context: What is known and accepted in your research area?
    - Your research contribution: Has your previous work contributed? How?
    - Complication: What is the problem, roadblock, the unknown?
    - Long-term goal: What final "big results" will research help achieve?
    - Specific goal of this research: "What is "specific narrow goal" of this research?
    - Summary of research—path to hypothesis: How does previous research lead to hypothesis?
    - Hypothesis: What do you believe to be the answer to the complication?
    - Qualifications stressed: What makes you the right person to undertake the research?
- For elements where you are not sure how to complete, review with one of the instructional staff
- **Who will review:** Buddies

Full Draft 1

- Using your "structure of an aims page" outline, write the entire first draft of the Aims page, including all sections.
- **Who will review:** Jaline

Full Drafts 2-4

- Each new draft should be incorporate the feedback you received on the previous draft and anything new you have learned from the program, from literature review, or from executing the project. If you have chosen to reject a piece of feedback, provide a reason. If you need to change topics entirely, do so by returning to the *Outline Draft 2* step and moving forward from there with the new research question.
- **Who will review:** Jaline

Final Draft

- This should be a very polished Specific Aims page on your applied malaria project that you would be proud to submit to a funding agency.

Presentation Expectations

Presentation 0: Introductory Research Talk
A 30-minute talk showcasing 1 or 2 past or current projects to introduce yourself, your work, and your interests to the program participants, program staff, and team at Northwestern.

Presentation 1: Specific Aims Presentation
A 15-minute talk presenting the proposed research project using EMOD that you will be carrying out in the remainder of the program. Focus on the motivation, background, and proposed approach. Do not present results. This presentation will be followed by a feedback session with the other participants and program staff.

Presentation 2: Work-in-Progress Presentation
A 20-minute talk presenting the research project. Focus on the motivation, background, approach, initial results, and next steps. This presentation will be followed by a feedback session with the other participants and program staff.

Presentation 3: Final Project Presentation
A 30-minute talk presenting the research project. Focus on the motivation, background, approach, results, interpretation, and next steps. This presentation will be followed by a feedback session with the other participants and program staff.

Session Types

- Instructional Lectures – Sessions involving instructional presentations on modeling and best practices without in-session application/coding
    - 1 virtual (2 hours); 13 in-person (1-2 hours each)
- Guest Lectures
    - 5 hybrid (0.5-1 hour each)
- Discussions
    - 2 virtual (1-2 hours); 8 in-person (1-2 hours each)
- Coding/Tutorials – Sessions that involve participants writing/running code. Laptops needed.
    - 17 Total (2-3 hours each)
- Journal Club – One participant leads the discussion of an article which the whole group has read. Either the paper's author or the leader's buddy will also be present to help facilitate discussion.
- Presentations – Participants share either writing or a slide deck and receive feedback from the team
    - Week #2: Intro Research Presentation
    - Week #6: Aims Presentation
    - Week #11: Work-in-Progress Presentation
    - Week #18: Final Presentation
- WIP Practices - Faculty Enrichment teams will present their work-in-progress; first, to practice and receive feedback from the team and program participants; second, to the UHAS IHR weekly seminar
    - 8 practice sessions

- Aims page preparation – Participants will read aims draft to peers who will help workshop drafts to improve communication of ideas. Additional peer review should be done separately.
    - 1 peer editing session
- Biosketch preparation – Participants will prepare and undergo peer review of their NIH-style biosketch including a personal statement, their positions/appointments/honors, and contributions to science. Additional peer review should be done separately.
    - 1 peer editing session
- Weekly Meetings
    - Malaria Team Meetings (1 hour) - ?
    - 1-on-1 with team mentor (30 min)
    - 1-on-1 with Isaiah/Benedicta (30 min)
        - Some weeks may be scheduled as a 2-on-1 with team mentor and Jaline
- Program Evaluation
    - Qualitative Interviews (~1.5 hours each) in weeks #1, #9, and #18

Program Week-by-week

Week 0: Pre-Program Introductions (virtual)

Welcome! This week includes 3 days of virtual sessions before the in-person program. You'll get to know your fellow participants, the NU-UHAS modeling team, and program alumni. We'll also review some foundations of malaria epidemiology, discuss 2 papers in journal clubs, and establish a common baseline in R and python programming.

To-Do List

- Read journal club papers in advance
- Complete python and R tutorials, if needed
- Pre-Program Coding Assignment

Online Python and R Self-led Tutorials [tutorial]

Learn the basics of R and python programming languages, which will be used heavily throughout the program. These tutorials cover the skills needed to complete the Pre-Program Coding Assignment and should be completed on your own time before the program begins. Each tutorial is estimated to take a new programmer ~10 hours to complete*. Virtual "office hours" will be held during the week where you can ask any questions that arise from the tutorials or assignment.*

- Use both python and R to read, clean, and display data
- Use the tidyverse package to transform and visualize data

Week 0 Sessions

Program Introduction [discussion]

Meet the members of the Northwestern Malaria Modeling team who will lead the program and other participants.

- Get to know instructional staff and other participants involved in the program
- Discuss the program curriculum, handbook, and FE team slack

Advice from Program Alumni [discussion]

The main objective of this activity is to provide participants with the opportunity to interact with past participants of the FE program. It is expected that through this activity, current participants will learn from their challenges and experiences in the program and beyond.

- How to get support (technical and non-technical)
- Prepare for success during the program and at home
- Build connections with program alumni

Malaria Epidemiology Crash Course [lecture]

Brush up on some fundamental concepts needed to study - and model - malaria transmission.

- Describe malaria pathogenesis and disease burden metrics in humans
- Describe factors that affect the disease burden, including impact of interventions and host factors such as age and immunity
- Overview of epidemiological methods for measuring malaria morbidity and mortality and how information can be collected
- Identify examples of error, bias, confounding, and validity in malaria studies
- Describe the life-cycle of human malaria parasites, key stages, and their relevance to transmission and control
- Relate the parasite life cycle to pathogenesis, immune responses, and interventions
- Describe the life- and feeding cycle of malaria vectors

Journal Club 0: Use of Mathematical Modeling in WHO Guidelines

For the first journal club, we will discuss a systematic review which identifies and assesses WHO guideline recommendations that include evidence from mathematical modeling studies. The goal is to take a high-level view of the relationship between modeling studies and actual public health practice. Please read the journal club paper and come prepared to discuss your thoughts.

- Understand benefits and limitations of using mathematical modeling studies to guide global health policy
- List important ethical considerations of using modeling to inform policy
- Learn how modelers can ensure studies are conducted and reported in a transparent/rigorous manner
- Become familiar with examples of mathematical modeling in applied to global health polic**y**

Lo, N. C., Andrejko, K., Shukla, P., Baker, T., Sawin, V. I., Norris, S. L., & Lewnard, J. A. (2022). Contribution and quality of mathematical modeling evidence in World Health Organization guidelines: A systematic review. Epidemics, 39, 100570.

Week 1: Welcome to Hohoe

Welcome to your new home in Hohoe and here with us at UHAS ! This week we'll help you get oriented and ready to use EMOD, GitHub, and the computing cluster QUEST. You'll get an overview of EMOD and some of its applications, then start coming up with ideas for your own applied malaria modeling project.

To-Do List

- Prepare and present Introductory Research Talk – due May 28
- Practice presenting to peers beforehand.
- Review the "Structure of a Specific Aims Page"
- Meet with buddy & schedule weekly 1:1s
- Baseline Program Evaluation, if not already completed

Week 1 Events

Welcome Breakfast [discussion]

This session is designed to help introduce you to Hohoe (FNBSPH and Vice chancellor of UHAS) and the Faculty Enrichment program. Breakfast and lunch will be provided.

- Meet your program Directors/Instructors, the FNBSPH team, and other participants in person
- Understand FNBSPH UHAS requirements for new visiting scholars
- Plan for appointments with administrative assistant at FNBSPH to make sure all paperwork is completed on time.

Welcome Lunch [discussion]

We will have an informal lunch to facilitate getting to know everyone.

UHAS Tour [discussion]

We will go on a tour of the UHAS main campus in Ho so you can familiarize yourself with the university community and its operational structures. We'll also provide an overview of Hohoe including topics like transportation, food, and things to do.

- Navigate the Hohoe municipality
- Understand resources available to you outside of the program

Introductory Research Talks [presentations]

Participants will provide brief introductory talks on their background and research

- Introduce yourself and your research to team and other participants

Week 1 Sessions

Team Best Practices [lecture]

The goal of the session is to outline and demonstrate best practices related to team communication, code organization, scientific writing/presentations, and the use of shared resources. We will also review expectations for participation in program activities.

- Understand and apply team best practices to your own work Discuss expectations for office hours, 1-on-1, and 2-on-1 meetings
- Explain troubleshooting/getting help workflow

What is Applied Malaria Modeling? [lecture]

This session provides a broad overview of the concepts behind and practice of applied malaria modeling.

- Discuss the goals of applied malaria modeling and how they differ from goals of more theoretical modeling
- Discuss the process of applied malaria modeling and how it can differ from an academic process
- Show where modeling can be applied in programmatic decision-making
- Briefly discuss examples, highlighting those that will show up in journal clubs

Introduction to EMOD [lecture]

This session offers a broad overview of EMOD, the agent-based modeling platform we will use throughout the program, and how it differs from simpler epidemiological models.

- Describe the basic setup and capabilities of EMOD
- Discuss the differences between stochastic and deterministic models
- Compare and contrast agent-based models and compartmental models

Team Project Showcase [lecture]

Members of the FE team share examples of their previous.

Intro to High-Performance Computing with QUEST [lecture]

This session offers a basic introduction to high performance computing (HPC) and the QUEST system that we use to run EMOD.

- Understand the system architecture of QUEST, Northwestern's high-performance compute cluster
- Distinguish between nodes, cores (CPUs), and jobs
- Explain the benefits of using HPC for parallel computing
- Learn best practices for using shared computing resources on QUEST

Interactive QUEST Practice with Research Computing [tutorial]

Following the technical overview of HPC and QUEST, we'll go through some of the basics of using QUEST and the command line. This session will be hands on so you can log into QUEST yourself and practice some of the basic techniques we use regularly.

- Log-in to QUEST.
- Practice common UNIX commands to interface with QUEST

- Practice using bash commands for batch job submission.
- Back up files from a project directory to your home directory on QUEST
- Use Globus File Manager to transfer files from QUEST to your local machine.

GitHub [tutorial]

We'll help set you up to use GitHub for the duration of the program. GitHub is an online software development platform we use for storing, tracking, and collaborating on software projects.

- Fork, clone, and maintain a GitHub repository (FE-2025-examples; contains program-specific examples

EMOD Installation/Walkthrough [tutorial]

We'll help set you up to use EMOD and the Northwestern University computing cluster, QUEST, and go through a basic example run script and standard output files.

- Install and setup an EMOD virtual environment on your home directory on QUEST
- Walkthrough basic setup of a simple EMOD example
- Use EMOD task to setup suites, experiments, and simulations
- Run EMOD on QUEST
- Plot basic/sample simulation outputs.
- Understand standard error and output files

Week 2: Building Blocks of EMOD

This week starts with each of you giving a short presentation to introduce yourself, your research, and your goals. **Tuesday is a holiday.** In the tutorials, you'll get hands-on experience writing code to setup, run, and handle outputs from simulations in EMOD. Throughout the week, you'll develop specific aims for your own modeling ideas.

To-Do List

- Brainstorm ≥ 3 applied malaria modeling ideas of your own – due April 25
- Discuss with other participants
- Bring draft to review during 1-on-1 with buddy

Week 2 Events

Week 2 Sessions

EMOD Inputs [tutorial]

The most basic files used as inputs to EMOD simulations are 1) Demographics file defining geography and population, 2) Climate files defining temperature and rainfall, and 3) Configuration file defining disease characteristics and simulation specifications. In this tutorial you'll learn how to create and customize each.

- Generate and interpret EMOD input files describing demographics, climate, and other parameters
- Navigate configuration files to understand what each does

EMOD Outputs & Analyzers [tutorial]

Outputs are an important part of applied modeling as they contain simulation data that can be processed into results. In this session, we'll discuss some common EMOD outputs, how to add them to simulations, and how to analyze them.

- Generate EMOD output files and understand the difference between reports
- Analyze outputs to produce human-readable files
- Modify basic plotting scripts to plot different output channels

Week 3: Experiment Setups and Fine-Tuning

The tutorials this week focus on two ways we begin tailoring models beyond the building blocks of EMOD introduced last week: *calibration* and *serialization*. Throughout the week you will draft an outline of a Specific Aims page for your project.

To-Do List

- Draft 2-3 specific aims for two of your applied malaria modeling ideas, along with the appropriate context and motivation as bullet points – due May 2
- Bring draft to discuss during 1-on-1 with buddy
- Give and receive feedback on aims drafts with fellow program participants
- Read journal club article

Week 2 Events

Week 3 Sessions

Parameter Sweeping [tutorial]

Oftentimes we will want to examine a range of parameter values to understand how they impact model outputs. These may be for internal model parameters, such as those having to do with immunity, or parameters that go into campaigns, such as intervention coverage. This tutorial will introduce you to the basic mechanisms of sweeping through such parameter sets.

- Use EMOD task to setup sweep through a range of parameter values between simulations
- Run example code on QUEST

Calibration [tutorial]

It's important to compare model behavior to primary data, to check model assumptions and gain insight into its bias/error/uncertainty. For a set of inputs, there may be a wide range of outputs depending on the values of other model parameters. This tutorial features a simple (but common) calibration which selects larval habitat parameters to reach a target prevalence.

- Explain the rationale behind calibration to epidemiological indicators
- Choose appropriate calibration targets and parameters

Serialization [tutorial]

Some simulations take a long time to run, and the part you are interested in is at the end. EMOD's serialized population feature allows you to save the state of people – their health, infection, and intervention history – and restart from that saved state. This is useful for allowing populations to build immunity to malaria over decades, saving that state, and restarting with established immunity. It also allows for calibration chaining.

- Explain the rationale behind serialization & how to apply it to your own simulations
- Write serialized files for "burnin" simulations & read them for "pickup" simulations
- Draft a potential serialization timeline for one of your applied malaria modeling ideas

Journal Club 1: Intervention planning in Nigeria

In this week you have learned how the EMOD building blocks come together in a series of simulation experiments and scenarios across parameter sweeps. One of the most complex yet practical experiment setup can be found in modeling intervention impact in countries. Please read the journal club paper on such an application of modeling in Nigeria and come prepared to discuss your thoughts.

Ozodiegwu, I. D., Ambrose, M., Galatas, B., Runge, M., Nandi, A., Okuneye, K., ... & Gerardin, J. (2023). Application of mathematical modelling to inform national malaria intervention planning in Nigeria. Malaria Journal, 22(1), 1-19.

- Discuss a practical use case that demonstrates how EMOD building blocks and simulation steps come together to address a common question in malaria intervention planning
- Understand types of questions that malaria models can be used to answer

Week 4: Addressing Research Questions

So far, you've learned how to set up and tune a model so that it aligns with your setting of interest. This week's tutorials cover how to add antimalarial interventions to simulations, and how to specify individual properties distinguishing between groups of people. We'll also introduce the basics of spatial, multi-node simulations

To-Do List

- Complete the "Structure of an aims page" template for one of your applied modeling ideas – due May 9
- Discuss with other participants
- Bring completed template to 1:1 to discuss with buddy
- Begin literature search on possible data sources to parameterize your project
- Read journal club article
- If leading journal club, prepare content and analysis points and discuss with buddy
- Recommended read, as time allows

Week 4 Sessions

Adding Interventions [tutorial]

Learn how to add basic, customize, and track basic antimalarial interventions in simulations.

- Add basic interventions to simulations
- Add and analyze event reporting to verify interventions are distributed properly
- Change intervention parameters (timing, coverage, targeting, etc.) to examine how outputs change
- Identify the interventions needed to address your research questions

Individual Properties [tutorial]

Learn how to introduce heterogeneity among individuals in your simulation. For example, you can define property values for accessibility, age, geography, risk, etc. and use them to target (or exclude) individuals/groups when adding interventions.

- Explain the purpose and functionality of individual properties in EMOD
- Configure a demographics file to include individual properties
- Target an intervention through individual properties
- Analyze output by individual property value
- Choose the properties needed to address your research questions

Multi-Node Simulations [tutorial]

Learn how to set up and run simulations in multiple nodes simultaneously. This is useful when interactions between nodes are important. For most projects, single node simulations are just fine.

- Generate inputs for multiple nodes from a spreadsheet
- Assign node properties
- Deploy interventions differently between nodes

Journal Club 2: Seasonality of transmission and interventions

Last week we discussed the importance of calibrating models to match what has been observed in the "real world". Sometimes, however, fundamental quantities underpinning malaria transmission (mosquito populations, immunity levels, etc.) are essentially impossible to measure. For journal club this week, we'll discuss an article in which the authors leverage EMODs acquired immunity model and use seasonal parasite densities to capture transmission trends despite limited entomological data. Please read the journal club paper and come prepared to discuss your thoughts. If you are facilitating the session, prepare an overview of the paper and at least four guiding questions.

Selvaraj, P., Wenger, E. A., & Gerardin, J. (2018). Seasonality and heterogeneity of malaria transmission determine success of interventions in high-endemic settings: a modeling study. BMC Infectious Diseases, 18(1), 1-14.

- Describe the importance of capturing transmission levels and seasonality in model setup
- Understand how seasonality and transmission can impact malaria control interventions

Additional recommended reading:
Nikolov, M., Bever, C. A., Upfill-Brown, A., Hamainza, B., Miller, J. M., Eckhoff, P. A., ... & Gerardin, J. (2016). Malaria elimination campaigns in the Lake Kariba region of Zambia: a spatial dynamical model. PLoS computational biology, 12(11), e1005192.

Week 5: Geospatial Modeling

This week's sessions will cover geospatial modeling, which will help you understand spatial data types and show you how to develop geospatial models and create geospatial maps for both observed and predicted health outcomes, with a focus on malaria using the free R software and its associated packages. We will be working with possible scenarios, understanding the data and maps and why this is critical to supporting health policy and intervention strategies related to the malaria control and elimination program.

To-Do List

- Sketch a timeline of proposed experiments with serialization steps, interventions, and calibration points
- From your proposed timeline, identify data needed to inform model parameter calibration
- Prepare a presentation on the background/motivation, and specific aims of your applied modeling project
- Create a new GitHub repository for your project
- Begin a project notes document for your project, from the available template
- Review proposed timeline, repository, and project notes with buddy during 1:1
- Give/receive feedback on aims drafts and practice presentations with fellow program participants

Week 5 Events

Week 5 Sessions

Crafting a Biosketch [biosketch]

A workshop for introducing and starting the Biographical Sketch (or "biosketch") to highlight your qualifications and experience that will support your proposed Specific Aims.

- Understand the purpose and format of the NIH Biosketch
- Learn about the tools available for creating an NIH Biosketch
- Identify types of publications and objects of scholarly activity for the NIH biosketch
- Review of databases for finding citation and alternative metrics

Introduction to Geospatial Data Science [tutorial]

General introduction to geospatial data science, spatial data types, shapefiles, rasters, CSV, coordinates systems and their transformations, longitude and latitude, mapping observed malaria cases, mapping with plot, spplot, tmap, leaflet

- Overview of spatial data types: shapefiles, rasters, CSV
- Understanding coordinate systems and their transformations
- Mapping observed malaria cases using longitude and latitude
- Introduction to mapping tools: plot, spplot, tmap, leaflet
- Interactive web-based mapping of malaria counts and prevalence

Pre-processing of Geospatial Data [tutorial]

Good data visualization can reveal hidden patterns and trends or help tell a story in a more compelling way. How do you choose the right chart type for your data? Once you choose, what does it look like when done well? This R workshop will cover everything you need to know to start visualizing your data effectively.

- Gathering and pre-processing large-scale geospatial data
- Computational tools for geospatial data analysis
- Representation of spatial data: coordinate systems, cartographic projections
- Calculating distances on the Earth's surface
- Geospatial data visualization techniques for crude surfaces

Geospatial Modelling and Mapping [tutorial]

General introduction to geospatial data science, spatial data types, shapefiles, rasters, CSV, coordinates systems and their transformations, longitude and latitude, mapping observed malaria cases, mapping with plot, spplot, tmap, leaflet

Week 6: Geospatial Modeling (cont)

This week's sessions will cover Geospatial modelling and mapping practical for both geostatistical and lattice data in R, estimation of spatial correlation, spatial data preparation and further processing, mesh creation, extracting values from raster files, Integrated Nested Laplace Approximation (INLA), LISA, web-based mapping of malaria modelled surfaces to inform policy and intervention, mapping possible scenarios based on available public health resources.

To-Do List

- Sketch a timeline of proposed experiments with serialization steps, interventions, and calibration points
- From your proposed timeline, identify data needed to inform model parameter calibration
- Prepare a presentation on the background/motivation, and specific aims of your applied modeling project
- Create a new GitHub repository for your project
- Begin a project notes document for your project, from the available template
- Review proposed timeline, repository, and project notes with buddy during 1:1
- Give/receive feedback on aims drafts and practice presentations with fellow program participants

Week 6 Events

Specific Aims Presentations [presentations]

Participants will present on the specific aims of their proposed projects

- Present project aims with clear communication of ideas and background
- Provide feedback to other participants

- Revise aims, presentations, and projects based on peer feedback

Week 6 Sessions

Data Types & Sources [lecture]

This session provides an overview of different types of data sources and epidemiological studies as well as how we use them to inform model inputs and assumptions.

- Identify potential sources of commonly-used input data that are free and open-access
- Understand the strengths and limitations of using a given data type/source to inform a parameter of interest

DHS Program Data [lecture/tutorial]

Participants will be introduced to DHS as a data source. We will discuss types of data are collected (and collection methods), how we can use these data to inform country specific model parameterization, and how to access DHS data.

- Understand DHS Program data and how survey design impacts data interpretation
- Retrieve relevant DHS data directly in R using DHS API

Advanced Geospatial Modelling Techniques [tutorial]

General introduction to geospatial data science, spatial data types, shapefiles, rasters, CSV, coordinates systems and their transformations, longitude and latitude, mapping observed malaria cases, mapping with plot, spplot, tmap, leaflet

- Integrated Nested Laplace Approximation (INLA) for spatial modelling
- Local Indicators of Spatial Association (LISA) for spatial autocorrelation analysis
- Web-based mapping of malaria modelled surfaces
- Using geospatial modelling to inform policy and intervention strategies
- Mapping possible scenarios based on available public health resources

Application of Geospatial Analysis in Public Health [tutorial]

Good data visualization can reveal hidden patterns and trends or help tell a story in a more compelling way. How do you choose the right chart type for your data? Once you choose, what does it look like when done well? This R workshop will cover everything you need to know to start visualizing your data effectively.

To-Do List

- Complete first full draft of specific aims page – due May 23
- Present specific aims and revise based on feedback – due June 6
- Practice presenting to peers beforehand
- Identify sources of data from the literature that can be used to parameterize your project
- Read journal club article
- If leading journal club, prepare content and analysis points and discuss with buddy
- Recommended reading, as time allows.

Journal Club 3: Chemoprevention and malaria vaccine impact

We use data to inform model inputs for configuration, campaigns, and demographics. This paper provides a good example of data informing transmission and intervention coverage assumptions. Please read the journal club paper and come prepared to discuss your thoughts. If you are facilitating the session, prepare an overview of the paper and at least four guiding questions.

Runge, M., Stahlfeld, A., Ambrose, M., Toh, K. B., Rahman, S., Omoniwa, O. F., ... & Gerardin, J. (2023). Perennial malaria chemoprevention with and without malaria vaccination to reduce malaria burden in young children: a modelling analysis. Malaria Journal, 22(1), 1-13.

- Discuss how DHS data can be used to inform country specific model parameters
- Explain potential assumptions and adjustment requirements for model input that are dependent on data context
- Discuss differences in operational and target coverage and how we may think about them for modeling questions

Additional recommended reading:
Ozodiegwu, I. D., Ambrose, M., Battle, K. E., Bever, C., Diallo, O., Galatas, B., ... & Gerardin, J. (2021). Beyond national indicators: adapting the Demographic and Health Surveys' sampling strategies and questions to better inform subnational malaria intervention policy. Malaria journal, 20(1), 1-7.

Week 7: ……BREAK……

Week 8: Project Preparation

This week is about other types of data that are commonly used to inform models, with a focus on data on malaria vectors and vector control interventions. In the tutorials, we'll take a closer look at the vector model in EMOD, and practice extracting spatial estimates of vector control interventions from the Malaria Atlas Project (MAP). You will work together to reverse-outline, revise, and resubmit drafts of your Specific Aims pages.

To-Do List

- Specific aims draft #2 – due June 6
- Give/receive feedback on aims drafts with fellow program participants
- Reverse-outline peers' Aims Pages, mapping the content back onto the "Structure of an Aims Page" outline
- Read journal club article
- If leading journal club, prepare content and analysis points and discuss with buddy
- Identify and read literature related to vector species and behavior relevant to your project
- Identify additional data sources, outside DHS, to inform your model parameters
- Explain the strengths/weaknesses of data sources most commonly used for model parameterization

Week 8 Events

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Week 8 Sessions

Best-Practices Refresher [lecture]

We will review best practices for the program with a particular focus on your project needs, such as GitHub and project notes.

- Review and implement expectations for project upkeep

Entomology [guest lecture]

This session will introduce the use of entomological data in the malaria literature and potential uses for modeling.

- Discuss entomological data collection for malaria vectors
- Explain the entomological inoculation rate (EIR) and relationship to other entomological metrics such as human biting rate and vector density

Vectors in EMOD [tutorial]

Learn how to add complexity to vector setup and their associated interventions in EMOD

- Name and explain how vector parameters can be modified in EMOD
- Understand how to use entomological data for setting up the vector model in EMOD

MAP Raster Data [lecture/tutorial]

Learn about the Malaria Atlas Project's spatial data and its application for other modeling questions

- Explain what MAP spatial data estimates on high resolution "rasters" represent, and how to use them to parameterize interventions/inputs in EMOD.

Journal Club 4: Efficiency of Intervention Allocation

Often, we are interested in comparing various intervention scenarios using modeling to inform policymakers about the efficiency of allocation in controlling malaria. Please read the journal club paper and come prepared to discuss your thoughts. If you are facilitating the session, prepare an overview of the paper and at least four guiding questions.

Walker, P. G., Griffin, J. T., Ferguson, N. M., & Ghani, A. C. (2016). Estimating the most efficient allocation of interventions to achieve reductions in Plasmodium falciparum malaria burden and transmission in Africa: a modelling study. The Lancet Global Health, 4(7), e474-e484.

- Understand how modeling approaches can evaluate impact of different intervention scenarios
- Discuss different methods of thinking about efficiency and so-called optimal allocation such as in terms of cost, reducing burden and transmission, and scaling of implementation

Week 9: HBHI Case Study

Congratulations on making it half-way through the program! This week we'll discuss the High-Burden High-Impact initiative (HBHI) and the application of modeling as tool to provide more strategic information to support National Malaria Programs in sub-national tailoring of malaria interventions. We'll also have a guest lecture on vector genetics and novel control interventions.

To-Do List

- Midline Program Evaluation
- Brainstorm potential figures to portray the 2-3 key results of your project
- Create at least 2 draft plots of brainstormed figures using R or python

Week 9 Events

Project Setup Refresh - Benedicta, Isaiah

FE Participants Work-in-Progress Presentations [presentations]

Participants will present their project progress including background, methods, project plan, and initial results

- Present progress with clear communication of ideas
- Provide feedback to other participants
- Revise aims, presentations, and projects based on peer feedback

Week 9 Sessions

Vector Genetics & Control [guest lecture]

So far, we have seen how to add vectors and modify the basics of their configuration to simulate transmission in EMOD. This session will present more advanced vector handling in EMOD, such as vector genetics, insecticide resistance, and novel vector control tools.

- Understand vector genetics and behavior in EMOD
- Understand how to simulate insecticide resistance in EMOD
- Understand how to simulate novel vector control tools (gene drive mosquitoes, ASTBs, endectocides) in EMOD

HBHI, SNT, & Country Modeling [lecture & discussion]

In week 3, we read a paper on using EMOD for projecting impact of malaria interventions in Nigeria within the HBHI and SNT contexts. This week we will revisit these concepts as you have learned more about how EMOD works, the types of questions that are appropriate to answer using modeling and applied malaria modeling in countries. This lecture will take you through the background of the HBHI initiative and how modeling plays a role in the bigger picture. Additionally, we'll explore how the NU team's modeling workflow for applied country modelling is structured.

- Obtain an understanding of why a rethinking in global malaria policy is needed and how the High Burden to High Impact Initiative fits into the change of one-size-fits all approach to subnational tailoring and how it supports a country-led malaria response.
- Explain the role of modeling within the initiative
- Describe critical communication touchpoints with relevant stakeholders during the modeling analysis as part of the Global Fund application cycle in countries
- Describe conceptual the modeling workflow adapted for HBHI/SNT country support

Recommended readings: HBHI a targeted malaria response, World Health Organization

Week 10: Project Progress

This week is all about making progress on your individual projects. You'll revise and resubmit a draft of the Specific Aims page and prepare an updated presentation on your progress so far.

To-Do List

- Specific aims draft #3 – due June 20
- Give and receive feedback on aims drafts with fellow program participants
- Read journal club article.
- If leading journal club, prepare content and analysis points and discuss with buddy
- Recommended read, as time allows.
- Prepare a presentation on the background/motivation, plan, data sources, and early results for your project.
- Practice presentations with peers.

Week 10 Events

Journal Club 5: Tanzania SNT – Intervention Packages

Last week we revisited the application of malaria modeling within the HBHI and SNT contexts. This week we will read a paper that addressed similar questions but in a different model to support the national malaria program in Tanzania. An additional use-case that we read earlier in the program is included as recommended reading. Please read the journal club paper and recommended read and come prepared to discuss your thoughts. If you are facilitating the session, prepare an overview of the paper and at least four guiding questions.

Runge, M., Thawer, S. G., Molteni, F., Chacky, F., Mkude, S., Mandike, R., ... & Pothin, E. (2022). Sub-national tailoring of malaria interventions in Mainland Tanzania: simulation of the impact of strata-specific intervention combinations using modelling. Malaria Journal, 21(1), 1-17.

- Discuss specificities and differences of subnational tailoring of malaria interventions and stratification on the example for Tanzania
- Compare, to earlier SNT use-case of Nigeria
- Describe how heterogeneities in transmission and prevalence can affect intervention impact and model outputs

Additional recommended reading:
Ozodiegwu, I. D., Ambrose, M., Galatas, B., Runge, M., Nandi, A., Okuneye, K., ... & Gerardin, J. (2023). Application of mathematical modelling to inform national malaria intervention planning in Nigeria. Malaria Journal, 22(1), 1-19.

Week 11: 2nd Break

Week 12: Advanced EMOD – Reactive Interventions and Spatial modeling

This week you'll continue working on your project and share your Specific Aims page for feedback during Peer Editing Hour. You'll also begin writing and revising sections of your biosketch. In the tutorial, we'll introduce advanced topics related to reactive (conditionally-triggered) interventions.

To-Do List

- Share specific aims page during peer editing hour, and revise based on feedback
- Biosketch draft #1 – due July 4
- Read journal club article
- If leading journal club, prepare content and analysis points and discuss with buddy
- Draft the following sections of your biosketch and share with peers for feedback.
- Demographic Information
- Contributions to Science
- Positions, Scientific Appointments, and Honors

Week 12 Events

Specific Aims Peer Editing Hour [aims preparation]

Participants will present their third aims page draft in a peer review session. They will read the pages aloud and the instructional staff and other participants will provide feedback on both communication of content and writing specifics.

- Receive and provide constructive feedback on aims drafts.

WIP Practice Presentation – Isaiah Agorinya

Week 12 Sessions

Spatial Modeling [lecture]

In week 4 we introduced the concept of spatial modeling through examples of simulations in EMOD with multiple nodes. In this lecture we'll cover some more advanced concepts pertaining to multi-node simulations, like human and vector migration.

- Explain use cases for spatial, multi-node simulations in EMOD.
- Run simulations in EMOD with multiple nodes.

Add human and/or vector migration to EMOD simulations.

Reactive Interventions [tutorial]

Introduction to using interventions that use data to modify targeting of interventions over space and time, such as reactive case detection.

- Explain reactive interventions and how they are implemented
- Demonstrate how to add reactive interventions targeting to specific triggers in EMOD

Journal Club 6: Gerardin et al. Household interventions in Zambia

This week we are discussing reactive interventions so are examining a paper on reactive case detection in various transmission settings. Please read the journal club paper and recommended read and come prepared to discuss your thoughts. If you are facilitating the session, prepare an overview of the paper and at least four guiding questions.

Gerardin, J., Bever, C.A., Bridenbecker, D. et al. Effectiveness of reactive case detection for malaria elimination in three archetypical transmission settings: a modelling study. Malar J 16, 248 (2017).

- Understand how reactive case detection can impact malaria control & progress toward elimination
- Discuss the efficacy of reactive case detection in various transmission settings
- Discuss the use of archetypal settings for malaria modeling

Additional reading
Perera, R., Caldera, A. & Wickremasinghe, A.R. Reactive Case Detection (RACD) and foci investigation strategies in malaria control and elimination: a review. Malar J 19, 401 (2020).

Week 13: Advanced EMOD - Diagnostics

This week includes more project work, including revision and resubmission of the Specific Aims page. We'll also introduce the advanced topics related to diagnostics and the within-host model in EMOD.

To-Do List

- Specific aims draft #4 – due July 11
- Write the Personal Statement section of your biosketch and share full draft with your buddy, and revise

Week 13 Events

Week 13 Sessions

Within-Host Dynamics [guest lecture]

Within-host dynamics describe the complex relationships between the human host and malaria parasite. Parasite replication and host immunity are closely tied together and influence malaria infection and disease.

- Understand the components of within-host dynamics for malaria
- Discuss how these components impact each other and the course of disease
- Identify how different interventions may target within-host dynamics

EMOD Within-Host Model [lecture]

EMOD contains a complex within-host model for simulating parasite and immunity dynamics during malarial infection in the human host. In this lecture, we'll talk more in-depth about what this portion of the model looks like and how it can be used in your work.

- Understand the various components of the within-host model in EMOD.
- Discuss how within-host dynamics can impact model outputs.

EMOD Diagnostics [lecture]

In EMOD we can simulate different types of malaria diagnostic tools, such as microscopy and RDTs, which can impact how we are measuring outputs such as incidence and prevalence. These tests are useful tools in the field and can also be useful in designing our research questions and experiments.

- Explain the importance of matching diagnostic interventions and reporting in EMOD to those used in data sources
- Understand the types of simulated diagnostic tools and related outcome measures in EMOD

Week 14: Advanced EMOD - Vectors

This week we'll cover advanced topics related to vector genetics, behavior, and control interventions.

To-Do List

- Read journal club article
- If leading journal club, prepare content and analysis points and discuss with buddy
- Recommended reading, as time allows
- Biosketch draft #2 – due July 18

Week 14 Sessions

Journal Club 7: Diagnostics for Malaria Elimination

Last week we discussed diagnostics and the within-host component of EMOD, so this week journal club will dive into how we think about these for decision making as well as calibration. Please read the journal club paper and recommended read and come prepared to discuss your thoughts. If you are facilitating the session, prepare an overview of the paper and at least four guiding questions.

Slater, H. C., Ross, A., Ouédraogo, A. L., White, L. J., Nguon, C., Walker, P. G., ... & Ghani, A. C. (2015). Assessing the impact of next-generation rapid diagnostic tests on Plasmodium falciparum malaria elimination strategies. Nature, 528(7580), S94-S101.

- Understand similarities and differences between compartmental (Imperial College, Openmalaria) and agent-based (MAEMOD) models
- Learn about mass-screen-and-treat programs, focal MSAT, and reactive strategies to target the asymptomatic infectious reservoir
- Explore the impact of diagnostic thresholds on the success of mass screening intervention strategies
- Discuss the relationship between environmental or within-host factors and the success of mass screening intervention strategies

Additional recommended reading:
Gerardin, J., Ouédraogo, A. L., McCarthy, K. A., Eckhoff, P. A., & Wenger, E. A. (2015). Characterization of the infectious reservoir of malaria with an agent-based model calibrated to age-stratified parasite densities and infectiousness. Malaria journal, 14(1), 1-13.

Week 15: Limitations & Challenges

This week we'll discuss the limitations of modeling and challenges that may arise when continuing modeling in-country after the program ends. By the end of the week, you'll submit a final draft of your Specific Aims page.

To-Do List

- Specific aims final draft – due July 25

Week 15 Sessions

Strengths & Limitations of Modeling [discussion]

Mathematical modeling has many applications and has been proven as a useful tool for many research and programmatic questions; however, it is limited in what it can do and how outputs should be interpreted. In this session we'll discuss widely recognized strengths and limitations and how we can be cognizant of this in our own work.

- Understand how models can be used to inform policy, and when they should not
- Discuss limitations of using agent-based models related to model complexity and calibration Identify strengths and areas that you can help improve malaria modeling and EMOD

In-Country Challenges [discussion]

During this program you are immersed in an environment devoted to applied malaria modeling and your research projects, but this likely will not be the case at your home institution. There may be challenges for your time as well as technical capacities. In this session we will discuss some of these difficulties as well as the potential impact of taking what you've learned during your time at Northwestern home.

- Discuss difficulties and challenges of using EMOD at home to continue applied malaria modeling work, such as reliable internet and access to HPC
- Discuss potential capacity strengthening efforts and challenges to teaching trainees modeling
- Discuss potential difficulties integrating training with projects in home institution's research interest
- Discuss about how much and how long technical support can be provided after the program
- Discuss constraints in sustaining and expanding the interest in the project in the home institution

Week 15 Events

WIP Practice Presentation – ?

A practice presentation for the Institute for Global Health's Work in Progress seminar series

- Practice critiquing a talk and giving feedback

Week 16: Other Malaria Models

This week we'll hear from researchers from the Swiss Tropical and Public Health Institute (Swiss TPH) and from the Imperial College London (IC London) about other malaria transmission models and discuss their similarities/differences with EMOD. This is a great preview ahead of the Malaria Modeling Mini-Meeting next week.

To-Do List

- Prepare an updated presentation on background, rationale, project plan, *and early results* for your individual project
- Practice presentations with peers give them feedback
- Read journal club article
- If leading journal club, prepare content and analysis points and discuss with buddy
- Recommended read, as time allows
- Share biosketch personal statement during peer editing hour, and revise based on feedback – due July 28

Week 16 Events

Personal Statement Peer Editing Hour [biosketch]

During this week's peer editing hour, all participants will share their revised NIH-type biosketch with the team. You'll receive both technical and conceptual feedback on your draft to help improve it for the final draft in addition to reviewing your peers' work.

- Critically review writing to identify strengths and weaknesses
- Provide, and receive, constructive feedback on biosketch writing

Week 16 Sessions

OpenMalaria [guest lecture]

OpenMalaria is a microsimulation, individual-based model of Plasmodium falciparum malaria in humans, developed at the Swiss TPH initially for simulating malaria vaccines. The model has since then been extended to include the dynamics of malaria in mosquitoes and to capture the delivery and other malaria interventions such as chemoprevention and different types of vector control. OpenMalaria simulates the dynamics of parasitemia in the course of an infection, of transmission, of immunity, and of processes leading to symptoms and death.

- Compare and contrast the main characteristics and features of OpenMalaria with EMOD

Malaria simulation [guest lecture]

Malaria simulation is an individual based model for P. falciparum and malaria interventions, developed at IC London. The main goals are to make an extensible, maintainable, and fast simulation to evaluate and report on malaria intervention strategies.

- Compare and contrast the main characteristics and features of malariasimulation with EMOD

Model Differences [discussion]

Following the guest lectures from colleagues who use OpenMalaria and Malariasimulation, we will compare these three agent-based models for malaria. This discussion will be focused on how they have been used together, and separately, to address different malaria modeling questions to support decision-making or research.

- Describe the similarities, differences, and common use-cases for malaria models, focusing on the agent-based models presented

Journal Club 8: Cross-model Comparisons

This week we are covering other malaria models, so we will be discussing a paper that looks at the impact and cost-effectiveness of RTS,S across four mathematical models – including EMOD. Please read the journal club paper and recommended read and come prepared to discuss both the authors' findings and model comparisons. If you are facilitating the session, prepare an overview of the paper and at least four guiding questions.

Penny, M. A., Verity, R., Bever, C. A., Sauboin, C., Galactionova, K., Flasche, S., ... & Ghani, A. C. (2016). Public health impact and cost-effectiveness of the RTS, S/AS01 malaria vaccine: a systematic comparison of predictions from four mathematical models. The Lancet, 387(10016), 367-375.

- Understand the strengths and limitations of the different models used to assess the impact of RTS,S
- Critically evaluate the specific assumptions and parameters used by each model, and how these differences may affect their predictions and projections
- Provide reasons for comparing predictions from multiple models

Additional recommended reading:
Smith, N. R., Trauer, J. M., Gambhir, M., Richards, J. S., Maude, R. J., Keith, J. M., & Flegg, J. A. (2018). Agent-based models of malaria transmission: a systematic review. Malaria journal, 17(1), 1-16.

Week 17: Preparation for final Project presentation

Week 18: Program Conclusion

You did it! This is the last week of the in-person program. You'll each give a final presentation on your project and arrange for continued progress after you return home.

To-Do List

- Final Project Presentation – due August 14
- Endline Program Evaluation

Week 18 Events

Final Project Presentations [presentations]

Participants will present final progress on projects throughout the course of the program as well as next steps

- Present a comprehensive view of project progress throughout the program
- Plan next steps for continuing project and modeling work at home

Goodbye Lunch [discussion]

After our wrap-up session, we'll host a final end-of-program lunch to celebrate your accomplishments during the previous 18 weeks.

- Celebrate completing the program and all of your hard work!

Week 18 Sessions

End of Program Wrap-up [discussion]

This session will serve to complete the program and discuss steps for work at home as well as anticipated support from the instructional staff.

- Plan next steps for continuing project and modeling work at home

Best Practices

Conduct, ethics, and team culture

General conduct

All members of the team, along with visitors, are expected to abide by this code of conduct. I expect cooperation from all members to help ensure a safe environment for everybody. This team is dedicated to providing a harassment-free experience for everyone, regardless of gender, gender identity and expression, age, sexual orientation, disability, physical appearance, body size, race, or religion (or lack thereof). We do not tolerate harassment of team members in any form. Harassment can include offensive verbal comments, sexual images in public spaces, deliberate intimidation, stalking, following, harassing photography or recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome sexual attention. Members asked to stop any harassing behavior are expected to comply immediately. We expect members to follow these guidelines in all in person, phone, online communication, team-related events, university events, conferences, etc. If you are being harassed, notice that someone else is being harassed, or have any other concerns, please contact Jaline immediately. Please note that Jaline is a mandatory reporter, this means that she is required to report sexual misconduct to the Title IX office and may not be able to guarantee confidentiality.

Ethical Conduct of Research

I expect team members to be honest in scientific communications both within and outside the team. I expect that credit will be given where credit is due, including in scientific writing. It is never okay to tamper with data, make up data, omit data, or fudge results in any way, and this will not be tolerated. Science is about finding out the truth, not about fitting a hypothesis or data that looks pretty. My goal is for our team to have a reputation for performing impeccably rigorous science in an open and transparent way.

Culture of engagement and professional critique

We would like to foster a highly engaged research environment where everyone is included in discussions and professional critique is welcome. You are expected to think critically about your own work as well as others' work, and to express your questions and opinions politely and professionally. Our aim for your time with the team is to grow your independence and for everyone to do great work --- we are stronger when we give each other feedback and seriously consider each other's suggestions. This includes giving me feedback on what you think I can do better and pointing out my blind spots. I will not penalize you for disagreeing with me but will be glad you're speaking up.

Culture of working together

We work on an incredibly important health problem that affects millions of people, and the faster we can work the sooner we can have a positive impact. This means that I don't want you to spend weeks bashing your head against a problem if talking to someone else would mean it gets resolved more quickly. Think about where you add the most value: is it building software?

Designing experiments? Thinking about science? Communicating with our partners? Lean into your strengths and let the team help you with other aspects of your work.

Team Communication

Slack

Slack is the preferred method of electronic communication on our team. Generally, team members are expected to respond to one another within 24 hours (within normal working hours). You are welcome to join any of the Slack channels; some are more active than others.

You are expected to be on Slack when you are working. Slack will be the primary means of communication with NU team members.

Chicago Channel

- Post daily “to-do list” of tasks you are working on
- Keep an eye out for team-wide announcements

FE 2025 Channel

- Announcements and questions specific to the Faculty Enrichment Program should be posted here by both staff and participants
- Feel free to share outputs, items of interest, or other things relating to the program – this is your space!

Help Channel

- Post error messages / other issues here (along with your code & relevant outputs). You are more likely to get a quick response, and others will benefit from seeing the solution too.

Celebrations Channel

- Proud of an accomplishment (program-related or otherwise)? Post it here so we can celebrate with you!

University Email

You should be given access to a Northwestern email account and are free to use it as you see fit. However, it may be best to use a personal or home institution email for longevity of communications as NU email access may be limited after the program end.

Northwestern University administrators will use your Northwestern email for official communication, so make sure to check it occasionally.

Calendars

All meeting invites will be shared with you in advance – please be sure to stay on top of your calendar and attend all meetings in a timely fashion. Be sure to RSVP to all events and communicate with the organizer if you are unable to attend.

Meetings

With Buddy

Weekly 1-on-1 meetings will be held with your assigned buddy. These are designed to help you stay on track with learning materials and your project. You may use this time as you see fit but it is recommended that you discuss any problems you may be encountering in your work, results, next steps, and other questions. You and your assigned buddy will discuss any additional expectations during your first sessions to make the best use of this time.

With Program directors

Weekly 1-on-1 meetings will also be held with Jaline to discuss project progress, ideas, and needs. This meeting will be similar to buddy 1-on-1s and sometimes may be held together as a 2-on-1 to ensure that you are getting the best support possible throughout the program and everyone is on the same page. It is your responsibility to make the most of your meetings with Jaline, which includes being prepared with what you would like to discuss.

meeting policy:

In general, I have an open-door policy. If my office door is open, I am happy to answer questions or talk about your work---if I don't want to be disturbed, I will close my door. Please ping me on Slack at any time and I will respond as soon as I can. However, I am not always available, so if there is something important that will take a substantial time to discuss, it is best to schedule a meeting with me.

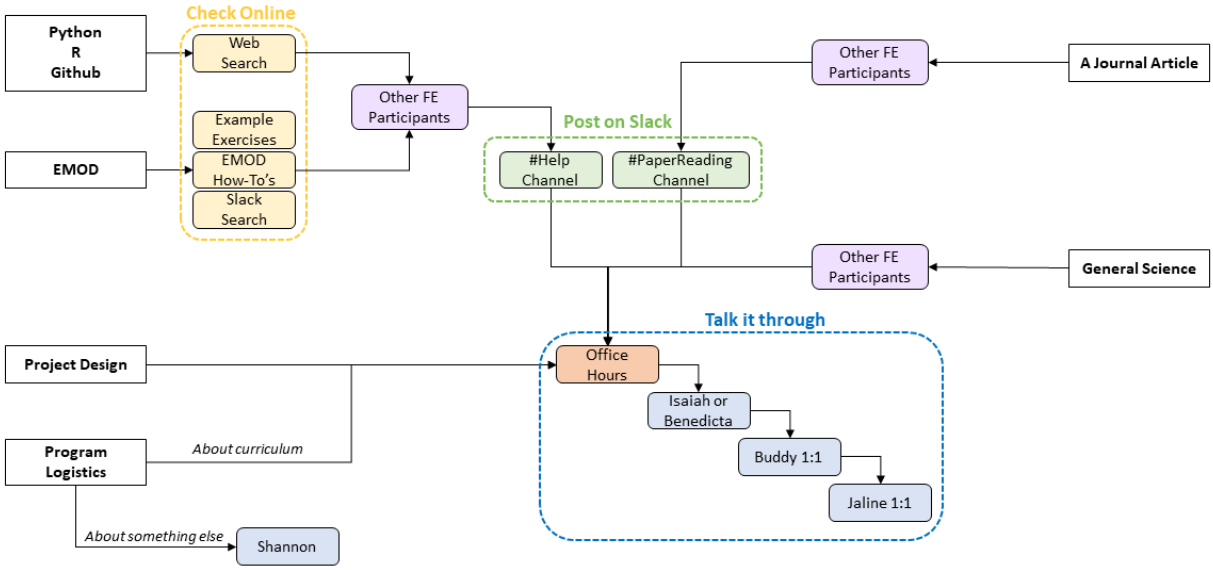
What should you bring to a meeting with me? It is your job to make the most of this time and usually that means coming in with a list of what you'd like to talk about. Here is what we will generally cover:

- What you have done: Generally, I prefer that you keep me/the group posted on new analyses via Slack. But the 1-on-1 is also a good time to talk over interesting results or roadblocks: What analyses have you done since the last time we met? I want to see all your new results, analyzed and in pretty graphs. We may also take a deeper dive to look at individual results or brainstorm new analyses, so bring that with you. If you don't have results, why not? What roadblocks are you facing and how are you working through them? What analyses or simulations are in progress? How are writing projects coming along? I am asking for this information not to evaluate if you are working hard enough, but to see how your project is progressing.
- Ideas: what do your results mean? What should we do next? Do we have what we need to do it?
- What do you need from me? This is the time to let me know if you need a signature, a letter of recommendation, a progress report, extra compute resources, or new software.
- Anything pertinent to your professional development or well-being. Are you progressing towards your goals for the program? If there are any issues in or outside of the workplace that may hinder your progress, this is a time to talk about it.

I strongly recommend you keep a log of your weekly 1-on-1's, noting what was discussed and any next steps you're planning to do.

Getting help

We find that learning by doing is incredibly useful to improving our skill and knowledge bases. In this process, things will inevitably go awry. These mishaps provide a learning opportunity and while annoying should not be seen as discouragement to continue. There are a variety of ways to seek help – the flowchart below can help you walk through the process of where and how to get the help needed for a few types of anticipated problems. Below that are team expectations for what these steps entail.



Expectations for getting help:

Searching online

1. Check the FE examples, how-tos, and coding resources for anything helpful. This is especially useful when you don't know or have forgotten how to add certain things to your script.
    a. For EMOD capabilities and parameter-related questions, the EMOD malaria documentation from IDM contains the most relevant information.
    b. For errors that are not EMOD-specific, you can search the internet more broadly. Sites such as stack overflow or package documentation (if questions on a specific function) can be particularly helpful for general coding questions. If you find a solution on one of these sites, make sure that you spend some time to understand what they are doing to fix the problem – do NOT just copy and paste.
2. Search the slack, particularly the #help channel to see if a similar question has been answered by the team previously. There are many common questions and errors experienced in running EMOD, so this space contains many useful answers.

Discussing with peers

If you have tried searching online for coding troubleshooting or have general scientific question about your work, your peers are a great place to seek help. You are all learning together and come from a variety of scientific backgrounds. We highly encourage you to discuss any errors you are encountering or questions you have with each other you may be able to solve the problem together without further assistance. This peer discussion process can also be helpful in cementing what you have learned through teaching.

Posting on slack

If you have not found a solution after searching online and discussing with peers, then we recommend posting on the #help channel on slack so everyone can see your question. This will also help yourself and others in the future who are asking similar questions. Of note, not everyone is in the same time zone so you may need to wait for others' availability. This is an interactive process where you will often have to try many things. Below is a checklist to help you shape posts for the #help channel so you and others can get the most out of it.

- Making the most of posting to the #help channel
    - *Error message*: Include the entire error message in your post so the channel can fully understand the problem. It is preferable to include the text of the error message rather than just a screenshot so the key words will pop up in future searches. You may include the most important part of the text and a screenshot of the entire message if it is a particularly long error. These icons in slack allow you to mark text as either a code line or chunk, respectively:
        - 
    - *Link to code where the error is occurring*: It is much easier for others to help you solve your problem if they can see the code that is generating the error. The easiest way to share this is through your GitHub repository, if it is up to date and viewable to team members. Be sure to link to the exact script and include any pertinent information (such as lines the error is coming from)
    - *Context of the error*: What were you doing when the error occurred? It can be helpful to know what the goal of the script is (e.g., running simulations, analyzers, etc.) as well as the answers to the following questions:
        - Did it ever work?
        - Is this a new error?
        - What has changed since it last worked?
    - *What have you done to try to solve it*: Include specifics of solutions you've tried and how you've changed the code. Saying that you searched online and talked to a peer does not help the channel understand what you have done and how it impacted the error. Without this information the channel may suggest potential solutions you've already tried which wastes everyone's time. Furthermore, including failed potential solutions can sometimes help us better understand what the problem is as sometimes error messages are not particularly helpful on their own.
- If you find a solution to a complicated problem that you think others would benefit from knowing, feel free to post it to the channel with the same kinds of details!

Office Hours

Office hours are protected, structured touchpoints that all members of the instructional staff will host to facilitate your learning experience. Most staff will have one hour scheduled per week dedicated to answering questions and providing assistance. This set aside time helps to ensure that someone is accessible to answer questions and talk about your work, without distraction, most days. You are encouraged to show up to any of the office hours – it does not have to be your buddy or the lecturer on the relevant topic as all of the staff should be able to assist or identify others if needed. This time can be used for many topics including errors encountered, general EMOD questions, or asking for feedback.

For technical problems, office hours are particularly helpful when you have already tried a few methods of solving the problem yourself (see flowchart and code troubleshooting, below). Come prepared to discuss 1.) the error that you are encountering, 2.) what you think may be causing the error/changes made since the code last worked, and 3.) any methods you have tried to solve the problem. Be sure to have all documentation ready to help the staff understand the problem (such as pushing your code to GitHub, a copy of the full error message, etc.)

Office hours can also be used for consultations on project design and scientific approach to the project.

Note that outside of 1:1s and office hours, instructional staff may not be immediately available for help due to their other obligations.

Logistical problems

Contact Zack by email or in the office. Reach out to him as soon as possible as sometimes bureaucratic problems can take time to solve. Logistical problems include:

1. Accessing team/UHAS resources
2. Expenses/reimbursements
3. Housing
4. Arranging visitor travel

Best Practices for Project Design & Code

Source Control

All code must be kept on GitHub. Be sure to commit and push regularly. Best practice is to commit several times a day when actively coding and push AT LEAST daily. The end of the workday is a great time to push. This serves three important purposes:

1) It keeps us from losing track of our code if we overwrite a file or want to revert to an older version of a script. Every version of our code that has been committed and pushed can be retrieved if lost or overwritten. Code that has not been committed and push cannot be retrieved.
2) Sharing our code lets us learn from each other and reuse code developed by other team members. If your repository is private, your code is only visible to those with whom you have explicitly shared it.
3) It is very helpful for troubleshooting! When your code is online, it makes it much easier for other team members to understand the issue you are running into as they can see your entire repository, including the script with the problem. The GitHub version control will show the most recent version as well as allow exploration of any changes made to the script.

Git can be tricky, and we've all had to deal with git problems. Please don't hesitate to ask for help on Slack (#help) or search the web as there are many existing resources, such as this tutorial from GitHub. You will learn it eventually and we have a lot of expertise on our team available to help make your life easier. Many of us use Sourcetree or GitHub Desktop to manage our repositories.

Commit messages & descriptions

When you make a Git commit, include a short but meaningful message that describes the changes that you are committing. Typical changes include new functionality, improved code, updated parameters, bugfixes and corrections among others. The commit message should provide information on type and reason of edits made (i.e., what changes did you make since the last commit?) and why (e.g., is this fixing a problem, adding new functionality, etc.). These commit messages can be short and to the point but should be helpful to you and others who may be going through the repository in the future. More advanced use allows for writing pull request messages when working from a developer and a clean master repository and you can read more about it once familiar with the basics of Git.

Managing your project

It is important to keep detailed notes for your project including design, progress, and analyses. The notes should be as comprehensive as possible to show so you can keep track of methods, changes you make, etc. By including all these details, you will be better equipped to make forward progress rather than going in circles and to eventually publish your results. A few key points:

- It is never too early to start your project notes! You should start them as soon as you begin a project, so you have details from the entire process.

    - There are many different platforms that you can use to take your project notes depending on your preferences. Team members often use Word or Rmarkdown but there are other notes apps that can be just as effective. It is preferable to take online notes as they are both searchable and shareable.
- Template project notes files are available here
    - Could be by date or by topic
    - Provide examples
- Stay organized and keep track of your workflow. You should include all necessary information for writing up the methods and results sections of a paper in addition to keeping track of incremental changes along the way.
    - Record what you did, what you saw as you made changes to your project. Keep good records of everything you try because you will try a lot and won't remember everything you did. It can be helpful to include all the details of your simulations at each update (i.e., Simulation ran for X years with X intervention details, etc.), even if this seems repetitive, so you can get a quick idea of what is going on. These detailed progress notes will help you avoid repeating the same steps unnecessarily. Be sure to include plots and discussion notes as you go as these will help you understand the outcomes of what you did and your thoughts on it.
    - Useful tools include snippingtool or Greenshot to make screenshots of plots and error messages, and writing slack messages to yourself or have another place for quick reminders, code snippets, or notes.
- Your project notes should be accessible to anyone with whom you are regularly collaborating. For faculty enrichment, be sure to share your notes with Jaline, your buddy, and the rest of the instructional staff. We will go through this together during the project setup session.

Best Practices for Simulations

Experiment design

When setting up a simulation experiment, be considerate about the number of parameters to change and scenarios to run. There is rarely a first single large simulation that will provide immediate answer at once and is correctly setup. Plan for multiple iterations that build up on another to gain confidence and better understanding before building a larger simulation experiment.

- Prepare a simulation plan (list of scenarios to run): which ones are the main simulation experiments you need to run in order to answer the research question? Which ones are out of scope?
    - You may find it helpful to create an excel sheet with the 1) parameter names and relevant values to explore and 2) combination of parameter values that define a simulation experiment to run. An example is provided [HERE]. More advanced use also includes notes about # number of scenarios, computational resources and time required.
- Pilot before scaling up: Start simple and use a template scenario that has been validated, then add the intervention or feature of interest for one or a few settings before running all.
- Technical feasibility before accurate predictions: It is OK to use placeholder parameters for test simulations to develop your code and scripts; however, do keep track of these and do not forget to update them to the correct parameters as soon as the initial testing is done.
    - In the pilot and test simulations, make sure to carefully investigate the input json and output files. See reviewing input and output files below.
- Give your simulation experiments meaningful names that can be versioned and tracked across iterations. For instance, any test runs may include ‘test’ in its name and have a v0, v1 or a date or similar included in the name or folder in which your simulations are stored.

Some general best practices for scientific computing are described by PLOS Biology in addition to what we specifically recommend for members of this team.

Reviewing input and output files

When designing new experiments, you should make sure to review input and output files to make sure your simulations are doing what you think they are. It can be tricky to get everything setup correctly the first time, even for experienced EMOD users, so this review process will help you verify prior to scaling up. Questions to check for investigating new simulation runs include:

- Were the campaigns actually deployed, at the correct coverage and time?
- How often were the campaigns deployed?
- How does the simulated population change over time?
- When running with burnin, was the burnin actually “picked up” successfully?
- Small simulations allow for individual event reports, at what ages and how often did individuals get an intervention or change property?
- Look at the same metric (i.e. prevalence) noy only at aggregated level over time, but monthly.

- Are the agebins correctly set up, extracted in the analyzer and aggregated?
- How do your plots compare to other known relationships?

Using Quest

Quest is Northwestern's high-performance computing cluster (HPC) on which we run our EMOD simulations. Quest is a linux-based HPC with the workload manager slurm on it to schedule jobs among its users. Everyone will need to apply for access to the team's Quest allocation, b1139, here. Once granted access, you will have 80GB of space on your home directory and access to the team allocation which has much more space. We recommend cloning GitHub repositories to the home directory but saving all outputs to an appropriate folder on the team allocation.

Resource Sharing

Because everyone on the team, as well as participating in the program, uses b1139 we need to be conscious of resource sharing. Please follow the best practices below so everyone can have the best experience using the cluster.

- Be aware of how long you expect your jobs to run. If they will take a long time, it is considerate to run fewer sims at once or to wait until times of low usage (such as evenings or weekends) to start the jobs. You can enable email notification for your submitted jobs, and also check in the terminal via squeue -u <username> or squeue –A b1139.
- If you must run a "big job" with many simulations, discuss any urgent needs for the cluster as others may have time sensitive projects. Submit <100 jobs at a time on b1139 to avoid "clogging" the cluster. It is easy to limit the number of jobs able to run at one time with idmtools, so you can submit all your jobs at once but only the specified "max_run_jobs" will run at one time. As simulations finish, the next ones will start automatically.
- Debug your simulations with small pilots (see experiment design) to make sure your simulations do what you expect before scaling up.
- Managing disk space, you can check for space used via typing 'homedu' or 'checkproject b1139' in the terminal. Simulations should typically be stored in respective project folders on b1139 so they are accessible to other team members for troubleshooting and due to low storage limits on home directories. Be sure to remove old and/or failed simulations when they are no longer needed as they can occupy a great deal of storage space.

Writing: General resources

10 Simple Rules for structuring papers
10 Simple Rules for improving your writing productivity

Specific Aims

The Specific Aims page is a 1-page document that summarizes the motivation, significance, innovation, and approach of your proposed project. Writing an Aims page will help you define your project concisely and communicate why it is worthwhile.

We recommend following the document setup guidelines here since this will give you the most space while staying within NIH guidelines.

From BioScience Writers:

"The Specific Aims section is the most vital part of any NIH grant application. In this section, you must quickly gain the reviewers' trust and confidence while simultaneously convincing them that your work is important to fund. You must also convey that you and your team are the best people to complete the work you've proposed. For these reasons, the Specific Aims can be one of the most difficult sections to write. In this article, we provide some tips on structure, content, and organization of your Specific Aims page."

Begin by watching these two excellent videos:

- Writing Introduction: The Rhetorical Pattern of Introductions in Aims Pages
- Writing Aims/Conclusion: Patterns and Content in the Specific Aims and Conclusions in Aims Pages

Then respond to each of these questions to create an outline for your Aims page:

- General context and significance: What is the "big picture" for research? Why is it important?
- Narrowing context: What is known and accepted in your research area?
- Your research contribution: Has your previous work contributed? How?
- Complication: What is the problem, roadblock, the unknown?
- Long-term goal: What final "big results" will research help achieve?
- Specific goal of this research: "What is "specific narrow goal" of this research?
- Summary of research—path to hypothesis: How does previous research lead to hypothesis?
- Hypothesis: What do you believe to be the answer to the complication?
- Qualifications stressed: What makes you the right person to undertake the research?

From this outline, you can start writing the first draft of the Aims page. Use the Aims Worksheet at the end of this handbook to guide your framing of the Aims.

NIH Biosketch

- Official instructions for the NIH Biosketch. Use the “Non-Fellowship” biosketch format and download a sample document that has the correct formatting.
- Start by filling in the header information (Name, ERA commons name, position title, education and training)
- Next, write part C, contributions to science
- Next, fill in part B, positions and honors
- Finally, finish with part A, the personal statement

Excellent instructions from Better at the Bench, which cites a workshop by Orit Rapaport:

Tackling the Contributions to Science

Contributions by the numbers

- Write up to five contributions to science
- Include up to four publications or research products per contribution
- Typically, each scientific contribution (including the publications) should occupy about half a page.

What is the definition of a publication or research product?

- You can only include/cite accepted publications. However, you can mention papers in progress in the text.
- You are allowed to include/cite preprints or other interim research products. However, you need to cite them properly. For full instructions regarding citing preprints or interim research products, refer to notice NOT-OD-17-050.
- Research products can include, but are not limited to the following:
  audio or video products; conference proceedings such as meeting abstracts, posters, or other presentations; patents; data and research materials; databases; educational aids or curricula; instruments or equipment; models; protocols; and software or netware. For more information about each category above, you can download the NIH Guide to Categorizing Products.

Orit’s five step guide to writing your contributions to science

- Gather all of your papers and research products
- Read through all your materials to re-familiarize yourself with the papers and research products.
- Divide these papers and research products into a maximum of five groups (where there is a maximum of four papers/research products per each of the five groups/contributions). Orit mentioned that the manner in which you set up your groups/contributions is entirely up to you, but here are a few that are commonly used:

    - Career phases — Early (undergrad), graduate, and postdoctoral career
    - Different perspectives in science
    - Development of different state of the art tools
    - Varying translational impact
- Instead of jumping directly into your research, for each contribution to science write a narrative/short story that includes these five components:
    - An opening or introduction of a problem in the field
    - A challenge in the form of a gap in knowledge or motivation
    - An action, which consists of what you did (your research contribution)
    - A climax, where you describe a result and its significance
    - A conclusion, end the paragraph with a statement indicating how this research has transformed or advanced the field
- Cite up to four papers/research products for each scientific contribution
    - Note, here you want to be a bit strategic. Maximize your citations! If you have more than four papers that you want to cite in a single scientific contribution, consider splitting the scientific contribution to allow for citing all your papers.
    - Note, bold your name in each citation to help the reviewer identify your name in the list of authors.

Include a link to a bibliography at the end (optional)

- This is optional, but Orit highly recommends that you include a link to your full bibliography at the end of your contributions to science. Importantly, the URL you provide must be from a Federal Government website (aka. you cannot use Google Scholar). It is highly recommended that you use the My Bibliography option that can be setup through My NCBI.

Tackling the Positions and Honors

It's time to brag about yourself and how awesome you are! :)
Read the full instructions on the NIH Grants and Funding website and the NIH General Application Guide for NIH and other PHS Agencies, but here are a few of the important details:

- List positions and honors in chronological order (oldest to newest/current)… you can list a future position/employment, just include the expected start date.
- Look at the examples, the positions and honors for both fellowship and non-fellowship applications is roughly divided into three sections:
    - (1) Positions and employment — Your postdoc can be listed as a position (in addition to adding it to the header). You can include TA work here.
    - (2) Other experience and professional memberships — You can include volunteer work here.
    - (3) Honors — You can include travel awards here.
- List any relevant academic or professional achievements and honors.
    - For students, postdocs, and junior faculty this includes scholarships, traineeships, fellowships, and development awards.
    - For clinicians this includes clinical licensures and specialty board certifications.
- Note, certain large honors (like receiving an F31 as a graduate student) can and should be listed in multiple sections of your biosketch — it should be included as an honor (part B), but it can also be mentioned in your contributions to science (part C), mentioned in your personal statement (part A), and included in your research support (part A, highlighted projects).

Tackling the Personal Statement

Last, but not least, it's time to write the personal statement! Orit suggests writing the personal statement at the end, because it will be tailored to the specific proposal. As with all other sections of the biosketch, read carefully through the instructions in the NIH General Application Guide for NIH and other PHS Agencies.

Personal statement instructions

- Briefly describe why you are well suited for your role(s) in this project.
- Should include aspects of your training, previous experimental work on this topic, your technical expertise, your collaborators, your scientific environment, and/or past performance in this field.
- At the end, you may cite up to four publications or research products that highlight your experiences and qualifications for this project.
- Note, this is also where you have the opportunity to address factors that affected past scientific productivity (including a death in the family or other obligations).
- Not explicitly written in the instructions, but the personal statement should be written in the first person and should fit on the first page (excluding the four citations).

Goals for the personal statement

Orit mentioned that the goals for the personal statement differ depending on if you are applying for a fellowship or non-fellowship, so keep this in mind when writing.

- Fellowship (F-grant) goals: The personal statement should describe how the research proposed will provide you with the best possible training to advance your career.
- Non-fellowship/career transition (K-grant) goals: The personal statement should describe how the research proposed will help you transition to an independent academic position.

Suggestions for writing the personal statement

By walking us through a well-written personal statement, Orit described lay out a excellent format to follow:

- Start with career goals and motivations
- Transition towards an exhibition of your research experience and here incorporate references to what you have already accomplished in science.
- End with a statement regarding how the research proposed in this grant will advance your career. Here it is important to show some aspect of growth. Explain how the research proposed will (1) provide the training necessary to allow you to find your science niche and (2) help you use new tools (or a new perspective) to make significant advances in science.

Additional notes and final thoughts

A few final thoughts from Orit's workshop:

- No diagrams or figures are allowed in the biosketch.
- Don't forget to update your biosketch over time (continue to add positions and honors, update funding, update scholastic performance/grades, etc).
- The biosketch should be tailored to each specific proposal.
- For the NIH, you will attach the biosketch as a PDF file.
- The biosketch cannot be longer than 5 pages long.

- Make sure you adhere to other NIH guidelines regarding font type, font size, margins — refer to the NIH format guidelines.
- Share with others, get feedback, and edit!

Peer Editing Hour

For Author

Come prepared with ~1 page of writing. Please send this to Shannon by the 9am CT the day of your peer editing session so she can ensure everything is in the right format to share with the team. Ideally, your writing should be in decent shape (i.e., not a messy first draft) by the time you are sharing it with the team. Be prepared to introduce your piece (context, audience, etc.) and read your writing aloud to the group, one paragraph at a time, and receive feedback as we go. The facilitator will document comments and changes to the text for you. You may receive feedback on writing style, word choice, sentence structure, grammar, general comments and questions about the work, etc. This time is meant to be constructive and help you improve your final product, so please make the best use of it possible.

For Facilitators

You will be responsible for documenting any changes, suggestions, or comments on the work presented – you do not need to be familiar with the work in advance. At the beginning of the hour, make sure that the document is in “track changes” mode so the author will be able to easily see any modifications when looking back at their work. Please be detailed in recording all comments so they can be as useful as possible.

For Audience

Bring your best constructive criticism and writing ideas! Be open to sharing your thoughts, big and small, to help your colleagues improve their writing. Authors may present work in various stages of development and/or completeness so ask clarifying questions as needed. This may be especially relevant for excerpts from specific sections of manuscripts where you may not understand the context (e.g., what is included in the first half of the background/introduction while we are editing the second half). Be sure to consider any information provided by the author when introducing their writing, such as the intended audience.

Plots & Figures

Any figures you make should be clear and thoughtful in content. They should help convey the story you are trying to tell and highlight key results. You should always spend time to think through what you are trying to show and why as this will lead your design process. Just because you've seen or made a figure in the past does not mean that it will be the best way to show your current results.

Likewise, consider your audience and the style of presentation of your figures. Are you presenting to experts in the field? Non-scientists? Are you preparing an oral presentation or paper? Each of these will have different implications for your figure so it can be the most appropriate and impactful.

For more extensive best practices for scientific figures, check out PLOS Computational Biology's article: 10 Simple Rules for Better Figures. Some key points that you should take away, that are not already mentioned, are to think through color, legends, and labelling. Oftentimes, the R and python defaults will not provide the best setup for a nice figure in these areas so you may need to adjust them to better tell your story. For example, color can help distinguish differences between simulations and can convey grouping and should be thought out for single figures as well as multiples contained in the same presentation or paper.

Presentations

For figures included in presentations, the font size should be at least 16pt. You do not have to include as detailed of a caption as you would in a paper; however, your slide title should include the key takeaway for the slide and figure, and you should be prepared to walk your audience through the figure as you present. Do not crowd a slide with too many figures, especially ones that are more complex. If you must include multiple figures on one slide, use animations to build the slide up and keep your audience focused on one figure at a time.

Papers

For figures included in papers, the font size should be at least 8pt. You must include a caption that concisely explains the figure. Avoid overcrowding of the space and ensure that all aspects are differentiable and legible.

Presentations / Talks

For Speaker

The most important things for the speaker to keep in mind is who is the audience and what are the objectives of the presentation. What is the single take-home message you would like to communicate? Everything in your talk should build toward that single message.

Review PLOS Computational Biology's 10 simple rules for effective presentation slides to understand general expectations for slide decks. Key takeaways include using slide headers as a summary sentence for the contents, with one main idea per slide, and designing slides to minimize distraction and overload that will prevent your audience from getting the full benefit of your talk. You should also review this document's section on figures for presentations.

Be sure to consider your audience and their background knowledge of the subject, as well as time limit when drafting slide decks as this will guide the level of depth and what to focus on. Understanding your audience will also help you frame your presentation to give appropriate background and motivation for your work and to emphasize the importance and implications of your results both generally and for the audience specifically.

For Audience

During presentations, all audience members are expected to be active and respectful listeners who give the presenter their undivided attention. We encourage asking questions both during and after the talk – if you are confused, chances are someone else is too. It should be noted that during certain presentations questions and comments should be saved for the end. This is typically only the expectation of practice talks while team meetings are open to questions at any time, and this type of special consideration will be established before the presentation starts.

After practice talks, all attendees are expected to provide comments and/or ask questions about the presentation in order to help the speaker improve before their official presentation. Speakers may ask for specific kinds of feedback which can help guide your commentary. If not, comments on presentation style and content are welcome. All comments should be constructive in nature and typically should not be repeated (i.e., a speaker does not need to hear "you should improve X" multiple times). You should be prepared to provide thoughtful feedback to all presenters, even if they are presenting on something outside your technical expertise, as we believe everyone has something valuable to contribute.

Journal Club

Through reading and discussing this series of papers, program participants will be introduced to the field of applied malaria modeling. Participants will see past applications of EMOD as well as a few other individual-based models that have been used to inform policy. The chosen papers reflect a wide range of topics such that participants will be exposed to different model capabilities.

Even if a particular paper is of limited relevance to someone's project, each paper and discussion is an opportunity to practice critical reading. Where did the model do well? What were its limitations? Was the approach rigorous? Did the results make sense, and were they presented clearly? Was the model fit for purpose? These are all questions we need to ask of ourselves in our own applied modeling work. Journal Club lets us practice thinking through how to answer these questions together.

For Leader

Journal club leaders are expected to be able to walk discussants through the paper, explaining the following on the *content* of the paper:

- Motivation for the work
- Approach used
- Walk through each figure, including methods and results
- Main conclusions

Journal club leaders should also have prepared their own thoughts on the *analysis* of the paper:

- Strengths and limitations of the model
- To what extent the conclusions are supported by the results
- What further evidence would support the modeling results
- What would be other interesting questions to ask, using either the approach in the paper or other approaches (modeling or not) – prepare at least 3-4 guiding questions for the discussion

If you are leading a journal club session, you will be expected to:

- Before
    - Read the assigned paper at least 3 days prior to the session
    - Prepare answers to the content and analysis points above and note anything confusing
    - Discuss answers with buddy and clarify points of confusion
- During
    - Lead everyone through reviewing the content of the paper, making sure everyone understood what was done and why
    - Lead everyone through a discussion of the analysis of the paper, covering each of the analysis points listed above, and bringing in new questions and ideas
    - Manage the discussion so everyone contributes and no one dominates
    - Manage the overall pace such that the entirety of the paper and the discussion points are covered

- After
    - Follow up on any questions raised during the discussion that could not be answered at the time

For Discussants

If you are attending journal club as a discussant, you will be expected to:

- Before
    - Read the assigned paper prior to attending the journal club session
    - Make notes and mark any questions you may have to discuss with the group
- During
    - Be an active participant so we can all learn from each other's ideas
    - If you have a question, others will too. We are here to learn

Administrative Contact

Zackaria Edem Gidi, Program Administrator

I’ll help you with navigating UHAS University administration and Hohoe, including getting settled and gaining access to university, housing, and transportation resources you will need during your stay.

Things to do Around Volta Region

These are non-sponsored activities you can choose to do with your personal funds.

- Wli Waterfalls (Longest Waterfall in West Africa)

Wli Waterfalls, located in the Hohoe Municipality of Ghana's Volta Region, is a breathtaking natural wonder. The falls drop from a height of about 80 meters, creating a misty veil that surrounds the area, making it a sight to behold. The waterfall is surrounded by lush greenery and rocks, adding to its natural beauty. The area is also home to a variety of flora and fauna, making it a popular spot for hiking, birdwatching, and nature photography. The falls are considered a sacred place by the local community, who believe it has healing properties. Visitors can enjoy a refreshing swim in the natural pool at the base of the falls, making Wli Waterfalls a must-visit destination for nature lovers and adventure seekers.

- Tagbo Waterfalls

Tagbo Falls is a waterfall in Ghana near Mount Afadjato, located at Liati Wote, some 27 kilometers east of the Hohoe settlement. The waterfalls in various phases, the last of which is roughly 60 meters high. The location is encircled by woodland.

- Afadjato (Tallest Mountain in West Africa)

Afadja Mountain, located in the Hohoe Municipality of Ghana's Volta Region, is the highest peak in Ghana, standing at an elevation of 885 meters (2,904 ft) above sea level. The mountain is part of the Agumatsa Range and offers breathtaking views of the surrounding landscape. The name "Afadja" means "highest point" in the local Ewe language, and the mountain is considered a sacred place by the local community. The area is home to a variety of flora and fauna, including rare species of plants and birds. Visitors can enjoy hiking and trekking to the summit, which takes about 2-3 hours, and experience the stunning scenery and natural beauty of the area. Afadja Mountain is a popular destination for nature lovers, adventure seekers, and those looking to escape the hustle and bustle of city life.

- Tafi Atome Monkey Santuary

Tafi Atome Monkey Sanctuary, located in the Hohoe Municipality of Ghana's Volta Region, is a protected area and home to Mona and Patas monkeys. The sanctuary was established in 1993 to conserve and protect these endangered species and their habitat. Visitors can take a guided tour through the forest and get up close and personal with these fascinating creatures, observing them in their natural habitat. The sanctuary also offers hiking trails, birdwatching, and stunning views of the surrounding landscape. The local community considers the monkeys sacred, believing they bring good luck and prosperity. The sanctuary provides a unique opportunity to learn about the importance of conservation and the need to protect Ghana's rich biodiversity.

- Amedzofe Canopy walk

Amedzofe is also home to the famous Amedzofe Canopy Walkway, which is a suspension bridge that offers breathtaking views of the surrounding forest. The walkway is 350 meters long and hangs 70 meters above the forest floor, providing a unique perspective on the natural environment.

- Mount Gemi

Mount Gami, situated in the Amedzofe area of Ghana's Volta Region, is a scenic mountain offering breathtaking views of the surrounding landscape. The mountain is considered sacred by the local community, who believe it holds spiritual powers.

- Likpe Caves
    - A hidden gem in Ghana's Volta Region, these ancient caves offer a glimpse into the region's rich history and culture. Also known as Likpe-Todome, meaning "Sharpening stones from under the mountain", these caves hold significant cultural importance for the Ewe people. Used as a refuge during times of war, the caves feature unique rock formations.

Worksheets and notes pages

Aims Worksheet

Answer each of these questions to build up a strong introduction and framing for your Specific Aims.

General context and significance: What is the “big picture” for research? Why is it important?

Narrowing context: What is known and accepted in your research area?

Your research contribution: Has your previous work contributed? How?

Complication: What is the problem, roadblock, the unknown?

Long-term goal: What final “big results” will research help achieve?

Specific goal of this research: “What is “specific narrow goal” of this research?

Summary of research—path to hypothesis: How does previous research lead to hypothesis?

Hypothesis: What do you believe to be the answer to the complication?

Qualifications stressed: What makes you the right person to undertake the research?

Project Notes Template

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GOALS

TO-DO LIST

-
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EXPERIMENT LOG

Experiment ID	Description	Simulation Duration	# Runs	Memory	Runtime
###-####-####-##	burnin	30 years	30	2GB	2 hours
###-####-####-##	pickup	5 years	2000	6GB	45 minutes

WORKFLOW

Script	Run Specifications	Outputs Created	Output Location
get_climate.py	Start and end year; path to demographics file	Weather files (.bin and .json)	simulation_inputs > climate > START-END
run_burnin.py	Supply path to demographics file and weather files from get_climate.py	None	N/A
run_pickup.py	Supply burnin_id from run_burnin.py experiment	InsetChart.json SpatialReportMalariaFiltered.bin (by node)	Suite > Experiment > Simulation > output
SpatialAnalyzer.py	ID from run_pickup.py experiment	SpatialReportMalariaFiltered.csv	simulation_output
EventAnalyzer.py	ID from run_pickup.py experiment	CountedEvents.csv	simulation_output

Notes