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<th>Name of Student</th>
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### MD-PhD Student Roster 2016-17

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<td><a href="mailto:marco.ramos@yale.edu">marco.ramos@yale.edu</a></td>
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## MD-PhD Student Roster 2016-17

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## Directors of Graduate Study and Registrars

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<td>Susan dos Santos</td>
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**2016-17 YALE’S MD/PhD FACULTY COMMITTEE**

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<tr>
<td>Barbara Kazmierczak MD,PhD</td>
<td>Int. Med. (Inf. Dis), Microbial Pathogenesis</td>
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<td>Fred Gorelick, MD, Deputy Director</td>
<td>Int. Med. (Dig. Dis), Cell Biology</td>
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<tr>
<td>Peter Aronson, MD, Assoc. Dir.</td>
<td>Int. Med. (Nephrology), TAC S255C</td>
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<td>Keith Choate, MD, PhD, Assoc. Dir.</td>
<td>Dermatology, Pathology &amp; Genetics 604B HRT</td>
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<td>Michael Nitarbach, PhD, JD, Assoc. Dir.</td>
<td>C&amp;M Physiology, Genetics, BE29 SHM</td>
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<td>Faye Rogers, PhD, Assist. Dir.</td>
<td>Therapeutic Radiology, HRT 213b</td>
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<td>Richard Sleight, PhD</td>
<td>Assoc. Dean, Graduate School, HGS 132</td>
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<td>Clara Abraham, MD</td>
<td>Int. Med/Digestive Disease TAC S155B</td>
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<td>Microbial Pathogenesis, WWW 403d</td>
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<td>Pharmacology, B226D SHM</td>
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<td>Daniel Cólón-Ramos, PhD</td>
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<td>Michael Craig, PhD</td>
<td>Neurobiology, SHM B-301, (Kristie Bruzenak)</td>
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<td>Raymond Johnson, MD, PhD</td>
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Funding and Compliance Pertaining to MD-PhD Students

Support while in the Program. The standard acceptance letter currently indicates that you will be guaranteed support which will include a stipend at the current NIH base rate and supplemented by the Medical School, health care coverage (single)(Rx included), and also the tuition responsibilities for the Medical and Graduate Schools (3½ years medical school, 2½ years graduate school). While supported by the MD/PhD Program, the student earns a stipend (fellowship), which is not subject to tax withholding, but is subject to tax reporting. Students should consult the University’s Tax Department’s website (www.yale.edu/tax) and also IRS Publication 970, Tax Benefits for Education. Many students also set up a quarterly estimated tax payment schedule.

At the point in your enrollment when you affiliate with a Ph.D. department and begin working in the lab, a portion of your stipend will be subject to tax withholding. When you affiliate, you should complete a Form W-4 for the federal and CT state governments. This will ensure the appropriate amount of tax is being withheld. Without the Forms W-4 on file, the University will deduct the maximum amount. This becomes critical when you are working full-time in the lab, and your support is 100% subject to tax withholding. When you finish in the lab and return to complete medical school, support from the MD/PhD Program is reinstated and your earnings are a full stipend again.

Summary points:
- Student receives NIH base stipend, supplemented by YSM until Ph.D. affiliation
- Program provides (single) health care coverage and tuition payments
- Review Yale tax website & IRS Publication 970 for info. on fellowships and reporting income
- Complete Forms W-4 (federal and CT state) upon Ph.D. affiliation

Realistically, most students will take 7 – 8 years to complete the dual degrees. Keep in mind that your PhD advisor must have a Graduate School appointment. When you have decided on a PhD advisor,
communicate this information to Cheryl. She will give you the affiliation form that needs to be completed, as well as convey financial obligations to your advisor in a timely manner.

When an advisor is confirmed and the student officially affiliates with a Ph.D. program, the student’s stipend will increase to that of the current graduate student stipend level, which is determined by the Graduate School, currently at $34,450 for the period July 1, 2016-June 30, 2017. In certain cases, this increased stipend level will be pro-rated to coincide with the fiscal year. The increase in stipend support, i.e. the supplement to the base rate, is equally split between the advisor and the Medical School. The stipend supplement will be subject to tax withholding, so be sure the appropriate tax forms have been completed.

Typically, when an MD/PhD student enters the 4th year of study, the student’s advisor is contacted to provide stipend and tuition support. It is during this time that the category of the student’s funding is changed from stipend to salary, and subject to tax withholding. During years 4-6 of the Program, 100% of the salary is provided by the advisor. The advisor is financially responsible until the student defends the PhD thesis, is no longer working in the lab, and resumes clerkship training. At this time, the student returns to Program funding. The Program has secured funding so that the student no longer experiences a “bump down” as a result of not having an advisor. The student’s stipend will remain at the current Graduate School level until graduation. The student must defend the dissertation prior to re-entry to the wards. It is important for the Program to know the student’s status with the lab to determine the proper stipend supplementation: (1) if the student has defended the dissertation, but is still working part-time in the lab while pursuing medical school requirements, the advisor should provide a stipend supplement; (2) if the student has submitted the dissertation and is still working part-time in the lab while pursuing medical school requirements, the advisor should provide a stipend supplement; (3) if the student has earned the Ph.D. and is still working part-time in the lab while pursuing medical school requirements, the advisor should provide a stipend supplement. Please note that although you may earn the Ph.D. before completing all of your medical school requirements, you are still enrolled as a full-time student in a pre-doctoral dual degree program. This means that the student cannot be paid as a postdoctoral fellow and can only receive a stipend supplement. The student must remain in close communication with the MD/PhD Program Office during this time. We are informing you of these procedures so that you will be aware of what we have told your potential advisor. You may also talk with Cheryl in the MD-PhD Program Office about funding information. The financial arrangements between the Program and the advisor are addressed by the Program and need not concern the student.

Continuation in the Program is dependent on satisfactory completion of the course and clerkship work in the Medical School curriculum as determined by its Progress Committee and satisfactory progress toward completion of the PhD as determined by your mentor, the Director of Graduate Studies (DGS), your thesis committee and the MD/PhD Program’s Faculty Committee. The Program’s role is to make sure that these committees meet with you and that you are informed in a timely manner of any concerns they may have. The Program has devised two venues for monitoring the student’s progress in the lab: (a) annual advisor reports containing a checklist of academic requirements for the Ph.D., including thesis committee meetings; and (b) assigning an Associate Director of the MD/PhD Program to the student’s thesis committee.

**Summary Points:**

- Stipend increases to Graduate School level upon Ph.D. affiliation; stipend will remain at Graduate Student stipend level until graduation
- Advisor must have a Graduate School appointment
- Notify Cheryl of Advisor in order to convey and confirm financial obligations
- Complete Ph.D. Affiliation Form when Ph.D. department is confirmed
- Complete relevant tax forms as stipend supplement is subject to tax withholding
- At the beginning of Year 4 in the Program, the student’s full stipend remains subject to tax withholding until the student leaves the lab; stipend then is categorized as fellowship
- Student must defend the dissertation prior to re-entering the wards
**External Fellowships.** Students are encouraged to apply for outside funding for their MD/PhD work, either through private agencies or the NIH. Students who are successful in obtaining individual fellowships may be considered for a combined award (i.e. bonus) to their stipend. Sample applications can be sent electronically by Cheryl. **All external fellowships and their accompanying administrative requirements must be processed through the MD/PhD Program.** Schedule a meeting with Cheryl to review the administrative requirements for submitting an external fellowship. You should also consult with Dr. Gorelick about your fellowship application.

The following administrative requirements that **must be completed prior to the submission** of any external fellowships:

(a) Conflict of Interest (COI) Disclosure Form – [http://coioffice.yale.edu/](http://coioffice.yale.edu/)

(b) Sponsored Projects Administration (SPA) Training - [http://researchadministration.yale.edu/training](http://researchadministration.yale.edu/training); click on training; faculty education; self-assessment online

(c) Review of Patent Policy & Agreement: [http://ocr.yale.edu/faculty/policies/yale-university-patent-policy-acknowledgement-agreement](http://ocr.yale.edu/faculty/policies/yale-university-patent-policy-acknowledgement-agreement)

(d) If applying for an NRSA - Completion of the NRSA Assurance of Compliance Form, which has to be signed by the fellow and faculty mentor

**Summary Points:**

- External funding requires the completion of administrative requirements, **prior to submission**
- When students apply for an external fellowship, grant, etc. they should schedule an appointment to meet with Cheryl. All applications must be processed through Cheryl’s office, as part of the MD/PhD Program. Even if you have affiliated with a Ph.D. department, your “home base” is with us.

**Compliance.** In light of the support each of you receives, the Program often requires information from each student that must be reported to various Program officials and agencies. **If we ask you for information, it is because we need to collect and report that information and expect you to be professional and timely in your responses to our requests.** Some of the items for which you will be asked to provide information include, but are not limited to:

**Annual Individual Development Plan** – this is information reviewed by the Program Director so that we can help you navigate through the Program and identify any problems that come up.

**Annual Funding Agency Reports** – this is information compiled and sent to the various funding agencies for students supported on the MSTP Training Grant, University funds or individual fellowships.

**Updating Information** – this is information that should be provided to the MD-PhD Program Office if you change your address, marital status, health insurance coverage, direct deposit information, etc.

**Clerkship/Re-entry Information** – this is information you need to provide to the Program at the time you meet with Terri Tolson (Medical School Registrar) and Dr. Tamar Taddei concerning your re-entry to the wards

- **Please note:** The MD/PhD Program will consider non-compliance to our requests as a deficiency in your academic standing. This could affect the processing of stipend and other payments.

**Summary points:**

- Collection of information is a professional responsibility of each student
- Students should respond to information requests in a timely manner
- Student must meet with Dr. Tamar Taddei and communicate with Cheryl concerning their timeline for re-entry at least 6 months prior to beginning clerkships. **See page 19.**
**Student Hosting during the Interview Season.** We rely upon our students to host applicants who come through for interviews. We are sure you remember how important it was to you to be hosted by a current MD-PhD student when you came for your interview. Please respond to our requests for hosting applicants. The request will come as an email from the MD/PhD Host Coordinator. This is a very important part of our recruiting efforts and we are depending on you for assistance.

The Program invites student hosts to attend the applicant dinners on Monday evenings. Due to budget cuts, however, it may not be possible for every student host to attend each dinner. Additional information will be provided as it becomes available. Please feel free to check in with Cheryl.

The Program also sponsors a pizza party with current MD-PhD students on Sunday evening for applicants who arrive in New Haven the night before their interviews and applicant lunches. Attendance by students in all years of the Program is encouraged for these programmatic activities.

This year’s interview dates are:
- Sunday, October 16th – Tuesday, October 18th
- Sunday, November 6th – Tuesday, November 8th
- Sunday, December 11th – Tuesday, December 13th
- Sunday, January 8th – Tuesday, January 10th
- Sunday, January 22nd – Tuesday, January 24th
- Sunday, February 5th – Tuesday, February 7th
- Sunday, February 12th – Tuesday, February 14th

**MD/PhD Student Council.** In February, 2011 the Program formed the MSTP Student Council to provide broadly representative student feedback and suggestions about Program activities. The MSTP Student Council has a representative from each class who meets with MSTP Program leadership every other month to provide input into planning program activities, such as the Research in Progress (RIP) sessions, annual retreat, mentoring system, and new initiatives. Each class selects its representative to serve a one-year term so that many students in each class will have the opportunity to serve on the Council during their time at Yale, if interested.

The representatives for 2016-17 are: Year 1 Laurel Kaye; Year 2 Stefano Daniele; Year 3 Dan Barson; Year 4 Alanna Kaplan; Year 5 Lee Ying; Year 6 Amanda King; Year 7 Wendy Xiao; Years 8+ Alexandria Marino.

**Committee on Women & Minorities.** During the 2016 Retreat, a focus group of MD/PhD students convened to discuss Inter-class unity and Women’s and Minority Recruitment for our Program. A formal committee has been formed and will meet every other month with the Program’s leadership. Current Committee members are Dan Barson, Shivani Bhatt, Nicholas Economos, Carrie Flynn, Kelsey Loeliger, Jessica Minor, Alyssa Mitson-Salazar, Danielle Miyagishima, Alice Lu, Rebecca Treger and Lorenzo Sewanan.

**NIH Publication Information and Acknowledgement of the MD/PhD Program in Publications**

**NIH Publications and Public Access Policy.** The NIH Public Access Policy ensures that the public has access to the published results of NIH funded research. It requires scientists to submit final peer-reviewed journal manuscripts that arise from NIH funds to the digital archive PubMed Central (PMC) ([http://www.ncbi.nlm.nih.gov/publish](http://www.ncbi.nlm.nih.gov/publish)) upon acceptance for publication. To help advance science and improve human health, the Policy requires that these papers are accessible to the public on PubMed Central no later than 12 months after publication.

All of your papers fall under the NIH Public Access Policy, whether in press or in print, and must include evidence of compliance in all of your NIH applications and reports. It is essential to provide the PMC numbers associated with your publications to the MD/PhD Program Office as we have to track your publications. Non-compliance on your part could jeopardize continued funding for the Program.
For complete information, please review the website at http://publicaccess.nih.gov/policy

Summary Points:
- All peer-reviewed articles must comply with the NIH Publications and Public Access Policy
- When citing papers, include PMC reference numbers
- Provide PMC reference numbers to the MD/PhD Program for incorporation into reports prepared for the NIH. Non-compliance could jeopardize continued funding for the Program

Acknowledgement of MD-PhD Fellowship Support in Publications. ALL students must acknowledge their financial support in all publications (except abstracts). The standard format is: “This work was supported by NIH Medical Scientist Training Program Training Grant T32GM007205 {also list other funding sources}.” It does not matter if you are supported by our MSTP TG at the time of your publication. The MSTP TG made it possible for you to be at Yale and do the work and it should always be acknowledged.

USMLE– Step I and II of the Boards
The United States Medical Licensing Examination (USMLE) assesses a physician's ability to apply knowledge, concepts, and principles, and to demonstrate fundamental patient-centered skills, that are important in health and disease and that constitute the basis of safe and effective patient care. Each of the three Steps of the USMLE complements the others; no Step can stand alone in the assessment of readiness for medical licensure. Because individual medical licensing authorities make decisions regarding use of USMLE results, physicians seeking licensure should contact the jurisdiction where they intend to apply for licensure to obtain complete information.

USMLE Step 1 assesses whether you understand and can apply important concepts of the sciences basic to the practice of medicine, with special emphasis on principles and mechanisms underlying health, disease, and modes of therapy. Step 1 is a one-day examination, lasting 8 hours. The testing day includes 310 multiple-choice questions, divided into seven 60-minute blocks.

USMLE Step 2CK (Clinical Knowledge) is designed to assess whether medical school students or graduates can apply medical knowledge, skills, and understanding of clinical science essential for the provision of patient care under supervision, with an emphasis on health promotion and disease prevention. US medical students typically take Step 2 during the fourth year of medical school. Step 2CK is a one-day examination, including 350 multiple-choice questions, divided into eight 60-minute blocks.

USMLE Step 2CS (Clinical Skills) uses standardized patients to test students on their ability to gather information from patients, perform physical examinations, and communicate their findings to patients and colleagues. Step 2CS is a one-day examination, lasting 8 hours. The examination is only offered in six cities across the country: Philadelphia (2), Chicago, Atlanta, Houston, and Los Angeles.

The common pathway for MD/PhD students involves completing the first two years of medical school and then moving to graduate school studies and research for a three- or four-year period. Following completion of PhD course work and all or most of their research projects, these students return to complete their two clinical years, thus completing the medical degree in seven to nine years after first matriculating.

- Each MD/PhD student MUST take Step 1 before beginning the required 6 months of clinical rotations and before beginning Ph.D. research. Step 1 must be taken by December 31st of Year 3 in the Program, though students are encouraged to take Step 1 before they affiliate with their PhD lab in Summer/Fall of Year 3.

The USMLE program recognizes that the recommended seven-year time limit may pose problems for medical licensure for some candidates with a combined degree (i.e., MD/PhD). For this reason, the USMLE program recommends to licensing jurisdictions that they consider allowing exceptions to the seven-year limit for MD/PhD candidates who meet the following requirements:
1. The candidate has obtained both degrees from an institution or program accredited by the LCME and a regional university accrediting body.

2. The PhD should reflect an area of study which ensures the candidate a continuous involvement with medicine and/or issues related, or applicable to, medicine.

3. A candidate seeking an exception to the seven-year rule should be required to present a verifiable and rational explanation for the fact that he or she was unable to meet the seven-year limit. These explanations will vary and each licensing jurisdiction will need to decide on its own which explanation justifies an exception. Students who pursue both degrees should understand that while many states' regulations provide specific exceptions to the seven-year rule for dual-degree candidates, others do not. Students pursuing a dual degree are advised to check the state-specific requirements for licensure listed by the FSMB.

Students who pursue both degrees should understand that while many states' regulations provide specific exceptions to the seven-year rule for dual degree candidates, others do not. Students pursuing a dual degree are advised to check the state-specific requirements for licensure listed by the FSMB. For additional information, please see www.usmle.org.

The MD/PhD Program does not cover the costs for these exams. The information listed below, using 2016 figures is provided for budgeting purposes:

<table>
<thead>
<tr>
<th>Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>USMLE Step 1</td>
<td>$600</td>
</tr>
<tr>
<td>USMLE Step 2 CS (apply during winter/spring prior to 4th year)</td>
<td>$1,275</td>
</tr>
<tr>
<td>Travel/hotel</td>
<td>$200-500</td>
</tr>
<tr>
<td>USMLE Step 2 CK (must take before 12/31 of 4th year)</td>
<td>$600</td>
</tr>
<tr>
<td>Electronic Residency Application Service (ERAS)</td>
<td></td>
</tr>
<tr>
<td>First 10 programs applied to</td>
<td>$99</td>
</tr>
<tr>
<td>11-20 programs</td>
<td>$12/program</td>
</tr>
<tr>
<td>21-30 programs</td>
<td>$16/program</td>
</tr>
<tr>
<td>&gt; 31 programs</td>
<td>$26/program</td>
</tr>
<tr>
<td>National Residency Matching Program (NRMP)</td>
<td>$75</td>
</tr>
<tr>
<td>Interviews</td>
<td></td>
</tr>
<tr>
<td>Airfare/Rental Car/Gas/Accommodations/Food</td>
<td>$2,000 - 10,000</td>
</tr>
</tbody>
</table>

**Summary Points:**
- Each MD/PhD student must take (and pass) Step 1 before beginning research
- Each MD/PhD student must take (and pass) Step 2 during the fourth year of medical school

**Protocol Information.** If you are working in the lab and involved in research, teaching and/or testing on live vertebrate animals, federal regulations (regardless of funding) require approval by the Institutional Animal Care and Use Committee (IACUC) prior to implementation of the project. Check with your PI and provide the Protocol information to Cheryl in the MD/PhD Program Office. It would be optimum if you could provide a copy of the approval letter listing your name.

If you are involved in research involving human subjects, Federal Regulations at 45CFR46 and University policy require that all projects be reviewed and approved by one of the University’s Institutional Review Boards (IRB).
Please check with your PI and provide the Protocol information to Cheryl in the MD/PhD Program Office. Protocol information includes the PI under whom the Protocol is registered, the Protocol Number, and the Protocol Approval & Expiration Dates. A copy of the Protocol letter would also be appreciated. This information is required by the NIH for continuation of our funding.

Trainee Reimbursements. The MD/PhD Program provides annual funds for trainee travel costs for participation and/or attendance at a scientific meeting and/or textbooks (that are not available in the University Library). The amount allocated is $300 per student during the fiscal year. If you are presenting a paper or poster, you may be eligible for additional funds. This is approved at the discretion of the MD/PhD Program. Due to University-wide budget cuts, the trainee reimbursement allowances and allocations have changed significantly.

PLEASE NOTE:
- If you are supported by the training grant or other Program funding source, you will be able to use the $300 allocation of funds to travel to a scientific meeting or purchase text books. There are federal guidelines and University guidelines that must be followed in order for the funds to be made available.
- If you are supported by an external funding source, such as an NRSA, private fellowship, or other departmental grant, you will not be entitled to the $300 allocation of funds from the MD/PhD Program, as these sources have their own travel monies.
- If you are supported by your advisor, you will not be entitled to the $300 allocation of funds from the MD/PhD Program, as the research grant/source from which you are funded by your advisor will have its own travel monies.

Unallowable Expenses include, but may not be limited to: Student activity costs, computers, computer equipment (hardware and/or software), cell phones, phone-type devices, electronic organizers, dues/memberships and/or extracurricular activities.

Reimbursement Guidelines and Procedures - 2016
The MD/PhD Program will provide reimbursement up to $300 each fiscal year for travel to a scientific meeting and/or the purchase of textbooks not readily available in the University Library system. Please review the reimbursement procedures below:

The time frame for submitting reimbursements is August 1, 2016 – May 31, 2017. If you are graduating from the MD/PhD Program, you must submit your reimbursements by May 15th to ensure sufficient processing time. All reimbursements are processed through EMS. Please be sure to use your “yale.edu” email address to respond to the EMS prompt to approve your expense reimbursement.

Each reimbursement request MUST be accompanied by the following:
- A signed MD/PhD Program Request for Trainee Reimbursement Form.
- A memorandum stating the reason for the reimbursement. If reimbursement is for attendance at a scientific meeting, the memo must indicate (a) the purpose of attendance (i.e., poster presentation, etc.) and (b) a summary of how participation has benefitted your research. The reimbursement will NOT be processed until the summary is received.
- Original receipts and proof of payment for each receipt submitted. The receipt(s) for textbooks must include name, shipping address and method of payment.
- If you are traveling as part of a group and another department is paying for a portion of the expenses, a copy of the other department’s expense report will have to be provided to Cheryl. The University requires full accounting of how you traveled and who paid for expenses. Your reimbursement should be prepared through the MD/PhD Office.

3) The reimbursement request with required supporting documentation must be submitted to Cheryl WITHIN 10
BUSINESS DAYS OF INCURRING THE EXPENSE OR RETURNING FROM THE TRIP. Items submitted after this time period may not be eligible for reimbursement. You can be reimbursed for conference expenses only after you have returned from the conference.

The MD/PhD Program encourages students to process their registration, travel, hotel, etc. with Cheryl so it can be put on an MD/PhD Program P-card, instead of providing reimbursements.

Travel reimbursement: Travel information must include date and place (city, state). The University will not reimburse for penalties incurred for changing reservations, for upgrades in travel, or for using frequent flyer or similar awards. If a ticket is refundable and was not used, a refund should be obtained.

- A conference program must be included as part of the reimbursement packet. If meals are offered at the conference, the University will not reimburse you for that particular meal. If meals are not offered at the conference, you will be entitled to per diem reimbursement for meals (receipt not required for per diem meals).
- Use of a personal vehicle for University-related business is reimbursable at 57.5 cents per mile.
- If a receipt is missing and the expense is greater than $25, it is your responsibility to obtain a duplicate receipt. If the expense is less than $25, a missing receipt form can be completed.

Non-reimbursable travel expenses include, but are not limited to: child care, pet care, in-room alcoholic beverages, gym and recreational fees, laundry or valet service (for travel under 5 consecutive days), personal grooming services, car rental insurance, baggage fees, theft, cash advance money, personal funds or property, parking tickets/traffic violations, meals for spouses/guests, travel-related expenses for spouses/guests.

The Program cannot reimburse for items related to preparation for Boards. Expenses that are reimbursed based on the conditions set forth above are not treated as income to the individual and generally will not be subject to tax withholding or reporting. If you have any questions, please contact Cheryl at Cheryl.defilippo@yale.edu.

Summary Points:
- The amount of reimbursement from the MD/PhD Program is $300 per student.
- If you receive support from an external funding source or your PI, you are ineligible for Program reimbursement
- A travel summary must be submitted to Cheryl prior to processing the reimbursement
- Reimbursements must be submitted within 10 working days of incurring the expense or returning from the trip
- All reimbursements will be directly deposited into your account. If you do not have direct deposit, sign up for it – or a check will be mailed to whatever address you have on file with the University.

Thesis and Prizes. The MD-PhD thesis prepared by our students is not eligible for an MD prize. The Program has its own Prize Committee and currently offers the following prizes:

The MD-PhD Thesis Prize: awarded for the most outstanding MD-PhD thesis. The student receiving this prize will also be asked to give a talk on Student Research Day.

The MD-PhD Award: awarded to outstanding members of the graduating MD-PhD class who have shown excellence in both research and clinical activities.

The MD-PhD Alumni Award: awarded to graduating MD-PhD students who have demonstrated outstanding academic achievements, leadership and service.

The Selma and Karl Folkers Prize in Biomedical Research: awarded to graduating MD-PhD students whose thesis research has demonstrated excellence in basic cell and molecular biology.

MD/PhD students can receive cum laude recognition for their thesis from the Medical School provided the following criteria are met:
- The student has received Honors in all required clerkships; and
- has passed all Boards; and
- will be awarded a research prize (from the MD/PhD Program)

**MD/PhD students can receive distinction recognition for their thesis from the Graduate School.** Each reader must rate the thesis as “distinguished” in the Reader’s Report. The student will receive a letter from the Dean of the Graduate School, but this recognition does not appear on the student’s transcript or diploma.

**Time away from the MD-PhD Program.** The MD-PhD Program is administered within the parameters of different funding sources and institutional guidelines. The Program does not have any stated “vacation” time for its students but there are procedures that have been in place to serve as guidelines for our students when there is a need to be away from the Program for a brief period of time.

- All students are permitted to take 2 weeks in addition to stated University holidays (Thanksgiving, Winter and Spring breaks, and major religious observances). However, students must refrain from being away during any time they are scheduled to participate in required courses, teaching obligations, clerkships or mandatory Program events.
- Following affiliation, the MD-PhD student must also take into consideration that research labs operate during semesters and throughout the summer months. You must discuss time away from the lab with your thesis advisor. If the student is affiliated with a lab outside of Yale, the student should conform to the official holidays observed by the institution at which the thesis laboratory is located.

**If a student wants to take additional time off beyond the permitted 2 weeks and University holidays, this must be cleared with your thesis advisor and the MD-PhD Program Director.** MD/PhD students making satisfactory academic progress may receive stipends during this time.

**Sick leave or other leave.** A student who is interested in applying for a sick, medical or personal leave should review the policies and procedures stated in the Graduate School Bulletin and consult the appropriate University representatives. Forms must be processed through Cheryl in the MD/PhD Program Office. The NIH permits the receipt of stipends for up to 15 calendar days per year. Anything beyond 15 calendar days requires filing for a medical leave of absence.

- **NIH Parental Leave Policy.** The NIH has a policy concerning parental leave that the MD/PhD Program follows. The policy states, “Trainees and fellows may receive stipends for up to 60 calendar days (equivalent to 8 work weeks) of parental leave per year for the adoption or birth of a child when those in comparable training positions at the grantee organization have access to this level of paid leave for this purpose. Either parent is eligible for parental leave. The use of parental leave must be approved by the training Program Director.”

**Changes to Health Coverage.** If you have any changes in your health insurance coverage, you should notify Cheryl. Changes include waiving coverage, marriage, divorce, birth of a child, adoption of a child, etc. and require the processing of new paperwork, which need to be renewed annually.

**Tax Information**

From your matriculation into the MD/PhD Program until you affiliate with a lab, you will receive a stipend, which is considered to be a fellowship and not subject to tax withholding. Your stipend is, however, reportable income when you file a tax return. In order to avoid having to pay taxes at the end of the calendar year, each student should set up estimated quarterly tax payments.

When you affiliate with a lab, the financial support provided by your thesis advisor is considered “earnings” and is subject to tax withholding. Each student must complete a CT Form W-4 and an IRS Form W-4 to determine your tax withholding status. Tax withholding also applies when you are teaching (for requirement and/or for pay), receiving a stipend supplement, serving as a Project Assistant, etc. If these forms are
not on file with the University, the IRS mandates that the maximum amount of tax be withheld from your earnings. Please see Cheryl for the appropriate forms.

The University Tax Department contains information concerning the filing of taxes for the calendar year. The website address is: http://www.yale.edu/tax. The website has a comprehensive tax guide for graduate students.

Summary Points:
- Questions concerning taxes should be directed to the Tax Department at Yale
- The student’s tax status changes throughout his/her enrollment in the Program. See Cheryl for updates concerning status changes and forms to be completed
- All students must complete the appropriate tax and University reporting forms

Working while in the MD/PhD Program. MD/PhD students engaged in any work-related activity for which compensation is provided may work up to a maximum of 10 hours per week. Compensation for any work activity must be scheduled and payments made through the MD/PhD Office. This policy also applies to teaching, whether for requirement or pay.

Mentoring Available to MD-PhD Students

An important activity of the MD/PhD Program which all students must take advantage of is our interest in what students take to satisfactorily complete their training both as physicians and scientists. To this end, we have organized mentoring opportunities to help you during the main transitions of an MD/PhD student: (1) identifying appropriate curriculum; (2) pre-clinical requirements and selecting a mentor and research lab; (3) re-entry to the wards with an appropriate clinical background; and (4) future careers as physician-scientists, i.e., the match for residencies, postdoc opportunities, etc.

Faculty Mentoring Program. Dr. Michael Nitabach, Associate Director for Graduate Mentoring, oversees the Faculty Mentoring Program. This Program focuses on 3 specific areas for faculty to provide guidance to our students: (1) choice of a mentor and Ph.D. lab; (2) coursework; and (3) career planning. As part of this Program, each incoming student will be assigned a faculty mentor, and the mentors are asked to contact their advisees. Each faculty mentor will have a group of 2-3 advisees at different stages of enrollment and most will retain the same mentor throughout their time in the Program. The Program requests mentors and students meet two times per year, preferably prior to registration and/or at a challenging point in a student’s academic schedule.

In order to facilitate contact with mentors, the MD/PhD Program will sponsor a social event for students and faculty mentors on September 14th in the Cohen Auditorium. This will provide an opportunity to meet informally to begin to establish contact, some for the first time. Subsequent meetings between mentors and students will either be on an individual or group basis. One of the goals of the mentoring program is for the senior students in a mentoring group to provide information and guidance to the younger members of the team, so a group meeting can be helpful in introducing the students in the mentoring group to each other. If at all possible, we tried to combine senior and junior students with the same Ph.D. department. This Program is presented as a mutual working relationship and both mentors and students must take the initiative to contact each other. We believe that there will be more relevance to the Program if both mentors and students agree to participate and make the effort to form a relationship.

We have also provided each mentor with an MD/PhD student timeline to better inform them how the Program works, and the student’s responsibilities during each component of enrollment through graduation, so they will feel more comfortable in advising how to reach those milestones.

Questions concerning the Faculty Mentoring Program should be addressed to Dr. Michael Nitabach, Associate Director for Graduate Mentoring.
Choosing a Lab and Deciding on Research Topics. When students transition from medical school into the thesis research years, the Program provides guidance in choosing a mentor and lab. The Program schedules a meeting with Dr. Kazmierczak and Dr. Gorelick to discuss choosing a lab.

MD-PhD students are strongly encouraged to carry out two 6-week lab rotations during the summer between the first and second years of medical school. These are designed to familiarize students with research options before they start thesis work. Assistance in making the choice of a rotation lab is provided at several levels.

- All of the first- and second-year MD-PhD students meet with Drs. Kazmierczak and Gorelick as a group, and subsequently with Dr. Kazmierczak, to discuss issues related to selecting a research mentor.

- Meetings with the first-year students focus on the processes of defining an exciting research question and establishing useful criteria for identifying the appropriate research environment in which to address this question. Strategies for approaching potential research mentors are discussed, and the students discuss their plans for summer laboratory rotations.

- Meetings with the second-year students focus on their rotation experiences. Students discuss their research experiences and impressions of the training environment. These meetings allow students to ask questions or express concerns about their choice of a dissertation laboratory.

Students who are undecided or who harbor concerns about their choices meet individually with Dr. Kazmierczak. Through these meetings, strategies for addressing concerns or identifying alternative research mentors are developed. These interactions help to ensure that by the end of their second year, students have established a productive relationship with their ultimate research mentor.

See Appendix I: MD-PhD Student Lab Rotation Summary Chart which provides a listing of previous advisors and the MD/PhD students who were rotation students in their labs.

### Departmental Retreats

The Departments of Genetics, Cell Biology, Cellular & Molecular Physiology, Pathology and Molecular Biophysics & Biochemistry conduct annual retreats that take place at facilities on or off the Yale campus. MD-PhD students are invited to these retreats and are strongly encouraged to attend. The costs of their attendance are often times covered by the host departments. These retreats provide a unique opportunity for MD-PhD students to meet and hear faculty members present their work to their colleagues. These retreats also allow MD-PhD students to meet Departmental graduate students and postdoctoral fellows in a relaxed off-campus setting. Through these interactions they are better able to identify laboratories that will provide training environments best suited to their own individual needs. Please see Sue Sansone for departmental contacts.

<table>
<thead>
<tr>
<th>Department</th>
<th>Date of Retreat</th>
<th>Contact person</th>
<th>email address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthropology</td>
<td>No, but an Orientation on Aug 30</td>
<td>Marleen Cullen</td>
<td><a href="mailto:Marlene.cullen@yale.edu">Marlene.cullen@yale.edu</a></td>
</tr>
<tr>
<td>BME</td>
<td>No</td>
<td>Cara Gibilisco</td>
<td><a href="mailto:cara.gibilisco@yale.edu">cara.gibilisco@yale.edu</a></td>
</tr>
<tr>
<td>C&amp;M Physiology</td>
<td>Sept 15, West Campus</td>
<td>Leisa Strohmaier</td>
<td><a href="mailto:leisa.strohmaier@yale.edu">leisa.strohmaier@yale.edu</a></td>
</tr>
<tr>
<td>CB&amp;B</td>
<td>No</td>
<td>Lisa Sobel</td>
<td><a href="mailto:lisa.sobel@yale.edu">lisa.sobel@yale.edu</a></td>
</tr>
<tr>
<td>Cell Biology</td>
<td>Sept 7, West Campus</td>
<td>Susan McMahon</td>
<td><a href="mailto:susan.mcmahon@yale.edu">susan.mcmahon@yale.edu</a></td>
</tr>
<tr>
<td>Program</td>
<td>Event Details</td>
<td>Contact Person</td>
<td>Email Address</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------------</td>
<td>------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>CNNR Program</td>
<td>Have not yet determined a date, but usually in April</td>
<td>Charlene Bloch</td>
<td><a href="mailto:charlene.bloch@yale.edu">charlene.bloch@yale.edu</a></td>
</tr>
<tr>
<td>EPH</td>
<td>No</td>
<td>Melanie Elliot</td>
<td><a href="mailto:melanie.elliot@yale.edu">melanie.elliot@yale.edu</a></td>
</tr>
<tr>
<td>Genetics</td>
<td>Sept 9 &amp; 10; Jiminy Peak, Hancock, MA</td>
<td>Nel Brewster</td>
<td><a href="mailto:Neltja.brewster@yale.edu">Neltja.brewster@yale.edu</a></td>
</tr>
<tr>
<td>History of Medicine</td>
<td>NO</td>
<td>Erica Lee</td>
<td><a href="mailto:erica.lee@yale.edu">erica.lee@yale.edu</a></td>
</tr>
<tr>
<td>Immunobiology</td>
<td>Oct 10 &amp; 11, Heritage Inn, in Southbury, CT</td>
<td>Barbara Cotton</td>
<td><a href="mailto:barbara.cotton@yale.edu">barbara.cotton@yale.edu</a></td>
</tr>
<tr>
<td>INP</td>
<td>Aug 19 (email has already been sent). West Campus</td>
<td>Carol Russo</td>
<td><a href="mailto:carol.russo@yale.edu">carol.russo@yale.edu</a></td>
</tr>
<tr>
<td>MB&amp;B</td>
<td>Sept 17 &amp; 18: <a href="http://www.mbbretreat.yale.edu">www.mbbretreat.yale.edu</a></td>
<td>Liz Vellali</td>
<td><a href="mailto:elizabeth.vellali@yale.edu">elizabeth.vellali@yale.edu</a></td>
</tr>
<tr>
<td>MCDB</td>
<td>Sept. 30 &amp; Oct. 1 Woods Hole</td>
<td>Marrisa DeLise</td>
<td><a href="mailto:marrisa.delise@yale.edu">marrisa.delise@yale.edu</a></td>
</tr>
<tr>
<td>Microbiology</td>
<td>Sept 23</td>
<td>Corey Brushetti</td>
<td><a href="mailto:corey.brushett@yale.edu">corey.brushett@yale.edu</a></td>
</tr>
<tr>
<td>Neurobiology</td>
<td>No, but now &quot;Neuroscience&quot;</td>
<td>Lynne Baumgarten</td>
<td><a href="mailto:lynne.baumgarten@yale.edu">lynne.baumgarten@yale.edu</a></td>
</tr>
<tr>
<td>Pathology</td>
<td>Have not set a date yet</td>
<td>Karen D'Angelo</td>
<td><a href="mailto:karen.dangelo@yale.edu">karen.dangelo@yale.edu</a></td>
</tr>
<tr>
<td>Pharmacology</td>
<td>Sept 9, West Campus</td>
<td>Kristen Porter</td>
<td><a href="mailto:kristen.porter@yale.edu">kristen.porter@yale.edu</a></td>
</tr>
</tbody>
</table>

**Maintenance of Clinical Skills for MD/PhD Students During the PhD Years**

All MD/PhD students are invited and encouraged to maintain some degree of clinical engagement during the PhD years. Opportunities for such experience range from formal, longitudinal clinical experiences to informal time spent with clinician mentors. Students who maintain clinical exposure during the PhD years routinely report that clinical activity enhances their research and eases their transition back to the wards following PhD work. In addition, the years spent doing research can offer additional opportunity to explore areas of clinical interest for students seeking to identify a clinical specialty. Demonstrating engagement in clinical activity is an integral part of the PhD individual development plan and the NRSA F30 application.

You will meet with Associate Program Director Dr. Tamar Taddei to discuss maintenance of clinical skills after you begin your PhD work. Engaging in clinical activity is encouraged throughout your PhD years, and it is strongly encouraged that you are actively engaged in clinical activity by the beginning of the third year of PhD work. You may discuss opportunities with Dr. Taddei at any time ([tamar.taddei@yale.edu](mailto:tamar.taddei@yale.edu)).

The following is a list of several of the options for clinical exposure that are available to you. Please note that this list is evolving as the new curriculum takes shape.

**Wednesday Evening Clinic at the Primary Care Center of YNHH**

The Wednesday Evening Clinic (WEC) is a longitudinal primary care clinic for up to 15 Yale Medical Students in Yale's Primary Care Center (a resident clinic during the daytime). Participation in WEC provides an opportunity for MD and MD/PhD students to follow their own patients and complete the Primary Care Clerkship during research or MBA/MPH years. Responsibilities include seeing 1-3 patients/night, discussing the patients with an attending, and writing notes. Students will also present at pre-clinic conferences, which involves presenting a case or disease common to primary care to fellow students. Students take turns bringing dinner. Pre-clinic conference and dinner are @ 5PM promptly, patients are then seen from 5:45 to 8:00PM. Work for the clinic is
mostly completed during the evening on Wednesdays but follow-up on studies may occur throughout the week. Providers also may participate in the care of their patients outside of the clinic (i.e. scrub in on their surgeries).

The WEC is a wonderful and unique opportunity to be responsible for your own cohort of patients over the course of many months. Additionally, the attending physician staff is outstanding, engaging and excited about teaching students.

There is a minimum commitment of 1 calendar year (many MD/PhDs stay a few years). Students are required to attend at least 38 of 50 clinic sessions (the Wednesdays before Thanksgiving and between Christmas/New Years is always off). Students may start at any point during the year. Completion of the integrated Medical Approach to the Patient clerkship is required. If you have any questions, or would like to come by the clinic to learn more, please contact Shihan Kahn at Shihan.khan@yale.edu or Lee Ying at Lee.Ying@yale.edu. The WEC website can be found at www.yalewec.org.

**HAVEN Free Clinic**

The HAVEN Free Clinic is a student-run primary care clinic partnered with Fair Haven Community Health Center (FHCHC) and Yale University. Our model is unique in its inclusion of students across the disciplines of medicine, nursing, physician’s associates, and public health.

HAVEN Free Clinic is open on Saturdays from 9am to noon and is located at: Fair Haven Community Health Center, 374 Grand Avenue in New Haven.

Medical students of all classes and tracks are invited to volunteer at the clinic in one of the many different departments (Clinical Team, Phlebotomy, Social Services, Patient Services, etc.). Once they have completed the integrated Medical Approach to the Patient clerkship, MD-PhD students may volunteer as Senior Clinical Team Members (SCTMs), seeing patients and performing histories and physical examinations. To receive credit (elective or required clerkship is still to be determined in the new curriculum), volunteering as an SCTM for 15 Saturdays is required. Please see www.havenfreeclinic.org for more information.

If you are interested in volunteering at HAVEN, please contact the Student Recruitment Director at hfcrcruitment@gmail.com.

**Primary Care Experience at the VA**

MD/PhD students have had the opportunity to engage in a longitudinal rotation in the Center of Excellence in Primary Care Education at the VA for a one-year period. Interested students should contact the Clerkship Coordinator, 203-688-4545. This option is subject to preceptor availability at the VA.

**Longitudinal Electives for MD/PhD Students**

The following are suggestions for possible clinical exposure; this list is not exhaustive. You are encouraged to explore other opportunities. Depending upon the degree of patient care responsibility you have and the number of times you engage in your chosen activity, you may be able to receive formal elective credit. Any student with a “floating clerkship” from the prior curriculum is strongly encouraged to complete these during their PhD years. Wednesday Evening Clinic (WEC) fulfills both clerkships formerly known as ambulatory medicine and PCC. Arrangements may be made for longitudinal completion of the clerkships formerly referred to as psychiatry, pediatrics, and OB/GYN. Please note that the psychiatry, pediatric, and OB/GYN longitudinal clerkships are only available as an exception for those who have a “floating” clerkship.

**Longitudinal electives:** Currently offered medical school electives may be developed into longitudinal electives. This is done collaboratively with Dr. Taddei, Dr. Illuzzi, and the particular elective director with the needs of the specific student in mind. Students should proactively seek clinical mentors in disciplines in which they would like to pursue a longitudinal elective.

**Individual mentored experiences:** Students often make individual arrangements with Yale faculty physicians as well as clinicians in the community for both longitudinal and occasional clinical experiences.
You are encouraged to inquire about and even propose such experiences to faculty and community physicians you encounter during your initial clerkships. Ideally, you should receive elective credit for such arrangements that have specified learning objectives and offer the opportunity for formal feedback. Dr. Taddei would be happy to explore your clinical interests to identify a clinical mentor(s).

**Emergency Medicine:** Students may spend time in the Emergency Department on a casual basis.

**Re-entry to the Wards for MD/PhD Students**

**Rationale:** It is essential that students who have been away from clinical study return to clerkships with adequate clinical skills. The Educational Policy Committee, in conjunction with the MD/PhD Program, has determined that after any period of longer than one year in which a student has not engaged in meaningful clinical activity, students must engage in a clinical “re-entry elective” prior to entering clerkships. The objectives of this elective may be found on the elective site at: [https://medicine.yale.edu/education/curriculum/advancedtraining/clinicalelectives/electivecataloglisting/](https://medicine.yale.edu/education/curriculum/advancedtraining/clinicalelectives/electivecataloglisting/)

Students who have maintained clinical skills during research time by participating in a longitudinal experience generally do well when re-entering the clinical setting. It is vital that MD/PhD students have choices to accommodate their clinical interests, complicated schedules, and research commitments. MD/PhD students are required to meet with Dr. Tamar Taddei, the Associate Director for Clinical Affairs to discuss their re-entry.

- **It is required that MD-PhD students defend their dissertations before returning to fulfill the remaining Medical School requirements. Students should meet with Dr. Taddei at least 9 months prior to anticipated thesis defense and again at 4 months prior to scheduled thesis defense in order to plan re-entry.**

To assure flexibility, the following tracks have been created:

<table>
<thead>
<tr>
<th>Experience/Action</th>
<th>TRACK A</th>
<th>TRACK B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical experience prior to entering research or other non-clinical pursuit</td>
<td>6 month clinical experience prior to research</td>
<td>6 months clinical experience prior to research</td>
</tr>
<tr>
<td>Clinical experience during research</td>
<td>At least one year of longitudinal experience, e.g., Wednesday Evening Clinic (WEC) or other appropriate regularly occurring clinical experience</td>
<td>None or less than one year of longitudinal clinical experience</td>
</tr>
</tbody>
</table>
| Actions required at least 9 months prior to re-entry | 1. Mandatory meeting with the Director of Re-Entry  
2. Mandatory meeting with Registrar to confirm clerkship schedule  
3. Meeting with academic advisor | 1. Mandatory meeting with the Director of Re-Entry  
2. Mandatory meeting with Registrar to confirm clerkship schedule |
| Actions required prior to re-entry | 1. Participation in WEEKLY WEC or longitudinal equivalent | 1. Re-entry elective, usually two weeks in |
within 1 year prior to re-entry. If students are away from clinical pursuits for greater than approximately 1 year, they may need to follow track B after consultation with the Director of Re-Entry 2. Meeting with Academic Advisor
duration, as determined by the Director of Re-Entry 2. Faculty-observed clinical encounter (at the warm-up site or with standardized patient) 3. Meeting with Academic Advisor

<table>
<thead>
<tr>
<th>Career Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Peter Aronson, Associate Director for Career Development, offers an annual lecture for first-year students, “Career Tracks in Academic Medicine: Implications for Education and Training.” Dr. Aronson meets with each student as he or she completes the PhD thesis and re-enters clinical training. He provides advice about residency planning and refers students for additional career planning advice to physician-scientist faculty in the clinical discipline of the student's interest.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yale Medical School Academic Advisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Yale School of Medicine has an academic advising program for all students including MD/PhD candidates. Each student’s academic progress is charted and guidance and support are provided all along the course of study for academic and career decisions and challenges. The advisors, each of whom is responsible for one quarter of the student body, meet with all students individually and in groups and write the deans letters that accompany students’ residency applications. They make a special effort to get to know their MD/PhD advisees through individual and group meetings and social events. The advisors meet with the MD/PhD Program Director and Associate Directors periodically to identify and respond to these students’ unique academic requirements. They also meet weekly with the Associate Dean for Student Affairs to discuss important issues as they arise. The advisors are:</td>
</tr>
<tr>
<td>Marcella Nunez-Smith, MD, MHS, Associate Professor of Medicine (General Medicine)</td>
</tr>
<tr>
<td>Karen J. Jubanyik, M.D., Assistant Professor of Surgery (Emergency Medicine)</td>
</tr>
<tr>
<td>Michael K. O’Brien, M.D., Ph.D., Assistant Clinical Professor of Surgery (Gastroenterology)</td>
</tr>
<tr>
<td>Patrick G. O’Connor, M.D., Professor of Medicine (General Medicine)</td>
</tr>
<tr>
<td>Oscar Colegio, M.D., PhD., Associate Professor of Dermatology</td>
</tr>
<tr>
<td>Emily Wang, MD, Associate Professor of Internal Medicine</td>
</tr>
</tbody>
</table>
## MD/PhD Program’s Administration

In addition to your faculty mentors, you may also contact someone in the Program’s Administration:

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department</th>
<th>Address/phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbara Kazmierczak, MD, PhD</td>
<td>Director</td>
<td>Internal Medicine, (Infectious Diseases), Microbial Pathogenesis</td>
<td>ESH 317 5-4317 TAC S169B 7-5062</td>
</tr>
<tr>
<td>James D. Jamieson, MD, PhD</td>
<td>Special Advisor</td>
<td>Cell Biology</td>
<td>SHM C-226 5-5040</td>
</tr>
<tr>
<td>Fred Gorelick, MD</td>
<td>Deputy Director</td>
<td>Internal Medicine, (Digestive Diseases), Cell Biology</td>
<td>VA Med. Ctr 203 932-5711 (ext. 3679)</td>
</tr>
<tr>
<td>Peter Aronson, MD</td>
<td>Associate Director for Career Development</td>
<td>Internal Medicine (Nephrology), Cellular &amp; Molecular Physiology</td>
<td>TAC S255C 5-4902</td>
</tr>
<tr>
<td>Keith Choate, MD, PhD</td>
<td>Associate Director for Minority Recruitment</td>
<td>Dermatology, Genetics &amp; Pathology</td>
<td>HRT 604B 5-3912</td>
</tr>
<tr>
<td>Name</td>
<td>Position</td>
<td>Department</td>
<td>Office</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------------------</td>
<td>------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Michael NitaBach, PhD, JD</td>
<td>Associate Director for Graduate Mentoring</td>
<td>Cellular &amp; Molecular Physiology, Genetics</td>
<td>SHM BE29 7-2939</td>
</tr>
<tr>
<td>Faye Rogers, PhD</td>
<td>Assistant Director for Education</td>
<td>Therapeutic Radiology</td>
<td>HRT 213B 7-3658</td>
</tr>
<tr>
<td>Tamar Taddei, MD</td>
<td>Associate Director for Clinical Affairs</td>
<td>Internal Medicine (Digestive Diseases)</td>
<td>LMP 1080 7-6060</td>
</tr>
<tr>
<td>Cheryl DeFilippo</td>
<td>Associate Director for Program Administration</td>
<td>MD/PhD Program</td>
<td>ESH 319 5-2103</td>
</tr>
<tr>
<td>Susan Sansone</td>
<td>Registrar and Interview Coordinator</td>
<td>MD/PhD Program</td>
<td>ESH 316 5-4403</td>
</tr>
<tr>
<td>Yolanda Quiñones</td>
<td>Senior Administrative Assistant</td>
<td>MD/PhD Program</td>
<td>ESH 316A 5-4317</td>
</tr>
</tbody>
</table>
MD-PhD Timeline – Overview for the “New” Curriculum

Please read the detailed material that follows carefully

The new curriculum—and the opportunity to begin PhD studies earlier than in past years, i.e. in the Fall of Year 3—will undoubtedly change the timeline for MD-PhD students matriculating in Fall of 2015 and thereafter. The timeline outlined below may be revised as PhD-granting departments evaluate the impact of the new curriculum on MD-PhD coursework and timeline to the PhD.

Year 1:
- Discuss course selections with Dr. Kazmierczak, Dr. Gorelick and your Faculty Mentor
- Current MD-PhD students can also offer insight into courses
- You must earn 2 Honors within the first 2 years of the Program to satisfy the Graduate School’s Honors requirement
- Start thinking about your future research interests
- Every student completes 2 six-week laboratory rotations during the summer after the first year.

Year 2:
- Discuss course selections with Dr. Kazmierczak, Dr. Gorelick and your Faculty Mentor
- All students must engage in 6 months of clinical clerkships
- Identify a thesis lab by the spring semester of Year 2 and complete affiliation paperwork

Year 3:
- We encourage students to take Step I of the Boards in July/August after completion of year 2. Step I must be completed by December 31st of this year.
- Begin Graduate School courses
- Meet with the Director of Graduate Studies (DGS) of the Ph.D. department to discuss the timing and protocol for the qualifying exam

Year 4:
- Continue with courses in the Graduate School and continue thesis research
- Complete the Qualifying Examination and thesis prospectus by the fall semester of Year 4

Year 5 to Completion of Thesis:
- Continue thesis research
- Thesis must be approved and defended prior to re-entry to medical school
- Submission of a first-author peer reviewed science manuscript is encouraged
- Meet with Associate Director for Clinical Affairs to complete Re-Entry requirements

Any digression from this timeline must be discussed and approved by the DGS and the MD-PhD Program and documented in the student’s file. Continued participation in the MD-PhD Program requires timely completion of requirements.

Medical School Curriculum

The Integrated Basic & Clinical Science Curriculum includes eight Master Courses, three Longitudinal Courses, and nine Longitudinal Threads spread out over the first eighteen months of study for all medical students.
The Integrated Basic & Clinical Science Courses include:

**Eight Master Courses**
- Introduction to the Profession
- Scientific Foundations
- Genes & Development
- Attacks & Defenses
- Connection to the World
- Energy and Metabolism
- Homeostasis
- Across the Lifespan

**Three Longitudinal Courses**
- Professional and Ethical Responsibility
- Human Anatomy
- Scientific Inquiry: Biostatistics and Research Methods

**Nine Longitudinal Threads**
- Biochemistry
- Cell Biology
- Embryology
- Genetics
- Pathology
- Public Health and Clinical Epidemiology
- Pharmacology
- Physiology
- Diagnostic Methods

For a complete view of the curriculum, please go to [https://medicine.yale.edu/education/curriculum/integrated/](https://medicine.yale.edu/education/curriculum/integrated/)

**MD-PhD Timeline**

**Year One**: MD-PhD students complete courses in the Medical School. One of the first decisions entering MD-PhD students will have to make in the first two weeks of the Program is what graduate courses to take for credit. In addition to Dr. Kazmierczak, you can discuss courses with your assigned Faculty Mentor. Registration for MD/PhD students (courses, clinical clerkships, dissertation research, etc.) is processed online and through the MD/PhD Program Office. Sue will assist you in the registration process at the beginning of each semester. The Graduate School requires that you obtain two Honors during the first two years of entering a PhD program to continue registration. That is their only requirement, but it is strictly enforced. A number of first and second year courses, required and elective, can be taken for the Honors requirement.

You will be responsible for selecting your course work; there are no specific course requirements for MD-PhD students. You should take courses that interest and excite you and that are relevant to your future graduate program.

Some of the required Medical School courses are co-listed as Graduate School courses and are required courses for some of the graduate programs. The more of these courses that you take for credit in the Graduate School during your first and second years, the fewer course requirements you will have to satisfy later in the Graduate School years. In general, it is a good idea to take as many of the first- and second-year Medical School courses for credit in the Graduate School as possible. To receive credit for these courses in the Graduate School, you must list them on your Graduate School Course Enrollment Form, so they appear on your Graduate School transcript.

- Now is the time to begin thinking about your future research interests, which graduate program would be most appropriate, and their course requirements.

For example, the INP and Neurobiology Programs require you to take Principles of Neuroscience (Neuroscience 501a) and Structural and Functional Analysis of the Human Nervous System (Neurobiology 500b). You will take the Neurobiology 500b automatically as part of the first-year Medical School curriculum. The INP
strongly recommends that students who have a strong interest in the neurosciences also take the “Principles”
course in their first year because of educational and scheduling issues that arise if taken later. Please speak with
Charles Greer, Director of the INP and Carol Russo, Administrator of the INP, for details.

Another example is Cell Bio 502 a/b/c, listed in the Graduate School catalogue. It is one of the required
courses for the Cell Biology Program and an elective for the INP and MB&B Programs. To receive credit for this
course you must provide your grades to Dr. Peter Takizawa on the questions that been graded as part your
qualifier.

Finally, MB&B 800 can be taken in place of the Biochem course conferences. That will entail reading original
papers, etc. MB&B 800 is an elective for the INP and MB&B Graduate Programs. Please discuss details of this
course with Dr. Susan Baserga, the course director.

• Cell Biology 601 and MB&B 800 are courses that were primarily designed for MD-PhD students.
  Again, we strongly suggest that you sign up for these courses if your interests are in biochemistry, cell
  biology, genetics, developmental biology, or related disciplines. Cell Biology 601 is a requirement for
  the Cell Biology Graduate Program and electives for the INP and MB&B Graduate Programs. To
  reflect the specific educational goals of MD-PhD students, the content of this course has been designed
  to provide a foundation for your careers as physician-scientists. In this course you will receive
  valuable experience in researching, critically evaluating and presenting scientific information while
  working one-on-one with a faculty mentor. This course has been a favorite of both students and
  mentors and has shaped laboratory rotations for many students.

This summary illustrates which courses can be taken during your first year. Look carefully at the course
requirements for individual programs in the pages that follow -- and check with the DGS of the relevant
program(s) for further details and updates. Requirements do change and there can be flexibility depending on your
background. However, the final say concerning requirements is left up to the DGS and graduate program faculty.
Don’t forget, there will be time to take Graduate School courses when you affiliate with a graduate program in
your third year. Be aware that Medical School courses listed as required graduate program courses may not
substitute for upper-level graduate courses in the individual programs. Each program has its own upper-level
courses you that are required to insure that your PhD training is on a par with that of regular PhD students.

Your graduate course work should provide exciting opportunities for new learning and supplement and
reinforce your core medical school course. However, we offer a word of caution - there are many exciting
educational opportunities at Yale, but you must also avoid being overloaded by taking an excessive number of
courses. Such pursuits may compromise your ability to focus on what you must learn to advance through your first
two years.

• Please schedule time to individually talk to us about graduate courses in the Program offices where
  we will have more details and contact numbers. Also, discuss this issue with senior MD-PhD students
  who have recently and successfully navigated these waters.

Summary Points:
• Discuss course selection with Dr. Kazmierczak, Dr. Gorelick, or your Faculty Mentor
• Start thinking about taking courses that will give Graduate School credit. These can be used to
  satisfy the requirement for earning 2 Honors within the first 2 years of entering a PhD program
• Start thinking about your future research interests

Early Matriculation. Incoming students have the option of matriculating early (before beginning first-year
medical school classes) to do their first lab rotation at Yale through the START@Yale program.
Lab Rotations

- Every student should plan on doing two 6-week laboratory rotations during the summer after the first year.

Selecting the labs in which you will rotate is one of the most important things you will do during your first year. There will be many opportunities to inform your selection. For example, when invited, attend Departmental Retreats. These provide unique opportunities to meet faculty in a relaxed setting and learn about their work. Also, contact potential mentors to meet them, their lab members and attend their lab meetings.

Year Two: While taking courses in the Medical School during the first half of the academic year, you will need to fulfill the 2 Honors requirements for the Graduate School.

Spring Semester of Year Two:

- All students must engage in 6 months of clinical clerkships. Any exceptions to this policy must be confirmed by Dr. Kazmierczak and conveyed to Cheryl. (See MD-PhD Students and Clerkship Requirements at page 31.)

- Step I of the Boards is taken by December 31st after completion of year 2.

Year Three:

- By July at the start of the third year, a thesis lab should be identified and all paperwork should be completed (affiliation form completed and submitted to the MD-PhD Office).

The student begins Graduate School courses. You must meet with the Director of Graduate Studies (DGS) of the Ph.D. department to discuss the timing and protocol for the qualifying exam, which is separate from course examinations, which leads to admission to candidacy for the Ph.D.

There is a residency requirement imposed by the Graduate School. Students seeking the Ph.D. degree are required to be in residence in the New Haven area during at least three academic years. Any exception to the residency requirement must be approved by the Ph.D. department and by the appropriate associate dean.

Summary Points:

- Students should complete two 6-week laboratory rotations during the summer after the first year.
- Step I of the Board examination must be taken by December 31st following completion of Year 2.
- By the end of the 2nd year, a thesis lab should be identified and paperwork processed
- Students begin their third year as graduate students affiliated with a PhD department and lab.
  Students must speak with their DGS to confirm remaining course requirements for the PhD and to follow the department’s schedule for the qualifying exam.

Year Four: MD-PhD continue thesis research, and are expected to satisfy the 2 Honors requirements for the Graduate School at this time. Students complete their TA requirements during this year and are encouraged to prepare and submit a NRSA F30 fellowship proposal. The thesis prospectus must be approved and submitted to the Graduate School by the end of the second year of affiliation, i.e. the end of Spring Semester of Year Four. When the Thesis Committee approves the Prospectus, required paperwork is delivered to the PhD department so the department can complete the Admission to Candidacy paperwork and submit it to the Graduate School. The Prospectus must be submitted to the Graduate School at least six months before the dissertation is submitted.

Each student must complete the Qualifying Examination within one year of laboratory/program affiliation, i.e., by the fall semester of Year Four. This is a Graduate School rule and failure to comply may prevent Graduate School registration for the following semester. Your thesis prospectus must be approved and submitted by the end of Year Four.
**Year Five to Completion of Thesis:** MD-PhD students take courses in the Graduate School and continue thesis research.

Typically an MD-PhD student will complete and defend the dissertation during fall semester of Year Six. A copy of the dissertation should be provided to the MD/PhD Program Office.

- **MD-PhD students must have their written thesis submitted and approved and defend their dissertations before returning to fulfill the remaining Medical School clinical requirements.**

The Program has two mechanisms for monitoring the student’s progress in the lab: (a) bi-annual advisor reports containing a checklist of academic requirements for the Ph.D., including thesis committee meetings; and (b) assigning an Associate Director of the MD/PhD Program to attend at least one thesis committee meeting annually and in the final research year, sit as a member of that student’s thesis committee. We have asked each MD/PhD student to contact the assigned Associate Director and include him/her in the thesis committee meetings.

Failure to meet academic deadlines can cause an MD/PhD student to remain in the Program for up to 1 additional year. This becomes problematic for the Program in funding the student, and problematic for the student in planning for residency matching.

The student returns to Medical School and completes all remaining requirements and graduates in May.

**Summary Points:**

- MD/PhD students must have their written thesis submitted and approved and defend their dissertation prior to re-entry to the wards.
- The Program monitors student’s laboratory progress through: i) bi-annual advisor reports and ii) assigning an Associate Director of the Program to each thesis committee.

**Completion of Medical School Requirements and Re-entry to the Wards**

It is essential that students who have been in the lab have the appropriate clinical skills when they return to the wards. The MD/PhD Program has determined that after a prolonged absence, *i.e.* one year or longer, the student must engage in a “warm-up” period. Students who have participated in a longitudinal experience generally do well when re-entering the clinical setting. It is vital that students have choices to accommodate their at times complicated schedules and laboratory commitments. (See section on Re-entry for details).

While this Overview is considered a guideline for a typical MD-PhD student, we recognize that not every student will follow this path.

Any digression from this timeline must be discussed and approved by the DGS and the MD-PhD Program and documented in the student’s file. Continued participation in the MD-PhD Program requires timely completion of requirements.

**Details of Courses Co-listed as Medical School and Graduate School Courses**

(These can be taken for credit in years 1 & 2 without scheduling conflicts)

**These courses are being offered for credit as far as we know**

**Course selections for students in lab and/or on the wards**

- MEDC 999 01 (CRN TBA) [Courses in School of Medicine](#) Staff 2 HTBA *(2nd years)*
- QUAL 999 01 (CRN TBA) [Preparing for Qualifying Exams](#) Staff 2 HTBA
- CAND 999 01 (CRN TBA) [Prep: Admission to Candidacy](#) Staff 2 HTBA
- DISR 999 01 (CRN TBA) [Diss Research - in Residence](#) Staff 2 HTBA
- MEDR 999 01 (CRN TBA) [Clinical Clerkships](#) Staff 2 HTBA
Suggested courses for incoming 1st years (please do not register until after you meet with Drs. Kazmierczak and Gorelick at the Annual Program meeting): September 4th:

MEDC 999 01 (13318) Courses in School of Medicine Staff 2 HTBA (1st and 2nd years)
CBIO 502 01 (12298) Molecules to Systems Peter Takizawa, 3 HTBA
CBIO 601 01 (12299) Mol&CelBasisOfHumanDisease Fred Gorelick, James Jamieson M 4.00-5.30
MB&B 800 01 (12818) Adv Topics Molecular Medicine Susan Baserga, Konigsberg M 11.00-1.00

(Please Note: you must also let Leigh Cromley know that you want to take the advanced class).

NSCI 501 01 (CRN TBA) Principles of Neuroscience DiLeone, Louvi WF 3.15-4.45 (for those interested in Neuroscience)

B&BS 501: Responsible Conduct of Research: You will register for this in the Spring, however, there is ONE session in the Fall. September 8th; 9 a.m.

“The Cellular and Molecular Basis of Human Disease” is a graduate requirement for MD-PhD students and an elective for regular medical students. The course emphasizes the connections between basic science and human physiology as well as diseases and uses lecture and seminar formats. It is designed for students who are committed to considering a career in medical research or students who wish to explore scientific topics in depth. This course parallels the content of the Master Courses in the first and second years of medical school. Topics are often introduced with a short lecture given by eminent faculty who provide excellent role models for your academic careers. The lecture is followed by sessions in which 2 students review relevant manuscripts under the mentorship of a faculty mentor and present the material to the group. Students in the class are encouraged to submit questions to the presenters beforehand concerning techniques and concepts that may not be clear from the papers and which will be addressed during the presentation. In addition, sessions also discuss selection of research topics and obstacles to publishing findings and securing research funding. Student evaluations are based on attendance, participation in group discussions, and formal presentations. The course runs from October to mid-April and provides graduate credit. The organizational meeting and introduction will be on September 13th at 5 pm (room number to be announced). The class will meet on most Thursdays until mid-April from 5-6:30 and provide graduate credit for those who need it. F. Gorelick, J.D. Jamieson, George Lister, Karin Finberg, and Jonathan Bogan are organizers. Alice Lu and Laura Yockey are MD-PhD students and will be our TAs first and second semester, respectively.

NBIO 701 [01]/NSCI 701 [01], Principles of Neuroscience Ralph DiLeone, Angeliki Louvi
General neuroscience seminar: lectures, readings, and discussion of selected topics in neuroscience. Emphasis is on how approaches at the molecular, cellular, physiological, and organismal levels can lead to understanding of neuronal and brain function. WF 3:15–4:45

PATH 650 [02], Cellular and Molecular Biology of Cancer David Stern, Qin Yan
A comprehensive survey of cancer research from the cellular to the clinical level. The relation of cancer to intracellular and intercellular regulation of cell proliferation is emphasized, as are animal models for cancer research. Background in molecular genetics and cell biology is assumed. Open to advanced undergraduates with permission of the organizers. MWF 1–2

PATH 690 [01], Molecular Mechanisms of Disease Narendra Wajapeyee, Demetrios Braddock.
This course covers aspects of the fundamental molecular and cellular mechanisms underlying various human diseases. Many of the disorders discussed represent major forms of infectious, degenerative, vascular, neoplastic, and inflammatory disease. Additionally, certain rarer diseases that illustrate good models for investigation and/or
application of basic biologic principles are covered in the course. The objective is to highlight advances in experimental and molecular medicine as they relate to understanding the pathogenesis of disease and the formulation of therapies. T, TH 2-3:30

**MB&B 800 [01], Advanced Topics in Molecular Medicine** Susan Baserga, William Konigsberg.
The seminar, which covers topics in the molecular mechanisms of disease, illustrates timely issues in areas such as protein chemistry and enzymology, intermediary metabolism, nucleic acid biochemistry, gene expression, and virology. M.D. and M.D./Ph.D. students only. Prerequisite: biochemistry (may be taken concurrently). M 11–1

**NSCI 510b/NB 500b, Structural and Functional Organization of the Human Nervous System** Charles Greer, Michael Schwartz
An integrative overview of the structure and function of the human brain pertaining to major neurological and psychiatric disorders. Neuroanatomy, neurophysiology, and clinical correlations are interrelated to provide essential background in the neurosciences. Lectures in neurocytology and neuroanatomy survey neuronal organization in the human brain, with emphasis on long fiber tracts related to clinical neurology. Two-hour laboratory sections in close collaboration with faculty members. Lectures in neurophysiology cover various aspects of neural function at the cellular level, with a strong emphasis on the mammalian nervous system. Clinical correlations consist of regular sessions given by one or two faculty members representing both basic and clinical sciences. These sessions relate neurological symptoms to cellular processes in various diseases of the brain. Variable class schedule; contact course instructor. Registration for this course is by permission of the instructor.

**STAT 645 [02], Statistical Methods in Genetics and Bioinformatics** Hongyu Zhao
Introduction to problems, algorithms, and data analysis approaches in computational biology and bioinformatics; stochastic modeling and statistical methods applied to problems such as mapping disease-associated genes, analyzing gene expression microarray data, sequence alignment, and SNP analysis. Statistical methods include maximum likelihood, EM, Bayesian inference, Markov chain Monte Carlo, and some methods of classification and clustering; models include hidden Markov models, Bayesian networks, and the coalescent. The limitations of current models, and the future opportunities for model building, are critically addressed. **Prerequisite:** STAT 538a, 542b, or 661a. Prior knowledge of biology is not required, but some interest in the subject and a willingness to carry out calculations using R is assumed. Th 1-2:50

**CB&B 740 [01], Clinical and Translational Informatics** Richard Shiffman, Michael Krauthammer
The course provides an introduction to clinical and translational informatics. Topics include (1) overview of biomedical informatics, (2) design, function, and evaluation of clinical information systems, (3) clinical decision making and practice guidelines, (4) clinical decision support systems, (5) informatics support of clinical research, (6) privacy and confidentiality of clinical data, (7) standards, (8) issues in defining the clinical phenotype, and (9) topics in translational bioinformatics. Permission of the instructor required.

**CB&B 752 [01]/CPSC 752au/MB&B 752au/MCDB 752au, Bioinformatics: Practical Application of Simulation and Data Mining** Mark Gerstein
Bioinformatics encompasses the analysis of gene sequences, macromolecular structures, and functional genomics data on a large scale. It represents a major practical application for modern techniques in data mining and simulation. Specific topics to be covered include sequence alignment, large-scale processing, next-generation sequencing data, comparative genomics, phylogenetics, biological database design, geometric analysis of protein structure, molecular-dynamics simulation, biological networks, normalization of microarray data, mining of functional genomics data sets, and machine learning approaches for data integration. **Prerequisites:** biochemistry and calculus, or permission of the instructor. MW 1–2:15
MD-PhD Student Seminars

Research in Progress. These seminars, which are held from 5:00-6:30pm, provide a forum for students engaged in dissertation research to present their work to MD-PhD students and faculty. All students in their research years are required to prepare a 12-minute research talk, which is followed by ample time for questions and discussion. Pizza and beverages are provided.

The RIP seminars are important for students at all stages of their training, and attendance is expected. Our goals for the seminars include:

- Create a setting in which students can improve their presentation skills.
- Provide a forum for discussion and feedback from a multidisciplinary audience of peers and program faculty.
- Serve as an opportunity for 1st, 2nd and 3rd year students to learn about mentors and research opportunities at Yale University.
- Improve networking among all MD-PhD classes.
- Provide an opportunity for informal discussion and socializing between students, program faculty and research mentors.

RIP Dates during ’16-17: Sept. 19; Oct. 10; Nov. 14; Dec. 5; Jan. 17; Feb. 20; Mar. 6; Apr. 3

Responsible Conduct of Research

The Office of Student Research and the MD/PhD Program co-sponsor a compact ethics course that satisfies the NIH requirements for students supported on training grants. In addition to subject matter requirements, it is essential that accurate attendance records are maintained for each grant. The course will be perceived as an elective, but in essence is mandatory for all students supported by training grant or other sources. First-year MD/PhDs and medical students matriculating into the MD/PhD Program in their initial year must take this course. A “refresher” must also be taken once the student has completed 4 years in the MD/PhD Program.

The course is held in six (6) 1.5 hour sessions during the Spring 2017 semester, and will be held in Hope 110. The course format is lecture with group discussion and case studies. In addition to being listed as a medical school course, it is also co-listed with the Graduate School to ensure application to the transcripts of the MD/PhD students (B&BS 501). The topics to be covered and corresponding dates are:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Faculty Member(s)</th>
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<tbody>
<tr>
<td>Mentor/Mentee Responsibilities and Relationships</td>
<td>Dr. Michael Caplan</td>
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<td>Conflict of Interest</td>
<td>Dr. Stephanie Spangler</td>
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<td>And Research Misconduct and Policies for Handling Misconduct</td>
<td>Dr. Lawrence Cohen, Ms. Merle Waxman</td>
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<tr>
<td>Peer Review</td>
<td>Dr. Fred Gorelick</td>
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<td>And Responsible Authorship and Publications</td>
<td>Dr. Marina Picciotto</td>
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<td>Data Acquisition and Laboratory Tools, Management,</td>
<td>Dr. David Schatz</td>
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<td>Sharing and Ownership</td>
<td>Dr. David Lewin</td>
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<td>And Collaborative Research Including Collaborations</td>
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<tr>
<td>With Industry</td>
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<tr>
<td>Policies Regarding Human Subjects</td>
<td>Dr. Sandra Alfano</td>
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MD-PhD Students and Clerkship Requirements

All MD-PhD students complete the same clerkships requirements as MD students. The only difference is timing of the completion of these requirements. MD and MD-PhD students will complete these requirements at different times during their medical school enrollment.

- MD/PhD students must complete 6 months of clerkships prior to beginning their thesis work. Any exception to this policy will have to be authorized by Dr. Kazmierczak after consulting with Dr. Taddei and conveyed to Cheryl. The clinical exposure, which is provided by the 6 months of clinical rotations, will facilitate the student’s ability to integrate basic science with clinical medicine.

- In order to pursue any clerkships, students are required to complete the 1 ½ week “Tran-si-tion.” For those students taking the 6 months of clinical rotations prior to starting their thesis work, “Tran-si-tion” is completed during June of that year, immediately after finishing the second year of medical school.

- Each MD/PhD student must take Step I before beginning clinical rotations and before beginning research. Step I must be taken by December 31st of the 3rd year of medical school.

If an MD-PhD student is interested in completing the third year of medical school before beginning the Ph.D. work, special permission must be obtained from Dr. Kazmierczak and conveyed to Cheryl. This exception will generally pertain to students whose Ph.D. programs require that they attend classes that are only offered in the fall semester (i.e. students affiliating in EPH).

Only in extraordinary circumstances are students allowed to break up their thesis work with clinical rotations. The MD-PhD Program does not encourage its students to begin their thesis work at the end of the first year of medical school because they will not have had a chance to do rotations between the 1st and 2nd year, which is important in deciding upon a mentor and a Ph.D. project. In addition, there are clinical programs that require continuity between the 1st and 2nd year.

Summary Points:
- All students must complete 6 months of clerkships prior to beginning their thesis work.
- Tran-si-tion must be completed before beginning clerkships
- Step I of the Boards must be taken prior to beginning clinical rotations and before beginning research. The deadline for taking Step I is December 31st of the 3rd year of medical school.

Tran-si-tion: The Clerkship Years

n 1. Passage from one form, state, style, or place to another.

At the end of Year 2, two weeks before you are about to start a whole new experience in your medical education, we offer a mandatory orientation called, Tran-si-tion.
As you will come to discover there are many requirements for working at YNHH, the VA-WH and Bridgeport hospitals that all faculty and residents go through prior to being able to work with patients, such as EPIC (EMR) Training, ACLS, background checks/fingerprinting, Infection Control, Healthcare Respiratory Fit Testing, HIPAA, and OR scrub training. In addition, to these activities, we have other Yale School of Medicine requirements, skills training sessions, opportunities to learn more about the clerkships, professionalism expectations, information about mandatory knowledge exams during the clerkships, the importance of self-care, and opportunities to hear from upper classmen to ask questions and get an “insiders” view.

Going from the classroom to actually seeing patients is definitely a rite of passage. We hope that these activities will help you prepare for this change in a positive way.

**Tran-si-tion and Clinical Rotation Dates**
Orientation to the Wards - Dates: 06/13/2016 – 06/19/2016

Attendance is **mandatory** for students beginning clerkships in the 2016-17 Academic Year
All students must participate in sessions and activities

Tran-si-tion Contact: Susan Larkin, Assoc., Dir., Office of Education
Tel. (203) 737-1984; susan.larkin@yale.edu

**Third Year Clerkship Rotation Dates**
Four, 12 Week Blocks

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<thead>
<tr>
<th>Block 1</th>
<th>06/20/2016 – 09/09/2016</th>
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<tbody>
<tr>
<td>Block 2</td>
<td>09/12/2016 – 12/02/2016</td>
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<tr>
<td>Winter Break:</td>
<td>12/03/2016 – 01/01/2017</td>
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<tr>
<td>Block 3</td>
<td>01/02/2017 – 03/24/2017</td>
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<tr>
<td>Block 4</td>
<td>03/27/2017 – 06/16/2017</td>
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- Each 12 week block starts on a Monday and ends on a Friday
- On the first day of each clerkship, students will participate in a shared Precede
  On Days 2-3, students participate in a discipline specific Precede

**CLERKSHIP & COURSE CONTACTS**

<table>
<thead>
<tr>
<th>Medical Approach to the Patient</th>
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<tr>
<td><strong>Clinical Neurology Clinical Component</strong></td>
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<tr>
<td>Dr. Daniel DiCapua, Clerkship Director</td>
</tr>
<tr>
<td>Donna Cartwright, Clerkship Coordinator</td>
</tr>
<tr>
<td><a href="mailto:donna.cartwright@yale.edu">donna.cartwright@yale.edu</a></td>
</tr>
<tr>
<td>Tel: 203-737-1860</td>
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<tr>
<td>Fax: 203-785-6246</td>
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<tr>
<td>LLCI 9, Room 910</td>
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<tr>
<th>Primary Care &amp; Psychiatry Clerkship</th>
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<tr>
<td><strong>Primary Care Clinical Component</strong></td>
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</tbody>
</table>
### Surgical Approach to the Patient Clerkship

**Emergency Medicine Clinical Component**
- Dr. Lisa Hile, Clerkship Director
- Dr. Alison Hayward, Associate Clerkship Director
- Rebecca Sullivan, Clerkship Coordinator
  - Email: [rebecca.sullivan@yale.edu](mailto:rebecca.sullivan@yale.edu)
- Tel: 203-737-2489 / Fax: 203-785-4580
- 464 Congress Ave

**Surgery Clinical Component**
- Dr. Anthony Kim, Clerkship Director
- Dr. Glenda Callender, Associate Clerkship Director
- Nelida Bonilla, Clerkship Coordinator
  - Email: [nelida.rodriguez@yale.edu](mailto:nelida.rodriguez@yale.edu)
- Tel: 203-737-4366 / Fax: 203-737-5209
- FMB 107

### Women & Children's Health Clerkship

**Obstetrics and Gynecology Clinical Component**
- Dr. Shefali Pathy, Clerkship Director
- Dr. Vrunda Desai, Associate Clerkship Director
- Dr. Crina Boeras, Assoc Clkshp Dir (Bridpt Hosp)
- Janice Crabtree, Clerkship Coordinator
  - Email: [janice.crabtree@yale.edu](mailto:janice.crabtree@yale.edu)
- Tel: 203-785-4212
- Fax: 203-785-6586
- FMB 307

**Pediatrics Clinical Component**
- Dr. Eve Colson, Co-Clerkship Director
- Dr. David Hersh, Co-Clerkship Director
- Gina Franco, Clerkship Coordinator
  - Email: [gina.franco@yale.edu](mailto:gina.franco@yale.edu)
- Tel: 203-785-6935
- Fax: 203-737-2461
- LMP 5039

### 4th Year Clinical Elective/Sub-I and ICM Course

**YSM Clinical Experience**
- Office of Student Affairs
- Contact: Jack LeConche, Dir. of Student Affairs
  - Email: [NESI@yale.edu](mailto:NESI@yale.edu)
  - Tel: Jack 203-737-7027
  - Fax: 203-737-5495
  - ESH Second Floor

**Integrated Clinical Medicine (ICM) Course**
- Dr. David Rosenthal, Course Director
- Leigh Cromey, Course Coordinator
  - Tel: 203-737-4191
  - Fax: 203-737-4199
- ESH 305A

### REQUIRED CLERKSHIP DESCRIPTIONS

**Medical Approach to the Patient**

**Clinical Neurology Clinical Component:**
- Clerkship Director: Dr. Daniel DiCapua
- Clerkship Coordinator: Ms. Donna Cartwright
This clerkship is a 4 week rotation; offering 2 week blocks of time in various neurology services. This clerkship must be completed at an assigned YSM site and cannot be completed at an external site.

- The clerkship coordinator will email a preference form to students with service descriptions to choose from. To achieve a well-balanced rotation students may choose a combination rotation of 2 weeks on a primary service and 2 weeks on a specialties service or 2 primary services.

- For the combination rotation the student will choose one service in the Primary category (Stroke, Ward, Consult, Clinic, or VA) and one service in the Specialties category (Neurology ICU or Pediatric Neurology). For example a student may choose two weeks on the Ward service and two weeks on Neurology ICU.

- Please note the VA Medical Center is a combination of mainly outpatient services and a smaller inpatient service.

- The Neurology Clerkship is designed to provide all students with a core of fundamental procedural and analytical skills in Clinical Neurology. The 4 weeks of clinical service blocks will further amplify the acquisition of these skills through specific clinical experiences and a neurology core lecture series.

**Internal Medicine Clinical Component:**

**Clerkship Director:** Dr. Dana Dunne  
**Clerkship Coordinator:** Ms. Kathleen Bertier

Internal Medicine I & II are each four-week rotations. The 8 weeks will typically be assigned to be taken as a continuous experience, although some students will be assigned to do the 4-week Clinical Neurology component in between the two 4-week blocks.

- This clerkship must be completed at an assigned YSM or YSM affiliated site and cannot be completed at an external site.

- Either Internal Medicine I or Internal Medicine II must be completed at Y-NHH York Street Firms; the other rotation can be completed at another firm like the VAMC, St Raphael (Yale’s Chapel St campus), or Bridgeport Hospital.

- The clerkship coordinator will email preference forms for choosing Med I and II firms approximately one month in advance of the start date of the rotation.

- The entire medicine clerkship MUST be completed by the end of the third year in order to schedule a Medicine Sub-I in your fourth year.

- On Internal Medicine I, students will interview and examine patients, write admission and progress notes, give a presentation, complete a Med I Student Portfolio and work with medical teams in the care of patients.

- On Internal Medicine II, students will receive increasingly more responsibility for patient care, the number of admissions, progress notes and presentations, complete a Knowledge Assessment Exam and submit a Med II Student Portfolio.

- Conferences and teaching rounds are held daily. In addition to teaching sessions about core IM curricular topics, students will receive a longitudinal curriculum in radiology, ECG interpretation, and will have numerous opportunities to practice clinical reasoning skills.
Primary Care & Psychiatry Clerkship
The students in the primary care-psychiatry clerkship will participate in an integrated clerkship orientation and combined classroom curriculum covering essential topics in both primary care and psychiatry, as well as at their interface.

Clerkship Director: Dr. Walter Kernan
Associate Director for Internal Medicine: Dr. Peter Ellis
Associate Director for Pediatrics: Dr. Ada Fenick
Clerkship Coordinator: Ms. La Quanda Evans

The primary care clinical component comprises 6 weeks of instruction. Most students will be placed in two sites for the full 6 weeks. These students will spend part of each week (4-6 half-days) in an adult primary care site and the balance of their time each week (2-4 half-days) in a pediatric site. Some students will be placed full time in an adult primary care site for 4 weeks, preceded or followed by 2 weeks full time in a pediatric site. Practice sites may specialize in family medicine, general internal medicine, or general pediatrics. Currently, all participating practices are in Southern Connecticut. Students will not be placed at sites that do not have an existing relationship with the clerkship, although this may change later in the 2016-2017 academic year when the clerkship will need extra teaching sites to accommodate extra students. The clinical curriculum features active participation by student in the care of patients. Under the supervision of experienced, board-certified physicians, students will interview and examine patients, develop differential diagnoses, present to preceptors, counsel patients, write visit notes, and complete any necessary post-visit communication with their patients. Students will have increasing responsibility in patient care commensurate with their experience and capability. In addition to direct patient care, students will receive regular patient-based feedback and instruction from their preceptors to assure maximum growth in all key domains of professional competence including clinical knowledge, patients care skills, and professional responsibility. One of the core learning objectives of the integrated clerkship is for students to acquire the capacity to critically appraise practice design and care delivery in primary care. Through classroom activities and practical experience students will continually build upon this capacity.

• The clerkship coordinator will email preference forms approximately 4-6 weeks in advance of the student’s start date for site selection.

• This clerkship has a “selective” option to complete the 6-wk Primary Care Dermatology Selective.

Psychiatry Clinical Component:
Clerkship Director: Dr. Kirsten Wilkins
Associate Clerkship Director: Dr. Andres Barkil-Oteo
Clerkship Coordinator: Ms. Jennifer Dolan-Auten

The psychiatry component of the primary care-psychiatry integrated clerkship includes: • Three weeks of full-time inpatient psychiatry
• Three weeks of full-time consultation or emergency psychiatry
• Six half-days in an ambulatory setting
• This clerkship cannot be done away.

• Students will have the opportunity to complete the rotation at the inpatient and research units at the Connecticut Mental Health Center; inpatient, consult service, and/or emergency room service at the Yale New Haven-Hospital York Street and St. Raphael’s campuses; the inpatient, consult service, and/or emergency room service at the VA
CT Healthcare System; the Child Study Center’s Inpatient Child Unit (Winchester One); Middlesex Hospital; Bridgeport Hospital; and Norwalk Hospital. The ambulatory component of the clerkship includes a rotation at one of a variety of outpatient community and VA psychiatric clinics.

- During this clerkship, students will learn interview and mental status examination skills in order to identify psychiatric symptoms and make a differential diagnosis. Students will participate in biopsychosocial evaluation and treatment planning in collaboration with patients, families, and multidisciplinary treatment teams.

- Clinical preceptors will enable students to have an active part in patient evaluation and treatment commensurate with each student's experience and capability.

**Surgical Approach to the Patient Clerkship**

*Surgery Clinical Component:*

- Clerkship Director: Dr. Anthony Kim
- Associate Clerkship Director: Dr. Glenda Callender
- Clerkship Coordinator: Ms. Nelida Bonilla

*Emergency Medicine Clinical Component:*

- Clerkship Director: Dr. Lisa Hile
- Associate Clerkship Director: Dr. Alison Hayward
- Clerkship Coordinator: Ms. Rebecca Sullivan

- The 12 week Clerkship Block will include 6 weeks of General Surgery, 3 weeks of Emergency Medicine, and 3 weeks of Surgical Subspecialties.

- This clerkship is scheduled by Surgery Clinical Component Coordinator.

- Students will have an opportunity to complete a preference form for site assignments but will not be guaranteed a specific assignment, nor will they be able to indicate which rotation will be done first; this is determined by the clerkship administration based on space availability.

- The 6 week General Surgery Core Rotation can be completed at YNHH-York St. Campus, YNHH-St. Raphael Campus, the West Haven VAMC, or Bridgeport Hospital (Service preferences include: Endocrine, Pediatric Surgery, Plastic Surgery, Thoracic Surgery, GI Surgery-Colorectal, GI Surgery-Minimally Invasive Surgery (MIS), Oncology Surgery, Trauma/Emergency Surgery, or VAMC Surgery).

- On the Surgical Subspecialty rotations, students may select subspecialty services which are completed at YNHH. (Service preferences include: Anesthesiology, Cardiac, Interventional Radiology, Orthopedic, Otolaryngology (ENT), Peripheral Vascular, Transplant, and Urology).

- This clerkship has a “Selective” option to complete the 4-week Surgery Ophthalmology Selective, the 3-week Urology Selective or the 3-week Orthopaedic Surgery Selective during the surgical subspecialty rotation.

- Students will participate in a faculty mentoring program throughout the 12 week block.

- This clerkship must be completed at an assigned YSM site and cannot be completed at an external site.

- This clerkship must be completed by the end of the third year
**Women’s & Children's Health Clerkship**
The 12 week Clerkship Block will include 4 weeks of OB/Gyn inpatient, 4 weeks of Pediatric inpatient, and 4 weeks of combined Ob/Gyn & Pediatric Outpatient.

**Obstetrics and Gynecology Clinical Component:**
Clerkship Director: Dr. Shefali Pathy  
Associate Clerkship Director: Dr. Vrunda Desai  
Associate Clerkship Director: Dr. Crina Boeras (Bridgeport Hospital)  
Clerkship Coordinator: Ms. Janice Crabtree

For the Ob/Gyn clinical component, students will spend 6 weeks at either Bridgeport Hospital or Yale New Haven Hospital. Time will be spent on each of three services: Obstetrics, Gynecology, and an outpatient clinic.

- A series of lectures, conferences, and workshops will cover topics in Obstetrics, Reproductive Endocrinology, Gynecologic Oncology, Maternal-Fetal Medicine, and Gynecology. Over the 12 weeks there will be meetings of all participants in the clerkship for shared didactics and activities pertaining to both women’s and children’s health.

- All students will attend an evening session with the Gynecologic Teaching Associates. This is held in the beginning of the rotation to refresh students’ pelvic and breast examination techniques.

- Assignments will be made on a lottery basis with consideration for past assignments at distant sites. The site assignments will be sent via email to the student approximately one to two weeks prior to rotation start date. No switches will be made.

- This clerkship must be completed at an assigned YSM site and cannot be completed at an external site.

**Pediatrics Clinical Component:**
Co-Clerkship Director: Dr. Eve Colson  
Co-Clerkship Director: Dr. David Hersh  
Clerkship Coordinator: Ms. Gina Franco

The 6 week Pediatric Clerkship Block is split between 3 weeks on an inpatient team (General Pediatrics – YNH & Bridgeport Hospitals, Hematology/Oncology, PICU, and Newborn ICU) and 3 weeks working with a medical or surgical subspecialty service in both inpatient and outpatient settings. Students are given an opportunity to submit a ranked preference list prior to assignments to clinical teams. Preferences will be taken into consideration when placing students, but schedule will be based on site availability.

- The Bridgeport Hospital general pediatrics rotation includes experiences in their Newborn ICU and their inpatient unit.
- Please note that all medical students will complete 2 weeks of outpatient Pediatric primary care during the Primary Care Clerkship.
- The Pediatrics component of the clerkship cannot be done at an away site.

(For M.D./Ph.D. students only: They have the option of completing the outpatient rotation at a longitudinal clinic at an approved site. This option must be arranged in advance with permission of the Clerkship Director.)

**Timing of Re-entry:** Discussions with Directors of Graduate Studies of graduate programs have led to the general agreement amongst programs that MD-PhD students will be allowed to resume their final clerkship requirements for the M.D. provided they have written and defended their thesis. They do not necessarily have to
have had it submitted to the Graduate School in final form since the fine-tuning can easily be done during breaks in the clerkship.

- We no longer allow MD-PhD students to finish the M.D. without defending their thesis since experience has shown that this sequence almost inevitably means the Ph.D. will not be completed.
- The MD/PhD Program has determined that after a prolonged absence, i.e. one year or longer, the student must engage in a “warm-up” period. Please see page 19 of the Handbook concerning re-entry.

**MD-PhD Student Teaching Requirements.** The Teaching Fellow Program is the principal framework at Yale in which graduate students learn to become effective teachers. Learning to teach and to evaluate student work is fundamental to the education of graduate students. The Graduate School requires that all students who teach be in good academic standing.

The majority of graduate programs that MD-PhD students affiliate with for the completion of their PhD require the successful completion of one or more Teaching Fellow (TF) assignments (described below) as a degree requirement. Since each department or program defines its own teaching requirement (both the TF level and the number of terms or TF units required), you must check with the DGS in the department in which you affiliate to review that program’s teaching requirements. In addition you should consult with your DGS about the timing of any required TF assignment within your doctoral studies and get recommendations of courses that would be appropriate to satisfy the TF requirements.

- MD/PhD students must pass the Qualifying Exam prior to teaching.
- You may not perform “optional” teaching to gain additional experience and earn additional income until your teaching requirement is completed.

**Please inform Cheryl if you are teaching, and provide the following information:** 1) if the teaching is for requirement (Priority Teaching) or if you have already satisfied your teaching requirement; 2) the department for which you are teaching; 3) the contact name within the department; 4) the teaching level; 5) the name of the course; and 6) the course registration number (CRN), if known.

During any semester in which you are fulfilling your program’s teaching requirement, a portion of your standard departmental stipend will be provided by the Teaching Fellow Program. You may note that while serving as a TF, that portion of your paycheck provided by Teaching Fellow Program will be subject to IRS tax withholding. Thus, your net stipend disbursement will be different than your standard stipend. Please check the following web site for information concerning withholding and taxes: http://www.yale.edu/graduateschool/financial/taxes.html

Changes have been made to the Teaching Levels – there are two types: TF10 - $4,000 per semester; and TF20 - $8,000 per semester.

If you decide to serve as a TF after completing your required teaching, you will be paid above your standard stipend according to the level of the TF assignment as described below.

- If you are engaged in teaching, as a full-time student, you are permitted to work up to a maximum of 10 hours per week. Compensation for any teaching must be scheduled and payments made through the MD/PhD Office.

**Summary Points:**
- Students must be affiliated with a Ph.D. department in order to teach
- Each PhD department defines its own teaching requirements; meet with the DGS
- Money earned from teaching is subject to tax withholding
• You may not perform “optional” teaching to gain additional experience and earn additional income until your teaching requirement is completed

• Information on the semester in which you will teach, the course, and TF level should be provided to Cheryl as soon as you have confirmed you will be teaching.

Typically, students are able to choose among many teaching opportunities including courses offered through the School of Medicine, Yale College or the Graduate School.

Teaching Fellow Levels and Descriptions

Grader without Contact. Such graders normally grade exams and homework but do not hold office hours, discussion sections or help sessions. These are the only assignments that do not require the teaching fellow to have met the English proficiency requirement.

Grader/Tutor. Students serving in these positions may undertake a wide variety of activities. They may grade exams, papers, homework, or problem sets and meet with students for office hours and help sessions. They may also work with students in language and other classes as tutors who supplement the daily in-class meetings. Again, the type of tutoring varies according to the discipline in which it takes place.

Discussion Section Leader. Students across the disciplines lead one or two discussion sections for lecture classes per week. Discussion section leaders are expected to meet with the faculty leading the course once per week, and may attend lectures, grade papers, homework, problem sets and exams, and hold office hours. Sections may not normally exceed 18 students but in practice, many sections have enrollments of 15 or fewer students.

Lab Leader. Lab assignments occur most frequently in the sciences. Such teaching fellows may run lab sections for lecture classes. Lab leaders are expected to meet with the faculty leading the course once per week and may attend lectures, and grade papers, homework, problem sets and exams. Lab sizes vary widely depending on the discipline.

Part-time Acting Instructor (PTAI). PTAIs conduct sections of introductory courses or advanced seminars, normally seminars in their special fields. All PTAIs are supervised by faculty. In the case of multi-section introductory courses, the supervision often includes the use of a common syllabus and examinations. PTAI assignments may be made only at the TF20 level

Again, each student should consult with the DGS to determine which courses are acceptable for fulfilling their teaching requirements prior to accepting a TF position. This is important because teaching is an essential component of your academic training and will be part of your CV when looking for positions in the future. Should you have additional questions, you may also contact Howard El-Yasin, Assistant Director, Teaching Fellows Program (203) 432-2757 (howard.el-yasin@yale.edu).

The MD/PhD Thesis Requirement

The thesis you prepare, defend, and submit for the PhD Department in which you have affiliated will also satisfy the Yale School of Medicine’s MD thesis requirement. However, graduating MD/PhD students should ideally have their PhD thesis submitted no later than the Graduate School’s December deadline in order to avoid having to submit a separate MD thesis. If you miss the December deadline of your graduation year, and it is unlikely you will meet the March deadline of your graduating year, the following MD thesis requirements, overseen by the Office of Student Research, will apply:

“The Thesis Committee in conjunction with the Dean's Office has established the following deadlines for theses submitted in partial fulfillment of the requirements for graduation in May 2017. The deadlines insure that (1) students have all possible available time to complete their theses; (2) that there is sufficient time for departmental review and subsequent revision by
students before final approval. **These deadlines are rigidly adhered to without exception to maintain the integrity of the thesis requirement.**

<table>
<thead>
<tr>
<th>The deadlines are:</th>
<th>2017 Approved Deadlines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft presented to thesis advisor</td>
<td>January 6, 2017</td>
</tr>
<tr>
<td>Final draft submitted to Departmental Thesis Committee for approval (with approval letter from faculty advisor)</td>
<td>February 3, 2017</td>
</tr>
<tr>
<td>Submission of approved, bound thesis to the Office of Student Research</td>
<td>March 3, 2017</td>
</tr>
</tbody>
</table>

**The Future: Graduation Finally!**

The majority of MD-PhD students will obtain both their MD and PhD degrees on the same date in May of the year they will graduate. The PhD thesis satisfies the MD thesis requirement of Yale School of Medicine, but make sure you get it bound and submitted on the deadlines set by Dr. John Forrest and the Office of Student Research. This is clearly no problem for MD-PhD students who opt to get their PhD degrees before their MD degrees. However, occasionally an MD-PhD student may elect to receive the MD degree before the PhD degree. In this case, students must submit an MD thesis in order to receive the MD. This usually entails extracting sufficient material from what will become the PhD thesis to produce a bound MD thesis that must be submitted and reviewed at the deadlines set for submission of all MD theses. Again, Dr. Forrest’s office has that information.

**Course Requirements for Individual Graduate Programs**

**Biomedical Engineering (BME)**

**Director of Graduate Studies: Richard E. Carson**

The Qualification Procedure (QP) for a Ph.D. in Engineering and Applied Science (ENAS) are described in detail at http://seas.yale.edu/i-am/current-student/forms-and-guides and summarized briefly here. For clarifications, please contact the Engineering Registrar, Ms. Cara Gibilisco at cara.gibilisco@yale.edu.

**Course Requirements (8):** In Biomedical Engineering, the 5 core courses are: 2 semesters of Special Investigations (see below), Physiological Systems (ENAS 550a), Physical and Chemical Basis of Sensing and Imaging (ENAS 510a), and Advanced Engineering Mathematics (ENAS 549a, 505a, or 500a); M.D./Ph.D. students can substitute a more advanced physiology course for ENAS 550a. Of the remaining three courses, one must be in engineering or a closely related field. Students must obtain a grade of Honors in any two of these courses (excluding the Special Investigations) and maintain an average of High Pass. Courses must be completed in the first two years of the combined program. In the case of students accepted into the MD/PhD Program during their first year of medical school, a letter from the faculty member in charge of the first-year course indicating the grade achieved in the course is required and an official transcript from the Medical School must be submitted to the Graduate School.

**Special Investigations:** Like other PhD students, 2 semesters of Special Investigations are required. All students are expected to present their Special Investigation work at a Department Symposium held on the last day of Reading Period.

**Qualifying Exam:** There are no qualifying exams in ENAS.
**Teaching Requirements:** In Year 2 of graduate study, each MD/PhD student is required to hold one 10 hour TF position.

**Thesis Prospectus, Area Exam and Admission to Candidacy:** MD/PhD students must complete and submit their thesis prospectus by the end of the fifth semester as an affiliated graduate student. Thus, if the student affiliates at the customary point of year 3.5, they must submit the approved prospectus before the end of the spring semester of the fifth year (at the beginning of year 3 as an affiliated graduate student). After submitting the prospectus, students present their results to date and their proposed research to their thesis committee in an Area Exam. Students are given two opportunities to pass this exam. Passing the Area Exam is the final requirement for admission to candidacy in the Graduate School.

**Other requirements:**
All graduate students who are admitted to candidacy are required to have an annual Thesis Committee meeting. BME Seminars are held on Thursdays at 4pm. Attendance at these seminars for graduate students is mandatory. In the first year after admission to candidacy, students are expected to present their research work at a BME seminar.

**Cell Biology**
**Director of Graduate Studies:** Karin Reinisch

**Required Courses (5):** MD/PhD students are required to take for a grade a total of 5 graduate-level courses, including Molecules to Systems (CBIO 502), Molecular Cell Biology (CBIO 602), and a seminar course that involves the reading and class discussion of research papers. The remaining courses can be in areas such as Genetics, Neuro-biology, Immunology, Microbiology, Pharmacology, and Physiology. Students must meet the Graduate School requirement of a grade of Honors in two courses, if necessary taking additional courses beyond the five required in the department to fulfill this requirement. Students must also maintain an average grade of High Pass in all courses.

**Teaching Requirement:** One term of teaching.

**Qualifying exam:** The qualifying exam consists of 1) a written research proposal based on the prospective thesis project and 2) an oral exam in which the student defends the research proposal before a qualifying exam committee. The qualifying exam must be taken within one year of joining the PhD program. The qualifying exam committee consists of 3 faculty members, with at least one having a primary or secondary appointment in Cell Biology. This committee becomes the student’s thesis committee. The members of the committee are chosen by the student in consultation with the thesis advisor and with approval from the DGS. For further information, please see the Cell Biology Graduate Student Handbook, which can be found on the Cell Biology Department website: [http://www.cellbiology.yale.edu/graduate/](http://www.cellbiology.yale.edu/graduate/)

**Cellular & Molecular Physiology**
**Director of Graduate Studies:** David Zenisek

**Required Courses:** Students must pass at least three graduate-level courses in addition to the courses that are part of the Yale Medical School M.D Program.

**Mandated: One C&MP Course that is not part of the Yale Medical School M.D Program.** Preferably C&MP 560b, Cellular and Molecular Physiology: Molecular Machines in Human Disease
Plus two elective graduate-level courses outside the regular Yale medical school M.D. curriculum, subject to approval by the DGS.

Two grades of Honors: Graduate courses that are part of the Yale Medical School M.D. Program and taken for a grade may be counted towards the Honors fulfillment.

Teaching Requirement: One semester of teaching.

Two rotations in two different laboratories over one summer. Each rotation should last five weeks.

Chemistry (2015)
Director of Graduate Studies: Patrick Holland

Each sub-discipline has specific course recommendations as outlined below. In some cases, recommended courses are not offered every year, and one should take advantage of the course when it is offered. The course requirements have been designed for students with a primary interest in some form of preparative chemistry or in physical/biophysical chemistry. The physical chemistry course curriculum is slightly different for those interested in biophysical chemistry than for those interested in physical chemistry or chemical physics, and the preparative chemistry curriculum is slightly different for those interested in organic chemistry, chemical biology, or inorganic chemistry.

Note: In addition to the required courses for each sub-discipline, a course in the responsible conduct of research is also required (Chem 590a “Ethical Conduct and Scientific Research”). For MD/PhD Students, the Responsible Conduct of Research Course (BB&S 501) will satisfy this requirement.

Preparative Chemistry Course Requirements:
A student who will be conducting research in areas of preparative chemistry, such as coordination chemistry, bioinorganic chemistry, chemical biology, synthetic organic chemistry, physical organic chemistry, organometallic chemistry, materials synthesis, or catalysis, must complete six credits during the first three semesters. These courses should be composed of two elective courses plus one offering from each of the following four distributions (listed in the Table below): synthetic chemistry, biological chemistry, transition metal chemistry, and theoretical and mechanistic chemistry. Electives can be fulfilled with any additional courses listed among these distributions, or alternatively, they can involve coursework in the areas of physical and spectroscopic methods, molecular biology, cell biology, chemical biology, or bioinorganic chemistry. Courses listed in the table of CBI Electives (below) would also be appropriate options. Programs will be designed in consultation with a designated faculty advisor.

Required courses can be completed in several possible formats to fit the schedule of course offerings: you may enroll in three courses each of the two semesters of the first year, four courses the first semester and two the second, or three courses the first semester, two the second semester and one course the first semester of the second year.

The following table provides guidelines on sample series of courses that provide an exposure to synthesis, biological chemistry, transition-metal chemistry and reaction mechanisms.

<table>
<thead>
<tr>
<th>Synthetic Chemistry</th>
<th>Transition Metals</th>
<th>Biological Chemistry</th>
<th>Theory and Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthetic Methods 523</td>
<td>Organometallics 552</td>
<td>Chemical Biology 521</td>
<td>Advanced Organic 519</td>
</tr>
<tr>
<td>Organometallics 552</td>
<td>Modern Coordination Chemistry 557</td>
<td>Bioinorganic Chemistry 554</td>
<td>[Transition Metal Reaction Mechanisms 555]</td>
</tr>
<tr>
<td></td>
<td>Bioinorganic Chemistry 554</td>
<td>Enzyme Reaction Mechanisms 556</td>
<td>Enzyme Reaction Mechanisms 556</td>
</tr>
</tbody>
</table>
Those chemical biology students supported by the Chemistry/Biology Interface (CBI) training grant are expected to take three full-semester courses for credit each term of their first year. Specific courses are chosen in consultation with a designated faculty advisor. It is expected that by the end of the second year in residence, students supported by the Chemistry/Biology Interface (CBI) training grant will possess a solid background in both organic and biological chemistry, as well as a sophisticated understanding of important methodologies in cell and molecular biology. These requirements may, however, be fulfilled in whole or in part through courses taken as an undergraduate.

**Selection of Elective Courses (2):**

In addition to fulfilling the core requirements for Preparative Chemistry, students supported by the Chemistry/Biology Interface (CBI) Training Grant will take one elective from each of the two course listings below. All students will audit the Current Topics in Organic Chemistry Seminar Series (Chem 740), Seminar in Chemical Biology (Chem 740), or Seminar in Inorganic Chemistry (Chem 760) throughout their residence at Yale.

**CBI Electives (One elective from each list is required):**

<table>
<thead>
<tr>
<th>Biochemistry/Structural Biology</th>
<th>Cell and Molecular Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBB600 Principles of Biochemistry I</td>
<td>MCDB603 Cell Biology</td>
</tr>
<tr>
<td>MBB601 Principles of Biochemistry II</td>
<td>MCDB625 Genetic Analysis</td>
</tr>
<tr>
<td>MBB720 Macromolecular Structure and Biophysical Analysis</td>
<td>MBB705 Mol Genetic Prokaryotes</td>
</tr>
<tr>
<td>MBB721 Macromolecular Interactions and Dynamic Properties</td>
<td>MBB734 Advanced Eukaryotes Molecular</td>
</tr>
<tr>
<td>Chem556 Biochemical Kinetics and Dynamics</td>
<td>MCDB570 Biotechnology</td>
</tr>
<tr>
<td>MCDB630 Biochemical and Biophysical Approaches</td>
<td>PHAR502 Pharmacology I/II</td>
</tr>
<tr>
<td>MBB800 Advanced Topics in Molecular Medicine</td>
<td>PHAR504 Principles of Pharmacology</td>
</tr>
<tr>
<td>Mechanisms of Disease: Organs and Systems (Second-year Yale Medical School pharmacology course)</td>
<td>CBIO601 Molecular &amp; Cellular Basis Of Human Disease</td>
</tr>
<tr>
<td>C&amp;MP500 From Molecules to Systems: Medical Physiology</td>
<td>C&amp;MP600, Medical Physiology Case Conferences</td>
</tr>
</tbody>
</table>

**Second-Year Oral Examinations in Preparative Areas of Chemistry.** The requirements for the second year oral examination are slightly different for students formally enrolled in Organic Chemistry and Chemical Biology compared with those in Inorganic Chemistry. The specific requirements for the two different types of student are outlined below:

**a. Organic Chemistry and Chemical Biology.**

The oral examination will consist of a two-hour-long examination based on a proposal for research on the topic of your thesis work. This proposal uses the format of an NIH fellowship proposal, and details are given in the Chemistry Graduate Student Handbook. You will be expected to demonstrate a thorough knowledge of the thesis area and related areas of chemistry and to discuss competently the results that have been obtained and the future direction of the project. The exam will emphasize fundamental chemistry, including the material of your course work. In addition to your performance during the oral and written part of the exam, you will be judged on progress in research. The chair of the examining committee will provide to the student and Registrar a written summary of
recommendations. You should obtain a form for this purpose from the Registrar and bring it to the examination. The examination must be taken by May 31.

b. Inorganic Chemistry
The oral examination in Preparative Inorganic Chemistry consists of two parts that will be administered on the same day. One part consists of a proposal for research on the topic of your thesis work, and the second part consists of a proposal on a topic separate from the thesis research. You will be expected to demonstrate a thorough knowledge of the thesis area and related areas of chemistry and to discuss competently the results that have been obtained and the future direction of the project. Both sections of the exam will emphasize fundamental chemistry, including the material of your course work. In addition to your performance during the oral and written part of the exam, you will be judged on progress in research. The chair of the examining committee will provide to the student and Registrar a written summary of recommendations. You should obtain a form for this purpose from the Registrar and bring it to the examination. The examination must be taken by May 31.

Biophysical Chemistry Course Requirements
Students are expected to carry three full-semester courses for credit each term of their first year for a total of six credits. These six courses are composed of the four required courses (see below), along with two additional elective courses. Programs will be designed in consultation with a designated faculty advisor using the following guidelines.

By the end of the second year in residence, it is expected that students will have obtained a solid background in physical and biological chemistry and an understanding of the major molecular biophysical methods (magnetic resonance and X-ray crystallography). The specific course requirements are listed below. Requirements may, however, be fulfilled in whole or in part through courses taken as an undergraduate.

In addition to the six required courses listed above, students supported by the Biophysics Training Grant will take the Biophysics Research Rotations and Ethics course, Chem 700, in their first year. Biophysical Chemistry students not supported on this training grant are encouraged to audit Chem 700. All students will audit Biophysical Chemistry Seminar Series (Chem 750) throughout their residence at Yale.

Course requirements:

1. Four one-semester courses in biophysical/physical chemistry:
   - Molecules and Radiation I (normally Chem 540a),
   - Biochemical Kinetics & Dynamics (normally Chem 556b),
   - Statistical Methods and Thermodynamics (normally Chem 530b),
   - Biophysical I (Chem 551a)

2. Two elective one-semester courses. We recommend that one be an advanced biological course, such as molecular biology, cell biology, chemical biology, or bioinorganic chemistry, and the other an advanced course on physical methods such as Biophysics II (Chem 558b) or computational chemistry.

For students who have not taken biochemistry as an undergraduate, MB&B 600a/601b is required in addition to the above course requirements.

Second-Year Oral Exams in Biophysical Chemistry. Two oral exams with accompanying written reports must be passed during the second year: a thesis-area exam in the Fall term and an independent research proposal exam in the Spring term. The thesis-area exam covers the area of proposed thesis research and is intended to be more an advisory procedure than an academic hurdle. The second oral examination evaluates your design and research of a research project that is outside of your thesis research area.

For the first oral exam, it is expected that each student will think through, in detail, the particular research project about to be pursued. Students are encouraged to consult with other members of the faculty prior to making a long-term commitment to their research project. The examination will be administered by the two members of the student’s thesis committee and chaired by a third member substituting for the advisor. The written report is due on October 15, and the oral exam must take place before November 1.
The first oral examinations should begin with no more than a ten-minute oral presentation by the student of the topic under question. Questions and responses that follow should probe the student’s knowledge of necessary background material and go beyond that specifically related to the thesis.

The second oral examination will be carried out in two steps. First, a written one paragraph summary detailing the project goals and the steps taken to achieve them is submitted for approval to the committee by the first Monday after spring break of the second year of residence. The final proposal is typically limited to about 10 pages and will follow the outline for an NIH-style grant application as for the first exam, except ‘Preliminary Results’ will, of course, not be included. This proposal is designed to test the student’s ability to assess the literature and successfully develop an independent project. The second oral must be original with the student, should be outside the area of thesis research, not too closely related to work currently being carried out within the department, and should not include a student's previous undergraduate or industrial research or a trivial derivative thereof. In general, a proposal will be deemed to lie outside the thesis area if the advanced literature survey required for its preparation shows, at most, minor overlap with that required for the thesis. The candidate must schedule the second oral examination before or during the week prior to final examinations. In addition to assessing the student’s progress in research, it is expected that the oral exam will explore questions of basic physical or biophysical chemistry to establish the broader context of the specific research plan. The focus of these broader issues will be drawn from the list of references explicitly stated in advance as part of the committee’s comments on the written progress report.

The committee should meet immediately before the second oral examination to discuss the student’s performance thus far in graduate school. The research supervisor should bring all of the student’s records kept by the graduate secretary to this meeting. In both exams, the committee chairman should provide to the student and registrar a written summary of recommendations. A form for this purpose should be obtained by the student from the registrar and brought to the examination.

Time Required for Completion of Degree.
Although it is difficult to stipulate the exact time required for completion of the Ph.D. degree, 4-5 years is normal. Progress toward a degree after advancement to candidacy is evaluated largely on the basis of research potential. Yearly reports from the student are reviewed by the thesis advisor and submitted to the Graduate School. During the third or fourth year, if a student's advisor feels that the student is struggling, the thesis committee may be asked to provide an evaluation of the likelihood that the student will complete the thesis research project.

Teaching. Being a Teaching Fellow for 2 semesters at the TF20 level is required for the Ph.D. in Chemistry.

Experimental Pathology (“ExPath”)
Director of Graduate Studies: Themis Kyriakides, PhD

Course requirements:
Generally, there are three to four terms of coursework required: two Pathology "core" courses (Pathology 650b-Cellular and Molecular Biology of Cancer, and Path 690a- Molecular Mechanisms of Disease), plus four other electives that can be tailored to meet the specific needs and interests of the individual student in consultation with the DGS. In the first year, there is also a required seminar course, in which students learn how to critically evaluate and present primary scientific literature. Some of these requirements may have been met during didactic training in Medical School, and the Path 690a requirement may be waived in consultation with the DGS. All requirements of the Graduate School of Arts and Sciences, including the Honors requirement, must be met.

Qualifying Examination:
The Qualifying Exam of the ExPath graduate program comprises: 1) two literature reading periods; 2) a research proposal based on the proposed thesis research project; and 3) an oral exam, in which the student is examined by the Qualifying Exam Committee on the research proposal, the reading periods, and general knowledge of
experimental pathology. This exam is taken in the second term of the second year. The three components of the qualifying exam are described in detail below, as is the composition of the qualifying exam committee, and specific roles of those involved:

**The Qualifying Exam Committee:** This committee consists of three faculty members, with at least one having a primary or secondary appointment in the Department of Pathology. The qualifying exam committee is chosen by the student, in consultation with their thesis advisor, but its final composition requires approval by the DGS. The student will read with two committee members (see “Literature Reading Periods” section below) and write the research proposal with initial guidance from the third committee member. At the oral exam itself, one member of the committee will be selected as the chairperson and is responsible for documenting the results of the exam for submission to the DGS.

**Literature Reading Periods:** The first stage of the qualifying exam is the organization of the literature reading periods with two of the members of the examination committee. The subject for each reading period will be agreed upon by the student and the faculty member involved, and is to be broadly related to the thesis project. That is, in choosing the topics, care should be taken to avoid too narrow a focus, so that a greater depth of knowledge is achieved.

**Research Proposal:** The research proposal is based on the student’s thesis project research area. However, it is distinct from the “thesis prospectus.” The proposal should demonstrate the student's ability to recognize important, unsolved questions and to design experiments to answer them. The proposal, which is limited to 10 pages (with a minimum of 8 pages), should be written in the same general format as an NRSA postdoctoral fellowship proposal and concisely review the pertinent background information, logically and clearly state the questions being asked, and intelligibly lay out the experimental plan.

**The Oral Exam:**
The oral examination will focus on the student’s ability to present and defend the research proposal. The student should come to the exam with a short (~30-40 minute) presentation of the thesis-related proposal with visual aids. The committee can also ask questions on topics covered during the reading period and general topics in experimental pathology that will have been covered in courses.

**Prospectus:**
Upon successful completion of the qualifying examination, the student will constitute a Dissertation Committee, including (at minimum) three members in addition to the dissertation advisor. At least two of the Committee members must be Pathology Department faculty. The membership of the Committee must be approved by the DGS. The student will prepare a written thesis prospectus, consisting of a summary of background information in the field of interest, the specific questions to be answered, a rationale for choosing those questions, and a research plan for addressing those questions. Upon completing the course requirement with at least two terms of Honors, passing the qualifying examination, and submitting a thesis prospectus, students will then be admitted to candidacy for the Ph.D. degree.

After completing their thesis research, the student must then submit a written thesis describing the research and present a public thesis research seminar.

**Genetics**

**Director of Graduate Studies: Mark Hammarlund**

MD-PhD students affiliate with the Department of Genetics Graduate Program via a different route than other incoming graduate students in the Genetics Department, resulting in some modification of the academic requirements for the PhD portion of the MD-PhD degree. Typically, one or more research rotations are done during
the first two years of medical school (in many cases, the first rotation is done during the summer between years one and two). No set number of research rotations is required. MD-PhD students officially affiliate with the Department of Genetics after selecting a thesis advisor and consulting with the DGS. MD-PhD students interested in Genetics are required to consult with the DGS prior to formal affiliation to determine an appropriate set of courses tailored to the student’s background and interests.

The courses, rotations, and teaching requirements for MD-PhD students entering the Genetics Graduate Program (see below) are modified from the normal requirements for PhD students. Apart from the modifications in these three requirements, MD-PhD students in the Department of Genetics are subject to all of the same requirements as the other graduate students in the department.

**Coursework**
Four graduate level courses taken for a grade are required (two Yale graduate level courses taken for a grade during Medical School may be counted towards this requirement at the discretion of the DGS). Coursework is aimed at providing a firm basis in genetics and in cellular molecular mechanisms, with graduate-level proficiency in genetics, cell biology and biochemistry. In addition to these four courses, all Genetics students are required to take two semesters of Graduate Student Seminar and Scientific Ethics.

**Required Courses**
- GENE 760b, Genomic Methods for Genetic Analysis. James Noonan
- Graduate Student Seminar (2 semesters; GENE 675, graded Sat/Unsat)
- Scientific Ethics (GENE 901b, graded Sat/Unsat)

**Recommended Courses**
- Advanced Eukaryotic Molecular Biology (MB&B 743b)
- Biochemical and Biophysical Approaches in Molecular and Cellular Biology (MCDB 630b)
- Molecular and Cellular Basis of Human Disease (CBIO 601)

**Electives**
Other courses may be taken in a wide variety of fields relevant to the biological and biomedical sciences.

**Laboratory Rotations:** One or more rotations are necessary to identify a thesis advisor. No set number of research rotations is required.

**Teaching:** One semester of teaching is required. Previous teaching while enrolled at Yale Medical School may count towards this requirement at the discretion of the DGS.

**Qualifying Exam:** MD-PhD students take their qualifying exam in the semester following the completion of their coursework. The structure of the qualifying exam is identical to that for other Genetics PhD students. Students read with three faculty members for five weeks, one of whom supervises the reading on the thesis research topic, but who is not the thesis advisor. The following two weeks are devoted to writing two research proposals, one on the thesis research topic. An oral exam follows in the eighth week. For details, see the Qualifying Exam section of the Genetics Graduate Program handbook.

**Prospectus:** MD-PhD students submit their prospectus once their qualifying exam has been completed, but no later than the 30th of June following their exam.

**Candidacy:** MD-PhD students will be admitted to candidacy once they have completed their coursework, obtained 2 Honors grades, passed their qualifying exam, and submitted their dissertation prospectus.
Thesis Committee: All students are required to have one thesis committee meeting per year, beginning the semester after passing their qualifying exam. However, students are strongly encouraged to consider having additional meetings if they feel their project could benefit from the assistance of members of the thesis committee.

History of Science and Medicine
Director of Graduate Studies: Naomi Rogers

Special Requirements for the Ph.D. Degree
All students must show proficiency in either French and German, or in two languages relevant to the student’s research interests and approved by the Director of Graduate Studies (DGS). Students may fulfill the requirement by DGS approval of demonstrated command of a native language other than English, by graduation from an approved foreign university where teaching is conducted in a language other than English, by passing an approved language course for credit, or by passing a language test administered by the program faculty. Students will ordinarily take twelve courses during the first two years. All students will normally take the three core “Problems” seminars: Problems in History of Science, Problems in History of Medicine, and Problems in Science Studies. In addition, students will take four graduate seminars in history of science or medicine and at least one graduate course in a field of history outside of science or medicine. The remaining courses can be taken in history of medicine or science, history, science, or any other field of demonstrated special relevance to the student’s scholarly objectives. Two of the twelve courses must be graduate research seminars in the History of Science and Medicine.

At the end of each semester, the DGS will ask faculty members whether they have serious concerns about the academic progress of any first- or second-year students in the Ph.D. program. Faculty members who have such concerns will provide written feedback to the DGS at his or her request. The DGS will use his or her discretion to ensure that feedback is provided to any students about whom there are concerns in a clear and effective manner. At the end of the academic year, the HSHM faculty will hold a special meeting to review each first- and second-year student in the program. The purpose of the meeting is to assess students’ academic progress. In order for second years to proceed to the third year, they must demonstrate through written work, classroom performance, and participation in departmental activities that they have the ability to: a) speak and write clearly; b) conduct independent research at a high level; and c) develop coherent scholarly arguments. A faculty vote will be taken at the conclusion of the review meeting to decide whether each second-year student may continue in the program. If a majority of faculty present and voting determine that a student may not continue, the student will be informed in writing and withdrawn from the program. The review meeting must be a full faculty meeting, but faculty members with no knowledge of the students under review may abstain from the vote, and their abstentions will not count in the total. Those members of the faculty who have worked with or know the students being evaluated are required to attend. In the event that any necessary faculty members absolutely cannot be present, they may send their views in writing to the DGS who will read them at the meeting.

Students who enter having previously completed graduate work may obtain up to three course credits toward the completion of the total course requirement, the amount being contingent on the extent and nature of the previous work and its fit with their intended course of study at Yale.

The Qualifying Examination
Prior to entering on their dissertation work, all students are expected to develop a broad general knowledge of the discipline. This knowledge will be acquired through a combination of course work, regular participation in the Program colloquia and workshops, and dedicated preparation for the qualifying oral examination. Students will normally spend the summer following their second year preparing for the oral Qualifying Examination, which will be taken in the third year, preferably during the first half of it. The Qualifying Examination will normally consist of four fields, each of which will be examined by a separate faculty member:
• Two fields in the history of science and/or history of medicine.
• One field in an area of history outside of medicine and/or science.
• One field of special interest, the content and boundaries of which will be established in consultation with the student’s advisor.
Possibilities for the field of special interest include a second field in history outside of history of science or medicine, a field with a scientific or medical focus (such as bioethics, health policy, public health, medical anthropology, or medical sociology), or a field at the intersection of science, medicine, and other subjects (such as law, national security, religion, culture, biotechnology, gender, race, literature, the environment, and so on).

Teaching
Teaching is an important part of the professional preparation of graduate students in History of Medicine and Science. Students will teach, usually in the third and fourth years of study. They may, however, teach in the second semester of the second year, deferring the completion of their required course work to the first semester of the third year. Students are also encouraged to participate in the programs to develop teaching skills offered by the Graduate School. At least two terms of teaching are required of all students; four terms are required of students on Yale-supported fellowships.

Immunobiology
Director of Graduate Studies: Susan Kaech

M.D./Ph.D. Students Who Join Immunobiology
An M.D./Ph.D. student affiliates with the Immunobiology Graduate program through the MD/Ph.D. program. You will have chosen your research Ph.D. course of study after matriculating through the YSM, and completing one or more research rotations during the course of your first two years of medical school. In many cases, the first rotation is done during the summer between years one and two of medical school. MD-PhD are required to do a minimum of two rotations, which can be done during a single summer.

Once a thesis laboratory is selected, the student completes an application for a Ph.D. department filing it with both Cheryl DeFilippo and Barbara Cotton. M.D./Ph.D. students with interests in the Immunobiology Graduate Program should discuss their situation with the Director of Graduate Studies as early as possible and notify Barbara Cotton so that your graduate school paperwork can be processed.

You are typically further advanced than the traditional first year BBS graduate student, by the time you have joined Immunobiology. It is possible to defend your preprospectus (preliminary description of your prospectus research) after the first semester and prospectus (preliminary description of your thesis project) after the second semester. Typically a student presents the preprospectus during a RIP research in progress seminar to the department at large. This is a good format for the student to gather further insight for the project.

Courses / Requirements
1. Six graduate level (science) courses, taken for a grade.
2. Ibio 530a: Biology of the Immune System
   a. Required unless consultation with DGS and course director determines that passing the previous year final exam shows sufficient knowledge in subject. Does not reduce the six course requirement
3. Ibio 531b: Advanced Immunology
4. Two advanced seminar courses (choose from IBI 536, 537, 538, 539)
   b. Seminar courses are typically available every Fall and every other Spring. First seminar must be taken for a grade. If the student has completed six courses, then the seventh class (seminar) can be audited.
5. Ibio 601b, Responsible Conduct in Research, unless taken in medical school (Pass/Fail)
6. Ibio 503b, Responsible Conduct in Research, Refresher Course, 4th year students, unless taken in medical school.

7. Teaching: one semester-long science courses.
   –The Yale McDougal Center offers a one day seminar entitled “Teaching at Yale”. Attending this seminar is recommended prior to teaching.

8. Pre-prospectus and successful completion of prospectus exam, both oral and written components.

9. First committee meeting post your prospectus with a signed committee form verifying student is in good standing, together with advisor summary report of meeting, including IDP certificate.

10. Advance to Candidacy (all requirements met and committee report submitted, as discussed in #9)

11. Written dissertation, approved by Thesis Committee and an outside reader.

12. There is a very strong expectation that your thesis research will result in at least one first author primary research paper, published (or at the very least submitted) prior to the oral defense of your dissertation. Exceptions must be approved by your thesis committee and the DGS.

13. Oral Dissertation defense

In addition, students must fulfill all requirements set forth in the Yale University Graduate School Programs and Policies Manual.

**Interdepartmental Computational Biology and Bioinformatics**

Co-Directors of Graduate Studies: Mark Gerstein, Hongyu Zhao

**Course Requirements (9):** Nine courses are required plus a seminar on responsible conduct of research. Course distribution is: 3 required graduate courses in CBB, 2 courses in biological sciences, 2 courses in informatics (computer science, statistics, applied math), and 2 electives from the above areas. With DGS approval, some courses taken toward the M.D. degree can be counted toward the nine required courses. Such courses must have a graduate course number and the student must register for them as graduate courses (in which grades are received). Students must fulfill the Graduate School requirement of 2 honors grades.

**Laboratory Rotations:** Rotations are available but not required.

**Teaching:** One teaching assistantship is required.

**Qualifying Exam:** During the Qualifying Exam, the student presents and discusses a dissertation research prospectus and is also questioned on several CBB topic areas previously identified by the qualifying exam committee. The Qualifying Exam should normally be held before the end of the 4th term after CBB affiliation.

**Admission to Candidacy:** MD-PhD students should normally be admitted to candidacy by the end of the 4th term after CBB affiliation.

**Other Requirements:** After admission to candidacy, students should have an annual Thesis Committee meeting.

**Interdepartmental Neuroscience Program (INP)**

Director of Graduate Studies: Charles Greer

**Course Requirements (3):** Three courses are required, and students must obtain a grade of Honors in two of these courses. This must be completed by the end of the second year of full time graduate work. Required courses are Principles of
Neuroscience (INP 701a) and Structural and Functional Analysis of the Human Nervous System (Neurobiology 500b). One more elective graduate level course is required. Graduate courses taken during the first two years of medical school will count towards the student's elective requirement in the INP, provided the student has registered to receive a graduate grade in the course. Examples are CBIO 601 and MB&B 800a. In the case of students accepted into the MD-PhD Program during their first year of medical school, a letter from the faculty member in charge of the first-year course indicating the grade achieved in the course is required and an official transcript from the Medical School must be submitted to the Graduate School. The INP also requires affiliated MD/PhD students to register for INP 513 a/b Second-Year Thesis Research in the first two semesters of affiliation with the graduate program.

Laboratory Rotations:
Two rotations are required; rotations in another department/program will count towards this requirement upon approval of the INP Director of Graduate Studies.

Teaching Requirements:
MD-PhD students are required to TA one term; two terms are preferred. Previous teaching (as TA) in the histology labs or courses in MCDB does count toward this requirement as long as the student has taught while enrolled at Yale as an MD-PhD student.

Qualifying Exam:
MD-PhD students must complete their qualifying exam before the end of their first year as an affiliated graduate student. If affiliation begins in September of the third year, then the qualifying exam must be completed by the end of May of that year.

Prospectus:
MD-PhD students must complete and submit their thesis prospectus by the end of the second year as an affiliated graduate student. If affiliation begins in September of the third year, then the prospectus must be submitted and approved by the end of May of the fourth year.

Please note that every thesis prospectus MUST be approved by the Thesis Committee.

Admission to Candidacy:
MD-PhD students are required to have been admitted to candidacy by the end of the second year as an affiliated graduate student. Generally, the submission of the thesis prospectus is the final requirement for admission to candidacy and paperwork for both is submitted to the Graduate School at the same time.

Other requirements:
All graduate students who are admitted to candidacy are required to have an annual Thesis Committee meeting. All graduate students are required to give a student research presentation annually and are expected to attend student research talks as well as INP-sponsored journal clubs and other INP-sponsored events.

Affiliation requirement: A copy of the student’s application to the MD-PhD program, a copy of the student’s current transcript and notation of rotations completed must be submitted to the INP office. The DGS must have this information in hand before the official MD-PhD student affiliation form can be approved.

Typical Timeline:
Year One: MD-PhD students complete courses in the Medical School and register for selected courses in the Graduate School. Most who identify Neuroscience as their probable Ph.D. field will take the required course, Principles of Neuroscience, in the fall semester. This is the recommended timing. MD-PhD students should take Neurobiology 500b in the spring for graduate school credit/grade. Other electives as listed above may be taken for
graduate school credit to fulfill our requirement and indeed, it is recommended that this be done. Two laboratory rotations should be completed in the summer. The DGS and the Neuroscience Office may be of assistance in identifying appropriate laboratories based on the student’s interests.

Year Two: Courses in the Medical School are typically taken. Part 1 of the Boards is taken.

Year Three: With the advent of the new curriculum, students will affiliate with their thesis lab in September of the third year. All paperwork should be completed (affiliation form completed and copy of student’s academic record including application transferred to the Interdepartmental Neuroscience Program Office). Qualifying Examination must be completed within one year of laboratory/program affiliation. This is a graduate school rule and graduate school registration for the following semester may be held up if this requirement is not fulfilled in a timely manner.

Year Four: The Thesis Prospectus must be approved and submitted to the Graduate School by the end of the second year of laboratory/PI affiliation. Registration for the following semester may be held up if this requirement is not fulfilled in a timely manner. The Thesis Committee approves the prospectus and required paperwork is then delivered to the INP Office by the student. The INP Office will then complete the Admission to Candidacy paperwork and submit it to the Graduate School. The Prospectus must be submitted to the Graduate School at least six months before the dissertation is submitted.

Year Five: Dissertation research in residence continues.

Year Six: We require that MD-PhD students defend their dissertations before returning to fulfill the remaining Medical School requirements.

Year Seven: Student completes all remaining requirements and graduates in May.

While this is considered a guideline for a typical MD-PhD student, we recognize that not every student will follow this path. Any digression from this timeline must be discussed and approved by the DGS, with appropriate notes to the student’s file and copies to the MD-PhD Office. Continued participation in the INP is subject to the satisfactory completion of requirements in a timely fashion and if any question arises about the satisfactory progress of a student and the qualifying examination committee or the thesis committee cannot agree on an appropriate resolution, then the INP Executive Committee will have the authority of the INP faculty to determine a course of action.

Medical Anthropology (2015)
Director of Graduate Studies: David Watts

Course Requirements
All students in the MD-PhD program in Medical Anthropology will complete six graduate courses and original doctoral research as follows:

- One graduate theory seminar (“Medical Anthropology at the Intersections: Theory and Ethnography,” “Topics and Issues in Evolutionary Theory,” or “Evolutionary Perspectives on Health and Disease”)
- One graduate topical seminar in medical anthropology and global health (“Global Health: Ethnographic Perspectives” or “Health Disparities and Health Inequities”)
- One graduate research seminar that includes professional development in research methods (“Research in Sociocultural Anthropology: Design, Methods, and Proposal Writing” or other courses with the approval of the Medical Anthropology faculty)
- Three distributional seminars from a list of elective graduate courses in medical anthropology (see below)
• Completion of a dissertation prospectus approved by the dissertation advisory committee (DAC) chair (due before registration for the 4th year)
• Completion of a doctoral project, which includes field research conducted during the fourth (and possibly fifth) year of the program
• Completion of a PhD dissertation, approved by the dissertation advisory committee, which will consist of the chair and at least two other faculty members, one of whom must be a Yale ladder track faculty member.

Dissertation Advisory Committee (DAC)
The DAC must consist of at least 3 full-time Yale faculty members, at least one of whom must be ladder faculty in the Department of Anthropology (Assistant, Associate on Term, Associate, or full Professor). A third committee member may be from outside Yale, if appropriate.

Qualifying Examination
Each student will take written and oral qualifying examinations, usually at the end of the second year of medical anthropology coursework. With consultation from the student’s dissertation advisory committee, the student will cover three areas of chosen concentration in medical anthropology, based on coursework completed. Following the written examination, each student will undertake an oral examination with the dissertation advisory committee, with questions and answers expanding upon the written exams. Students who are successful in their qualifying exams will advance to PhD candidacy. Some students may pass their qualifying exams with distinction. Those who do not pass may petition for a terminal M.Phil. degree in accordance with the rules set forth by the Graduate School of Arts and Sciences.

Courses for Medical Anthropology MD-PhD students

Theory Seminar
ANTH 548b, Medical Anthropology at the Intersections: Theory and Ethnography. Marcia C. Inhorn. The subfield of medical anthropology boasts a rich theoretical and empirical scholarly tradition, in which a significant number of critically acclaimed, award-winning ethnographies have been written on topics ranging from embodiment and local biologies to the health problems engendered by structural and political violence. Many medical anthropology scholars engage across the social science and humanities disciplines, drawing upon history, philosophy, political science, cultural studies, science and technology studies, and gender studies perspectives in their writing. In addition, medical anthropology intersects with medicine and public health, offering both critiques and applied interventions. This graduate seminar showcases the theoretical and ethnographic engagements of more than a dozen disciplinary leaders in the subfield of medical anthropology. Guided by the key text, Medical Anthropology at the Intersections: Histories, Activisms, and Futures—which was based on Yale’s historic medical anthropology conference held in 2009—the course will explore the canonical works of a number of leading medical anthropological theorists. Three major foci of medical anthropological engagement will be highlighted, including 1) structural violence and social suffering, 2) gender, technoscience, and embodiment, and 3) global health and humanitarianism.

ANTH 851a, Topics and Issues in Evolutionary Theory. Biological Anthropology Faculty
This seminar aims to provide students with a basic understanding of the theory of evolution by natural selection. Readings are drawn from various sources including the paleontological, comparative, and human evolutionary biology literature. The goal is to provide students with a comprehension of the biological mechanisms that have shaped our species as well as the historical context in which this theory has been developed.

ANTH 8xx, Evolutionary Perspectives on Health and Disease. Biological Anthropology Faculty
This seminar aims to introduce students to advanced concepts related to the role of evolutionary biology in the understanding, development, and treatment of health and disease. This includes the application of evolutionary
and life history theory towards questions of degenerative and infectious disease, diseases of modern society and globalization such as obesity and reproductive cancers, health disparities, epidemiology, and demography.

**Topical Seminar in Medical Anthropology and Global Health**

**ANTH 523/GLBL 823, Health Disparities and Health Equity. Catherine Panter-Brick**
Current debates in medical anthropology and global health specifically focus on health disparities and health equity. Faculty working in this area adopt a biocultural approach, based on the understanding that biological and cultural issues intersect in matters of health research and health intervention. Four thematic areas are addressed including: biomedical perspectives on health; poverty, inequality, and health; health interventions; and structural violence and health. Knowledge of conceptual and theoretical issues and debates in the field of health disparities is emphasized, especially those located at the intersection of biology and society. Faculty in this area encourage critical thinking regarding health disparity and equity issues across cultures and their relevance for research and policy, using compelling case studies of health disparities and equity issues in a variety of global sites.

**ANTH 640/GLBL 624, Global Health: Ethnographic Perspectives. Marcia C. Inhorn**
This interdisciplinary seminar, designed for graduate students in Anthropology and Global Health, explores in an in-depth fashion anthropological ethnographies on many of the serious health problems facing populations in resource-poor societies around the globe. The course focuses on three major issues: (1) poverty, structural violence, and health as a human right; (2) struggles with infectious disease; and (3) the health of women and children (and men, too). Within these three themes, many major issues of global health concern are addressed, including the health-demoting effects of poverty, racism, patriarchy, and inhumane conditions of life and labor in many countries; men's and women's sexuality in the era of HIV/AIDS; the politics of epidemic disease control and other disasters, and the role of communities, nation-states, and international organizations in responding to such crises; issues of coercion in population control and the quest for reproductive rights; and how child health is ultimately dependent on the health and well-being of mothers. The underlying purpose of the course is to develop students' awareness of the political, socioeconomic, ecological, and cultural complexity of most health problems in so-called developing nations and the consequent need for anthropological sensitivity, contextualization, and activist involvement in the field of global health. The course is also designed to expose students to salient health issues in many parts of the world from the United States to China. However, the primary focus is on global health issues facing sub-Saharan Africa and Latin America.

**Research Seminar**

**ANTH 502, Research in Sociocultural Anthropology: Design, Methods, and Proposal Writing. Marcia C. Inhorn**
This graduate seminar for anthropology doctoral students is designed to provide a comprehensive overview of the ethnographic research enterprise. The course focuses on ethics and entrée to the research setting, ethnographic research design, interview-based and observational methods of data collection and documentation, and ethnographic data analysis. A major goal of the course is preparation of a doctoral dissertation field research proposal, in National Science Foundation (NSF) Cultural Anthropology format, which incorporates the skills and approaches discussed in class.

**Distributional Seminars: Elective Courses for Medical Anthropology MD-PhD students**

**ANTH/WGSS 651, Intersectionality and Women’s Health: Ethnographic Approaches to Race, Class, Gender, and “Difference.” Marcia C. Inhorn**
This interdisciplinary, graduate seminar, designed for students in medical anthropology, women’s studies, and related fields, explores contemporary intersectionality theory: namely, how the intersections of race/class/gender and other axes of oppression (e.g., based on age, ethnicity, ability) affect women’s lives and women’s health in the contemporary United States. In this course, recent feminist approaches to intersectionality theory will first be introduced. Then intersectionality will be explored through anthropological ethnographies that highlight the multiple forms of oppression faced by poor women of color in the United States.
ANTH 655/WGSS 659, Masculinity and Men’s Health. Marcia C. Inhorn
This interdisciplinary seminar, designed for students in Anthropology; Women's, Gender, and Sexuality Studies; and Global Health, explores in an in-depth fashion ethnographic approaches to masculinity and men's health around the globe. The course begins with two theoretical texts on masculinity, followed by eleven anthropological ethnographies on various dimensions of men's health and well-being. Students gain broad exposure to a number of exigent global men's health issues, issues of ethnographic research design and methodology, and the interdisciplinary theorizing of masculinity scholars in anthropology, sociology, and cultural studies. In particular, the course demonstrates how anthropologists studying men's health issues in a variety of Western and non-Western sites, including the Middle East, Africa, Latin America, and Asia, have contributed to both social theory and ethnographic scholarship of importance to health policy.

ANTH/GLBL 628a, Conflict, Resilience, and Health. Catherine Panter-Brick
This course reviews issues at the nexus of health, resilience, and conflict — including military, ethnic, religious, and interpersonal types of violence. We draw readings from the health-related social sciences literature to examine three main issues: (i) the impact of violence on physical, emotional, and social suffering; (ii) the nature and drivers of collective, interpersonal, and structural violence; and (iii) the personal, family, community, and governmental dimensions of resilience, namely the ability to bounce back from significant life adversity. We also examine specific work in humanitarian settings to discuss the global agenda and the ethics of research and intervention projects. Materials from this course include case studies encompassing different cultural and geographic contexts, and work across the fields of health, social sciences, humanitarian policy, and human rights. The course thus offers an interdisciplinary overview and a practical understanding of issues related to health, resilience, and governance in conflict settings, at global and local level. For example, we examine which types of conflict exposures – from military to domestic violence – are the most salient for local communities in contexts such as the Gaza strip and Afghanistan. We review current debates on trauma, social suffering, and structural violence for displaced populations such as refugees and asylum-seekers. We look at responses to violent conflict for under-studied groups such as the next generation of adolescent youth. We examine the scope and implementation of health programs and the work of human rights and international aid workers in the midst of intractable conflicts and fragile states.

ANTH 803b, Reproductive Ecology. Richard Bribiescas
This course will survey various topics and issues relating to the proximate mechanisms of human and comparative reproductive biology, with specific attention devoted to life history trade-offs, human biological variation, phenotypic plasticity, as well as ecological and social stresses. Critical analysis of the validity of life history hypotheses as illustrated by experimental tests and clinical data will be the primary focus of discussion.

ANTH 843a, Evolutionary Biology of Human Aging. Richard Bribiescas
Aging is an aspect of evolutionary biology that is common to the life histories all organisms, including humans. Moreover, humans exhibit biological characteristics of aging that are both unique to our species and common to other organisms. This seminar aims to address how human aging has evolved and how it may inform our present understanding of age-related diseases. Topics to be covered include the somatic and behavioral aspects of aging, male and female reproductive senescence, the relationship between investment in reproduction and rates of aging, as well as the comparative physiology of aging.

ANTH 890, Health of Indigenous Peoples. Claudia Valeggia
From the highlands of the Andes to the lowlands of the Amazon basin and the frozen circumpolar steppes, from subsistence farmers and herders to hunter-gatherer groups, indigenous populations are changing their lifestyle so rapidly, and sometimes so profoundly, that it is difficult to follow the pace of the transformation. Indigenous peoples always fare far worse than non-indigenous ones in terms of health status. No matter where one looks, there are substantial health disparities between indigenous and non-indigenous populations in the form of mortality and
morbidity gaps. This seminar will go over the epidemiological landscape of indigenous populations and discuss causes of death and sickness, which vary from population to population. We will then expand on some of the possible interactive causes of these disparities, particularly the role that globalization and market integration is having in shaping the health situation of indigenous peoples. Finally, we will discuss the current surge of Global Health Programs, mainly at academic or research institutions in the northern hemisphere and the contribution of anthropology to those programs.

ANTH 8xx, Ethnopediatrics. Claudia Valeggia
Women in certain cultures wean their babies when they are days old, while others do so when the child decides to wean him/herself (years). Babies in some hunter-gatherer populations never crawl and only start walking when they are 18 months old and older. Babies in Western, industrialized populations are encouraged to crawl and walk at much earlier ages. Many infants are circumcised at birth and others at puberty. In most populations, babies sleep with their mothers for several years, while in the US, it is expected that they sleep through the night in a separate room as early as possible. How do all these ways of raising children affect their growth and development? Are there universal patters on child rearing? Can an evolutionary perspective contribute to a better understanding of variation in the way we raise our children and in their health patterns? In this course, we will discuss how the health, growth, and development of children are shaped by the interactive actions of human evolutionary biology, ecology, and local cultural patterns. Examples from current and past cultures as well as from non-human primate species, will be analyzed. This seminar-style graduate and advanced undergraduate course has two main objectives: 1) to provide an overview of the latest advances in ethnopediatrics, and 2) the mechanics of writing a research proposal in biological anthropology and related fields. We will discuss readings and exchange ideas on the different directions that this relatively new discipline may take. As a way of reviewing the material and train ourselves to present our ideas to a funding agency, we will write individual research proposals.

Microbiology
Director of Graduate Studies: Walther Mothes

Required Courses (4): MD-PhD students must take a minimum of four courses, three of which must be Microbiology courses. All students must obtain two Honors grades in their courses to remain in good academic standing. Credit may be given for advanced courses taken in the medical school that were graded, and an Honors grade obtained in one of these courses may count toward the Honors requirement, at the discretion of the DGS.

Laboratory Rotations: MD/PhD students are encouraged to think carefully about choosing a mentor and may need to perform up to three rotations to make this important choice. They are encouraged to begin rotations during the summer after their first year at Yale. However, if the MD/PhD student identifies a mentor early during the course of the rotations, he or she is not be required to complete three rotations if the proposed mentor and DGS support the choice of the student.

Teaching: MD-PhD students are required to fulfill one semester of teaching. Previous teaching in Histology or MCDB may count towards this requirement at the discretion of the DGS.

Qualifying Exam: MD-PhD students are encouraged to take the qualifying exam once their coursework has been completed and they have identified a mentor and a thesis project. This exam should take place as soon as practical, and certainly before entering their third year in the PhD program. For details on the exam, please consult the Microbiology Program Handbook.

Prospectus: MD-PhD students should submit their prospectus once their qualifying exam has been completed, and no later than the 30th of June following their exam.
**Candidacy:** MD-PhD students will be admitted to candidacy once they have completed their coursework and obtained two Honors grades, passed their qualifying exam, and submitted their dissertation prospectus.

**Thesis Committee:** MD-PhD and PhD students are required to have one Thesis Committee meeting per year. However, students are strongly encouraged to consider having additional meetings if they feel their project could benefit from the assistance of members of the Thesis Committee.

**Molecular Biophysics & Biochemistry (2015)**  
**Director of Graduate Studies:** Mark Solomon

**Required Courses (3):** All students are required to fulfill the following requirements:

- MB&B 800a, Advanced Topics in Molecular Medicine. Students must register for this course, which is taken in the first year of Medical School, and take it for a grade.
- MB&B 720a, Macromolecular Structure and Biophysical Analysis.
- A second course in molecular biophysics. Lists of approved courses fulfilling this requirement are available from the DGS and are listed in the MB&B and BBSB handbooks.

Students are also encouraged to take MB&B 730a, Methods & Logic in Molecular Biology, although it is not required. Enrollment is limited to students who have already joined the MB&B department. In addition, students with weak backgrounds in molecular biology should take MB&B 743b and students who have not had a course in Physical Chemistry (Thermodynamics) should take CHEM 328a. It is anticipated that students who affiliate with MB&B will have taken such courses in college and that few students will need to take either MB&B 743b or CHEM 328a. Please consult the DGS for a discussion of individual circumstances.

Students are required to attain at least two grades of Honors and to maintain a High Pass average.

Participation in a short discussion course in Responsible Conduct of Research (MB&B 676b) is required but may be replaced with the MD/PhD RCR course.

Rotations are not required for MD-PhD students, but are available.

**Teaching in one course is required of MD-PhD students.** Additional teaching is available.

**Qualifying exam:** Two written proposals that must be defended orally. One proposal is in a chemical/biophysical area and one in a biochemical/molecular biological area. One of these proposals must be the proposed thesis research. The other must be in a contrasting area, both in terms of subject matter and approach.

**Molecular, Cellular and Developmental Biology**  
**Director of Graduate Studies:** Scott Holley

**Course Requirements:** There is no specific curriculum of courses required, however students must obtain a grade of Honors in at least two graduate-level courses to fulfill requirements set by the Graduate School. The student, with guidance from a faculty committee, can choose a specific program of courses that are best fitted to their individual needs and career goals. Most students complete at least 5 courses during their first two years of study.
**Laboratory Rotations:**
3 rotations are required and rotations in other departments will count towards this requirement.

**Teaching Requirement:** One semester of teaching is required.

**Qualifying Exam:** The student will meet with a faculty committee in the third term of study to decide on a preliminary topic for dissertation work and to define the research areas in which he or she is expected to demonstrate competence. Each student then prepares a dissertation prospectus that outlines the research proposed for the Ph.D. The written and oral presentations must be successfully defended by the end of the Fall semester of the student’s second year to be admitted to candidacy for the Ph.D.

**Other requirements:**
All graduate students who are admitted to candidacy are required to have an annual Thesis Committee meeting. Students must also attend a weekly student research in progress seminar where each student will present yearly.

**Neurobiology (2015)**
Director of Graduate Study: Michael Crair

**Course Requirements (5):**
Five courses are required, and students must obtain a grade of Honors in two of these courses. This must be achieved in the first two years of the combined program. Required courses are Principles of Neuroscience (Neuroscience 501a) and Structural and Functional Analysis of the Human Nervous System (Neurobiology 500b). Three more elective graduate level courses are required. The following courses taken during the first two years of medical school will count towards the student's elective requirements in Neurobiology, provided the student has registered to receive a graduate grade in the course: CBIO 502a, CBIO 601, GENE 500b, IBIO 530a, MB&B 800a. In the case of students accepted into the MD-PhD Program during their first year of medical school, a letter from the faculty member in charge of the first-year course indicating the grade achieved in the course is required and an official transcript from the Medical School must be submitted to the Graduate School. Neurobiology also requires affiliated MD/PhD students to register for NBIO 513 a/b Second-Year Thesis Research in the first two semesters of affiliation with the graduate program. MD/PhD Students in their fourth year of medical school are required to enroll in the B&BS 503 RCR Refresher for Senior BBS Students.

**Laboratory Rotations:**
Two rotations are required; rotations in another department/program will count towards this requirement upon approval of the Director of Graduate Studies.

**Teaching Requirements:**
MD-PhD students are required to serve as Teaching Fellows (TF) for one term; two terms are preferred. Previous teaching (as TF) in the histology labs or courses in MCDB does count toward this requirement as long as the student has taught while enrolled at Yale as an MD-PhD student.

**Qualifying Exam:**
MD-PhD students must complete their qualifying exam before the end of their first year as an affiliated graduate student. Thus, if the student affiliates at the customary point in the beginning of the spring semester of the third year of matriculation at Yale, he/she must complete the examination before registering for the spring semester of the fourth year at Yale.
**Prospectus:** MD-PhD students must complete and submit their thesis prospectus by the end of the second year as an affiliated graduate student. Thus, if the student affiliates at the customary point in the beginning of year 3 as an affiliated graduate student, the student must submit the approved prospectus before registering for the spring semester of the fifth year.

Please note that every thesis prospectus MUST be approved by the Thesis Committee.

**Admission to Candidacy:**
MD-PhD students are required to have been admitted to candidacy by the end of the second year as an affiliated graduate student. Generally, the submission of the thesis prospectus is the final requirement for admission to candidacy and paperwork for both is submitted to the Graduate School at the same time.

**Other requirements:**
All graduate students who are admitted to candidacy are required to have an annual Thesis Committee meeting; more frequent meetings are encouraged. Advanced graduate students are required to give a Neurobiology Department Graduate Student Seminar annually, and all graduate students are expected to attend and participate in rotation/student research talks as well as journal clubs.

**Affiliation requirement:** A copy of the student’s application to the MD-PhD program, a copy of the student’s current transcript and notation of rotations completed must be submitted to the Neurobiology Department business office. The DGS must have this information in hand before the official MD-PhD student affiliation form can be approved.

**Timeline:**

**Year One:** MD-PhD students complete courses in the Medical School and register for selected courses in the Graduate School. Most who identify Neuroscience as their probable Ph.D. field will take the required course, Principles of Neuroscience, in the fall semester. This is the recommended timing. MD-PhD students should take Neurobiology 500b in the spring for graduate school credit/grade. Other electives as listed above may be taken for graduate school credit to fulfill our requirements and indeed, it is recommended that this be done. Two laboratory rotations should be completed in the summer. The DGSs of both the Neurobiology Department and the INP may be of assistance in identifying appropriate laboratories based on the student’s interests.

**Year Two:** Courses in the Medical School are typically taken. Part 1 of the Boards is taken.

**Year Three:** By January of the third year, a thesis lab should be identified and all paperwork should be completed (affiliation form completed and copy of student’s academic record including application transferred to the Neurobiology Department Office). Student’s stipend is supplemented by PI/PI’s primary department at time of affiliation.

**Year Four:** Qualifying Examination must be completed within one year of laboratory/program affiliation. This is a graduate school rule and graduate school registration for the following semester may be held up if this requirement is not fulfilled in a timely manner. Typically this will be fulfilled before the spring semester of the fourth year.

**Year Five:** The Thesis Prospectus must be approved and submitted to the Graduate School by the end of the second year of laboratory/PI affiliation. Typically, this is by the end of the fall semester of Year five. Registration for the following semester may be held up if this requirement is not fulfilled in a timely manner. The Thesis Committee approves the prospectus, and the required paperwork is then delivered to the Neurobiology Department Office by the student. The Neurobiology Department Office will then complete the Admission to Candidacy paperwork and submit it to the Graduate School. The Prospectus must be submitted to the Graduate School at least six months before the dissertation is submitted.
Year Six: Typically an MD-PhD student will complete and defend the dissertation at the end of the fall semester or the beginning of the spring semester. We require that MD-PhD students defend their dissertations before returning to fulfill the remaining Medical School requirements.

Year Seven: Student completes all remaining requirements and graduates in May.

While this is considered a guideline for a typical MD-PhD student, we recognize that not every student will follow this path. Any digression from this timeline must be discussed and approved by the DGS, with appropriate notes to the student’s file and copies to the MD-PhD Office. Continued participation in the Neurobiology Graduate Program is subject to the satisfactory completion of requirements in a timely fashion and if any question arises about the satisfactory progress of a student and the qualifying examination committee or the thesis committee cannot agree on an appropriate resolution, then the Neurobiology Graduate Program Executive Committee will have the authority of the Neurobiology Department Faculty to determine a course of action.

Pharmacology

Director of Graduate Studies: Elias Lolis

Course Requirements (5):
Graduate students are required to take PHAR 504a Principles in Pharmacology, a two-semester seminar course PHAR 502a/b or equivalent from another department, and two of the three other Pharmacology courses in the curriculum. These three courses are, PHAR 528a Principles of Signal Transduction, PHAR 529b Structural Pharmacology and PHAR 550a Physiological Systems; PHAR 560b Cellular and Molecular Physiology: Molecular Machines in Human Disease may be substituted for PHAR 550a. The Graduate School requires a grade of Honors in two of these courses, which does not include the seminar course. Courses taken during the first two years of medical school in the Departments of Pathology, Cell Biology, Genetics, Physiology, and Pharmacology will count towards the student's Honors and course requirements, provided the student has registered to receive a graduate grade in the course.

Laboratory Rotations: Two rotations (PHAR 506a/b) are required. Rotations in another department/program will count towards this requirement upon approval of the Director of Graduate Studies.

Teaching Requirements: MD-PhD students are required to TA one semester.

Qualifying Exam: MD-PhD students must complete their qualifying exam before the end of their first year as an affiliated graduate student. Thus, if the student affiliates at the customary point of year 3.5 (beginning of the spring semester of the third year of matriculation at Yale), they must complete the exam by registering for the spring semester of the fourth year at Yale. The nature of the qualifying exam in Pharmacology is posted at http://info.med.yale.edu/pharm.

Prospectus: MD-PhD students must complete and submit their thesis prospectus by the end of the second year as an affiliated graduate student. The Director of Graduate Studies will work with the student to ensure an optimal thesis committee. The nature of the Prospectus in Pharmacology is posted at http://info.med.yale.edu/pharm.

Admission to Candidacy: MD-PhD students are required to have been admitted to candidacy by the end of the second year as an affiliated graduate student. Generally, the submission of the thesis prospectus is the final requirement for admission to candidacy. Paperwork for both candidacy and the thesis prospectus is submitted to the Graduate School at the same time.
Other Requirements:
All graduate students who are admitted to candidacy are required to have at least one thesis committee meeting per year. All graduate students are required to give a student research presentation annually and are expected to attend rotation/student research talks and Departmental seminars. Prior to registering for a second year of study as a graduate student, students must successfully complete PHAR 580, Responsible Conduct of Research. In addition, two lectures from PHAR 580b and one lecture from B&BS 503b RCR Refresher for senior students, must be completed prior to end of the fourth year as an affiliated graduate student.

Affiliation Requirement:
For affiliation with the Pharmacology Department, copies of the student’s application to the MD-PhD Program, and the student’s current transcript must be submitted to the DGS of Pharmacology.

Public Health
Director of Graduate Studies: Christian Tschudi

All MD-PhD students must meet with the Director of Graduate Studies (DGS) in Public Health (PH), if they are considering affiliating with PH. Students in this program are expected to meet the guidelines listed below in the timeframe outlined. The Director of Graduate Studies must approve any variations to these requirements.

Teaching: One term of teaching will be required. If students teach beyond this requirement, they can be compensated. If a student has served as a teaching fellowship elsewhere on campus, this experience may be counted toward the requirement. DGS approval is required to waive the teaching requirement on the basis of previous Yale teaching experience.

Rotations/Internships: Students should do two research rotations/internships with potential advisors in PH. These short-term research projects will be with a specific Principal Investigator and can either be in a lab, or field work, or analysis of an existing dataset. The purpose of these rotations/internships is to learn lab technique and/or to allow the student time to determine if the PI’s research interests are compatible with his/her research interests. These rotations/internships are usually done during the summer between the first and second years of medical school course work. In some cases students may need to defer this requirement until the summer after the second year after taking certain courses and/or completing readings so that he/she possesses the background necessary for a successful rotation/internship.

Required Coursework: MD-PhD students are generally expected to take the same courses as traditional PhD students. Departmental requirements may vary; therefore students should confer with the DGS and their PhD advisor.

Timeline for Qualifying Exam: Students generally will take medical school courses in years one and two. Students can take PH doctoral courses in years one and two before they affiliate if scheduling allows. Once affiliated with the PH program, students will complete all course requirements for the department. This generally takes a minimum of two terms but can take up to four terms after affiliating with PH. The qualifying exam is commonly completed after the fourth term of affiliation with the PhD program in PH but can sometimes be done earlier with approval of the PhD advisor and DGS.

Prospectus Timeline: Following completion of the qualifying exam, students should focus on the prospectus, which has to be approved by the PH Graduate Studies Executive Committee (GSEC) before the end of their 6th term as an affiliated PhD student in PH.
Admission to Candidacy: To be admitted to candidacy, students must: (1) satisfactorily complete the course requirements for their department as outlined above, achieve grades of Honors in at least two full-term courses, and achieve an overall High Pass average; (2) obtain an average grade of High Pass on the qualifying exam; and (3) have the dissertation prospectus approved by the Graduate Studies Executive Committee. All PhD students must be admitted to candidacy before the start of the fourth year in the PhD program (i.e., before the start of the 7th term).

Sociology (2014)
Director of Graduate Studies: Ron Eyerman & Jeffrey Alexander

Outline of Graduate Program

Year 1
Semester 1                          Semester 2
Stat 1                              Stat 2
Theory                              Elective
Logic of Emp. Soc. Research         Elective
Elective                            Elective
Pro-Seminar (audit, no credit)      Workshop (ok to audit)

Year 2
Semester 3                          Semester 4
Elective                            Elective
Workshop/Elective*                  Workshop/Elective*
Research Paper Preparation          Research Paper Revision
[audit classes not previously offered]

*one workshop required for credit during 2nd year (to complete research paper)

Year 3
Semester 5                          Semester 6
Teaching Fellowship                 Teaching Fellowship
Field Exam                           Thesis Prospectus

Year 4
Teaching Fellowship and Dissertation Research/Writing

Year 5
Dissertation Fellowship and Dissertation Research/Writing

Subsequent Years
Dependent on Student Progress and Available Funding

Course Requirements: 12 seminars to be completed in years 1 and 2. Four required courses and eight electives, including at least one workshop.

Statistics I. This course provides an introduction to probability theory, sampling theory, distribution and measurement theory, linear regression and the general linear model.

Statistics II. This course provides training in multivariate methods including event history analysis, models with categorical and ordinal dependent variables, models for censored and sample selected data.

Theory. This course will be taught by a rotating group of faculty. Rather than specializing in one or another theorist or perspective, it will survey theoretical ideas from classical to modern to contemporary debates.
The course may be organized around themes, or consider significant theorists one by one. It will provide a synthetic overview of conceptual issues and ways of thinking that mark the sociological imagination.

**Logic of Empirical Social Research.** This course focuses on broad strategies and issues in empirical research rather than on methodological techniques as such. It considers questions of causality, explanation, the relation of theory to research, problems of data interpretation, and research design.

**Proseminar:**
Offered during the first semester on a weekly or biweekly basis, students will be presented with the full range of current faculty work. Very little student preparation will be required, and no examinations or papers.

**Workshops:**
One semester of workshop is required; no more than two semesters of workshop can be taken for credit. Credit will be conferred if students do the full range of readings and develop a final paper. Students are encouraged at least to audit workshops outside their specialties.

**Social Networks and Biosocial Science.**

**Non-Course Requirements:**

**Research Paper:** In addition to finishing the course requirements, which should be no more than four courses in the second year, the student’s second year focus will be on formulating, researching, writing, presenting, and revising an extended paper. This paper will be supervised by a committee of two faculty members, the chair of which will be the student’s Academic Advisor (see below). Initial discussion of this paper begins at the conclusion of the second semester, and a proposal will be formally developed at the beginning of the third semester. A draft of this paper must be presented in a Workshop in the course of the second year. After receiving feedback from Workshop participants, and the Workshop’s faculty organizers, students will revise the paper in consultation with their committee, who will evaluate it by the end of the fourth semester.

**Important** – students should be responsible for having the Research Paper Requirement signed by the committee and then the student should return it to Nancy.

The aim of this second year Research Paper is to kickstart the process of writing for publication. This paper should identify a theoretical controversy, methodological problem, or empirical puzzle. By making use of systematically generated evidence -- whether gained from theoretical argument, secondary literature, or survey, archival, interview, or participant observation data -- the student should adjudicate between these theoretical claims, address the methodological problem in a new way, or solve the empirical puzzle. Primary research will not be expected. The result of this effort will not necessarily be itself a publishable paper, but it will be a significant step towards this goal. Limited to around 30 pages, it will represent a reasonable product of one year’s part-time work.

The second year Research Paper may or may not be related to the student’s subsequent graduate work.

**Field Exam:** One Field Exam must be completed by the end of the 5th semester. In order to delimit the reading and preparation required, we suggest a “20/20” limit, i.e., 20 listed articles or books and twenty written pages. Rather than covering a generic field, this exam will be thematically focused. Students will identify some centrally important theme or controversy in contemporary sociology, for which some command over the literature in the broader field is assumed. For example, rather than “political sociology,” “stratification,” or “cultural sociology,” an important controversy will be addressed within or between such fields.

The field exam will be evaluated similarly to the Second Year Paper, by a committee of two faculty members, composed of the student’s Academic Advisor and another faculty member chosen in consultation with the student. An oral examination will be required. **Important** – students should be responsible for having the Report of Field Exam Committee form signed by the committee and then the student should return it to Nancy.

**Dissertation Prospectus:** No later than the beginning of the sixth semester, students will be required to appoint the Chair and two other members of the dissertation committee. By the end of the sixth semester, the student will be expected to defend the Dissertation Prospectus in an oral examination. If students do not pass this defense, they must retake the exam in the beginning of their fourth year (the seventh semester). The Prospectus should include (a) statement of the research problem, (b) elaboration of how the candidate will go about solving
the problem, i.e. research design or equivalent, (c) discussion of sources or data to be used and, if appropriate, the methodology, (d) an outline of the planned chapters.

Dissertation research: While students are expected to take their prospectus exams by the end of their third year – and to pass this exam no later than the beginning of their 4th year -- we recognize that student progress through the subsequent, dissertation phase of the program will be variable. Graduate School funding after the fifth year is not guaranteed, but teaching fellowships are sometimes available, as are funds for dissertation research, awarded on a competitive basis by national and international agencies.

The dissertation represents a test of the candidate’s ability to select and carry out a major research project of professional quality. It should show the student’s mastery of the field of specialization, and it must demonstrably contribute to the body of sociological knowledge. The evaluation of the dissertation by the faculty is not a matter of whether or not the prospectus, as approved, was carried out. Rather, it is an independent assessment of the quality and intellectual contribution of the completed research itself as reported in the dissertation.

When a student is ready to submit the dissertation to the Graduate School, they should request a copy of the Dissertation Guidelines from the Graduate School Dissertation Office, 141 HGS (phone #432-0461) or barbara.withington@yale.edu. In addition to the three copies of the dissertation required by the Graduate School, one copy should be submitted to Nancy Hopkins, once the dissertation is accepted.

Mentoring and Advising:

The DGS will be the “general advisor” for entering first year students, and will continue to be responsible for monitoring students’ progress through the program through the Dissertation Prospectus exam. However, during their first year students may request, after consulting with the DGS, an Academic Advisor, who will replace the DGS as the student’s academic mentor. By the end of the second semester, students will, in fact, be required to designate such an Academic Advisor, if they have not done so before.

The Second Year Paper will be supervised by a two-person committee. The chair will be the student’s Academic Advisor, the second member a faculty member chosen by the student in consultation with his or her advisor. This committee will make the final decision about whether the Second Year Paper is accepted. The same procedure will apply to the Field Exam, although the composition of the faculty committee can be changed at the student’s request.

Faculty will meet at the conclusion of every Spring semester to evaluate the progress of graduate students. The DGS will conduct this meeting, and will consult with students’ Academic Advisors in preparation.

Each semester, the DGS will conduct at least one “Professional Development Workshop,” in conjunction with other relevant faculty. These will cover requirements for the graduate program, such as Second Year Papers and Field Exams. They will also address the preparation and submission of professional papers, applying for research grants, and job market issues.

Waivers: Students entering the program with Masters Degrees will be eligible for two courses of reduction, though this is by no means automatic. These reductions may apply to electives or to the statistics requirements, but may not apply to Theory or The Logic of Inquiry.

Joint degrees: Special arrangements will be worked out for students enrolled in joint Ph.D. or professional programs.

Incompletes: Arrangements between students and instructors concerning incomplete work are constrained by deadlines set by Graduate School regulations: in a single term, only one TI is permitted. Temporary Incompletes received in an academic year must be converted to final grades by October 1 of the following academic year. If a grade is not received by the Graduate Registrar by this date, a TI will be converted to a permanent Incomplete (I) on the student’s record.

Teaching Fellowships: Serving as a Teaching Fellow or Part-Time Acting Instructor after the second year of full-time study is viewed as an integral part of the graduate education. The Graduate School requires that all students teach in each semester of their 3rd and 4th years unless no teaching positions are available in the department or if the student has research obligations elsewhere (in which case they can register in absentia and defer their teaching positions). Every effort is made to provide teaching positions within the Sociology
Department, but if positions are not available, students may be asked by the Teaching Fellow Program office to fulfill their teaching obligations in other departments in the University.

**M.A. and M.Phil. Degrees:** After completing one year of the program leading to the Ph.D. degree, the student may make application for the Master of Arts degrees. Two of the eight term courses required for the M.A. must include statistics and theory. A grade of High Pass or above must be achieved in five of the eight required courses. A student may petition for the M.A. degree in the semester following the completion of the requirements.

After all requirements for the Ph.D. degree have been met except submission of the prospectus and the writing of the dissertation, and after at least one year of academic resident graduate study at Yale, the student will be eligible for the Master of Philosophy degree.

**Degree Applications:** It is the responsibility of each qualified student to petition the Graduate School for the M.A., M.Phil., and Ph.D. degrees at the appropriate times (see Yale University Graduate School bulletin *Programs and Policies*). Before doing so, students should consult with the DGS to make sure that they have satisfied all requirements and that their files are in order.

**Leave of Absence:** See the Graduate Bulletin, *Programs and Policies.*

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**Graduate Programs and Faculty Research Interests at Yale for MD-PhD Students**

**Biomedical Engineering**

Students in the Biomedical Engineering Doctoral Program explore problems of human health and biomedical science using the tools and methods of modern engineering. Faculty in the department work in the areas of bioimaging and biomolecular engineering, including drug delivery and tissue engineering. Faculty research interests are broad and span investigators working on the North and South campuses. The Biomedical Engineering doctoral program seeks to develop students' research independence and creativity while strengthening their technical background. The excellent student-to-faculty ratio ensures ongoing interaction between students and faculty. Research and teaching focuses on a fundamental understanding of biomedical engineering problems. Doctoral studies in Biomedical Engineering consist of two years of course work and of original research. Areas of specialization reflect the research interests of faculty members. Students participate in research starting in their first year by way of two one-term research projects called "Special Investigations." Graduate students do their research in state-of-the-art facilities at the Yale School of Medicine and the Faculty of Engineering. Course work is typically required during the first two years in residence.

**Faculty Research Interests**

- **Joerg Bewersdorf**, Fluorescence imaging technology, visualizing 3D structure and dynamics at the molecular scale, new fluorescence microscopy techniques with spatial and/or temporal resolutions exceeding far beyond current technology, applications to a diverse set of biological questions.

- **Stuart Campbell**, Integrative cardiac muscle physiology and pathophysiology; mechanotransduction and remodeling in cardiac tissue; combining live cell imaging, magnetic resonance imaging, and multi-scale computational models to understand how genetic mutations lead to cardiomyopathies.

- **Richard E. Carson**, Positron Emission Tomography (PET); image reconstruction; mathematical models for novel radiopharmaceuticals; applications of PET tracers in clinical populations and preclinical models of disease, including addictive disorders, diabetes, Alzheimer’s disease, epilepsy, and cancer.

- **Michael A. Choma**, Optics, biomedical optics, optical coherence tomography, high-speed optical imaging, novel lasers, pediatric disease, respiratory disease, cilia-driven fluid flow, heart development. The overall impact of our work is two-fold. First, we are developing fundamental optical technologies for widespread use in biomedical optics. Second, the hypotheses that we test support new ways of diagnosing, understanding, and treating pediatric disease. We have a particular focus on pediatric respiratory disease and congenital heart disease.
Nicholas Christakis, Quantitative analysis of networks; social network structure and function; evolutionary biology of human social interactions; mixing autonomous agents with human systems to effect behavior change; development of virtual social environments and model systems; computational models of social systems; field trials of network targeting algorithms.

Robin A. de Graaf, NMR spectroscopy methods to measure metabolic pathways in animals and humans in vivo; cerebral energetics and neurotransmitter metabolism during increased neuronal activation; NMR spectroscopy and imaging methods for applications at very high magnetic fields

James S. Duncan, Biomedical image analysis and processing; development of algorithms and strategies to derive quantitative information from images to understand normal and abnormal function/structure and diagnose/predict disease; Current projects include estimation of left ventricular strain from 4D echocardiography, study of brain function/structure in Autism Spectrum Disorder from Magnetic Resonance Imaging (MRI), machine learning approaches to classify tissue and predict outcome from multiparameter MRI in brain, prostate and liver cancer, particle tracking methods to quantify vesicle motion from total internal reflection fluorescence microscopy (TIRFM).

Tarek Fahmy, development and characterization of novel biomaterials for modulating and detection of immune responses both in vitro and in vivo; biomaterials for targeted therapy and diagnostics in cancer, autoimmune and transplant disease state; demonstration of the application and efficacy of new biosystems in drug delivery, MRI, CT, SPECT imaging of immune cells in normal and disease conditions.

Rong Fan, development of microchip technologies for single-cell proteomics, epigenomics, and transcriptomics, with applications to diagnosis and therapeutic stratification of human cancers and autoimmune diseases.

Anjelica Gonzalez, Development of biomaterial based technology for investigation of immunological processes and disorders.

Karen Hirschi, A primary interest is to understand, at the cellular and molecular level, the events leading to blood vessel formation. Interested in the regulation of vascular cell commitment, differentiation and cell cycle progression, and defining signaling pathways that modulate these processes. Understanding how some vascular cells acquire specialized functions, such as the generation and/or maintenance of multi-lineage stem/progenitor cells.

Jay Humphrey, Vascular mechanics and mechanobiology; mathematical simulation of vascular remodeling, disease progression, and responses to clinical intervention; genetic basis of arterial stiffness; aortic and cerebral aneurysms; hypertension; tissue engineered vascular constructs.

D. S. Fahmeed Hyder, Present MRI practices in functional and molecular imaging suffer from compromising quantitative accuracy for spatial resolution, resulting in loss of specificity to diagnose function and disease. Furthermore present generation agents (e.g., iron oxide nanoparticles) for enhanced MRI contrast is usually incompatible with other modalities (e.g., MRS), limiting the power of noninvasive multi-modal scanning. We are innovating high-resolution biomedical theranostic imaging methods – which is at crossing points of bioengineering, material science, physics – that provide quantitative measures of brain function, physiology, and chemistry with emphasis on cancer imaging which is compatible with translational methods being used for diagnostics.

Themis R. Kyriakides, Analysis of the cellular and molecular events that occur at the interface between implanted biomaterials and tissues. Areas of basic research include biomaterial-induced inflammation, wound healing, tissue regeneration with a focus on angiogenesis, and extracellular matrix remodeling. In vivo work involves genetically-modified mice. Areas of applied research include gene delivery from biomaterials, development of biodegradable polymers, modification of glucose sensors, and development of artificial skin.

Andre Levchenko, combining novel experimental techniques with computational models to learn about the interactions of proteins and cells in healthy and disease states. Systems Biology; Signal Transduction and Cell-Cell Communication; Cell Decision Making; Microfluidics and Micro-and Nano-fabrication; Stem Cell Engineering.

Chi Liu, Development of quantitative PET/CT and SPECT/CT imaging techniques for cardiac and oncology applications; respiratory and cardiac motion correction; quantitative image reconstruction; translational molecular imaging.
Kathryn Miller-Jensen, Analysis of intracellular signal transduction dynamics in response to viral infection. Application of genetically-engineered viral vectors to study viral infection, and development of systems-level experimental and computational methods for monitoring protein networks. Current interests include how proteins expressed in early-stage HIV infections establish a pathogenic state in cells of the immune system, and how latent HIV can be reactivated to purge chronic infections.

Evan Morris, PET imaging of disease with novel tracers and novel methods of analysis. Kinetic modeling of injected tracers and contrast agents, receptors and neurotransmitters. Applications to addictions research, depression, oncology, other diseases. Preclinical (animals) and clinical (human) imaging. Parameter estimation to create parametric images of the brain and body. Inventing new ways to visualize and interpret image data.

Michael Murrell, Developing tools inspired from synthetic biology and soft matter physics to design and engineer novel biomaterials that mimic the mechanical behaviors living cells, including cell adhesion, division and migration. We hope to understand the mechanobiology of cell behavior through the ‘bottom-up’ assembly of non-living cells, in addition to identifying new design principles from biology which can be used to create novel technologies.

Laura Niklason, vascular biology and cardiovascular tissue engineering; vascular tissue engineering, adult stem cell differentiation into cardiovascular phenotypes, cardiac tissue engineering, biomimetic culture conditions for cardiovascular tissues, and vascular remodeling.

Xenophon Papademetris, Development of image analysis methodology for the automated quantification of three-dimensional images and image sequences with applications to whole organ segmentation, fat quantification in whole body mouse imaging, non-rigid brain registration and non-rigid motion/deformation analysis.

Douglas L. Rothman, Development of magnetic resonance spectroscopy and magnetic resonance imaging methods to image metabolic and neurotransmitter pathways non-invasively in humans and in animal models.

W. Mark Saltzman, Biomaterials and drug delivery, drug delivery to the brain, nanotechnology and drug delivery for cancer, drug delivery for women’s health, vascular tissue engineering.

Martin Schwartz, Mechanotransduction in the vascular system; including fluid shear stress sensing, mechanotransduction by integrins, matrix and vascular remodeling.

Fred J. Sigworth, Ion channel proteins: structural studies by cryo-EM imaging and statistical image analysis; functional studies by patch-clamp recording.

Brian Smith, Hematopoietic cell-cell interactions at the inflammation-coagulation interface, transfusion medicine bioengineering for improved storage, laboratory diagnostics.

Lawrence Staib, Biomedical image analysis, processing, quantification and measurement; models for the analysis of structure and function; imaging biomarkers; applications in brain, cardiovascular and cancer imaging.


Steven Tommasini, understanding the complementary contributions of bone mass, geometry and tissue material properties to whole-bone structural behavior.

Paul van Tassel, understanding, predicting, and controlling the incorporation of biomolecular or biomimetic entities onto or within synthetic materials.

Corey Wilson, Goal of our research is to establish an integrated experimental and computational framework to translate our understanding of the fundamental principles of biophysics and biochemistry (i.e., the physicochemical properties that confer function) into useful processes, devices, therapies, and diagnostics that will benefit society.

Jiangbing Zhou, Nanotechnology for systemic drug delivery to the brain, Nanomedicine for stroke and traumatic brain injury, Stem cell engineering, De novo design of functional protein nanoparticles, Brain cancer stem cells.

Steven W. Zucker, Computational and biological vision, computational neuroscience, computational biology.

Cell Biology The Graduate Program in Cell Biology offers students outstanding opportunities for research and training leading to the Ph.D. degree. Reflecting the truly multidisciplinary nature of cell biology today, students in
the program engage in independent research on a broad spectrum of exciting topics concerned with cellular structure, function, development, and organization in complex systems, with particular emphasis on molecular mechanisms and relevance to human diseases. Topics and fields include membrane traffic and protein sorting, membrane fusion, organelle biogenesis, epithelial cell polarity, neuronal synapse formation and function, neural circuit development, cell biology of protozoan parasites and of pathogen/host interactions, cell biology of the immune response, mRNA biogenesis and localization, RNA folding, non-coding RNAs, stem cells and cell fate control, the cytoskeleton, nuclear structure and dynamics, DNA nanostructures, cellular signaling and motility, cytokinesis. The curriculum is rigorous and comprehensive, providing in-depth exposure to the wide range of methodological approaches used by contemporary cell biologists, from molecular genetics and structural biology to functional genomics and state-of-the-art cellular imaging. Yet it is flexible as well to accommodate the individual interests and needs of students. Collaborative research is fostered by a highly interactive community of students, postdocs, faculty, and staff, and by communal research facilities. The overall goal of the program is to provide students with the skills for independent, critical, and creative thinking necessary for successful future careers as scientists.

**Faculty Research Interests:**
(*Primary Appointment) [http://info.med.yale.edu/cellbio/](http://info.med.yale.edu/cellbio/)

**David Baddeley,** Assistant Professor.  Microscopy, super-resolution.

**Joerg Bewersdorf,** Associate Professor.  Super-resolution fluorescence microscopy and its cell biological application

**Jonathan Bogan,** Associate Professor.  Cell biology of metabolic regulation

**Christopher Burd,** Professor.  Assembly and maintenance of the endomembrane system.

**David Calderwood,** Associate Professor.  Signal transduction involving integrin adhesion receptors.

**Michael Caplan,** Professor.  Epithelial cell polarity and genetic disease of the kidney

**Topher Carroll,** Assistant Professor.  Nuclear organization and chromosome biology.

**Jonathan Bogan,** Associate Professor.  Cell biology of metabolic regulation

**Christopher Burd,** Professor.  Assembly and maintenance of the endomembrane system.

**David Calderwood,** Associate Professor.  Signal transduction involving integrin adhesion receptors.

**Michael Caplan,** Professor.  Epithelial cell polarity and genetic disease of the kidney

**Topher Carroll,** Assistant Professor.  Nuclear organization and chromosome biology.

**Daniel Colón-Ramos,** Associate Professor.  Development of neural circuits

**Lynn Cooley,** Professor.  Cell biology of Drosophila oogenesis, actin cytoskeleton regulation

**Peter Cresswell,** Professor.  Molecular mechanisms of antigen processing

**Pietro De Camilli,** Associate Professor.  Neuronal cell biology, membrane dynamics, neurodegeneration

**Eric Dufresne,** Associate Professor.  Mechanics of cells and tissues

**Shawn Ferguson,** Associate Professor.  Lysosomes, membrane traffic and neurodegenerative disease

**Jorge Galán,** Professor.  Molecular mechanisms of bacterial pathogenesis

**Shangqin Guo,** Assistant Professor.  Mechanisms of cell fate control, hematopoiesis.

**Fred Gorelick,** Professor.  Cell biology of pancreatitis and protein transport in gastrointestinal epithelial cells

**Carl Hashimoto,** Professor.  Assistant Dean, Yale College & Graduate School

**James Jamieson,** Professor.

**Megan King,** Associate Professor.  Mechanical communication between the cytoplasm and nucleus

**Diane Krause,** Professor.  Self-renewal and differentiation of hematopoietic stem cells, mechanisms of leukemogenesis

**Thomas Lentz,** Emeritus Professor.

**Chenxiang Lin,** Associate Professor.  Engineering DNA-nanostructure-based molecular tools for biological study.

**Haifan Lin,** Professor.  Stem cells, translational regulation, epigenetic programming

**Patrick Lusk,** Associate Professor.  The organization and function of the nuclear envelope barrier in aging and disease

**Vincent Marchesi,** Professor.  Regulation of cell division

**Malaiyalam Mariappan,** Assistant Professor.  MembraneProtein quality control and Unfolded protein homeostasis, targeting, insertion, assemblyresponse.

**Thomas Melia,** Associate Professor.  Membrane fusion, autophagy

**Mark Moeseke,** Professor.  Molecular mechanisms of cytoskeletal structure, motility and assembly

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Cellular & Molecular Physiology The Graduate Program in Cellular and Molecular Physiology at the Yale University School of Medicine is an intensive course of study leading to the Ph.D. degree. The Program is intended to prepare individuals for productive careers in research and teaching. There is a broad range of research interests with particular emphasis on membrane transport processes and on cellular and molecular aspects of cellular regulation and neurobiology. Individual laboratories specialize in the biophysics, biochemistry and/or molecular biology of ion channels; active transport in epithelia and isolated cells; membrane protein targeting; muscle activation; hormone-receptor interaction and second messenger pathways; developmental neurobiology; organ physiology; and the neurophysiology of learning. Among the techniques currently in use are a wide range of electrophysiologic methods including single channel recording; molecular cloning and DNA transfection; transgenic mouse production; light, electron and confocal microscopy; dynamic fluorescent imaging; renal tubule perfusion; and membrane biochemistry. Resources include core facilities for tissue culture, molecular biology and biochemistry, light and electron microscopy, as well as a professionally staffed electronics and machine shop.

Faculty Research Interests:  http://info.med.yale.edu/cmphysiol/

Sviatoslav Bagriantsev, Sensory physiology; Biophysics; Biochemistry; Neuroscience; Electrophysiology; Polymodal ion channels; Temperature-sensitive ion channels; Mechanosensitive ion channels; Two-pore potassium channels; Ion channel pharmacology.

Cecilia Canessa, Structure-function and Regulation of Ion Channels from the ENaC/Degenerin Family.

Michael Caplan, Ion pumps in polarized epithelia: Sorting and function; Polycystic Kidney Disease.

Jean-Ju Chung, Ion Channels and Membrane Receptors in Mammalian Fertilization and Reproduction

Lawrence B. Cohen, Protein Sensors of Voltage and Calcium; Multi-cell Optical Monitoring of Action Potential Activity during Simple Behaviors.

Guillaume De Lartigue, We are studying the role of gut-brain signaling in the control of food intake. Specifically we are looking at the cellular mechanisms that get dysregulated in this sensory neural pathway in obesity, and developing novel electrical, pharmacological, and genetic methods to target these peripheral gut-brain neurons to reverse obesity.

Biff Forbush, Epithelial Ion Transport; Molecular Physiology of Na-K-Cl Cotransporter.

Elena Gracheva, Sensory physiology, molecular adaptations, hibernation, thermoregulation, ion channels, neuroscience.

Erdem Karatekin, Membrane fusion, exocytosis, secretory vesicle dynamics, fluorescence microscopy, image analysis, microfluidics, supported bilayers, proteoliposomes.

Michael N. Nitabach, Genes, Clocks, and Neurons: Molecular Genetics and Systems Physiology of Animal Behavior.
Vincent A. Pieribone, Physiological, Structural and Molecular Analyses of the Pre-Synaptic Vesicle Release Machinery in Individual Synapses.

Jesse J. Rinehart, Kinase/Kinome Interactions and Targeted Phosphoproteomics in Physiological Systems.

Fred J. Sigworth, Single-Particle Imaging in Electron Cryo-Microscopy and Patch-Clamp Recording to Study Ion Channel Function.

Satinder K. Singh, Structural Biology of Neurotransmitter Transporters.

Clifford L. Slayman, Proton Pumps, Proton-coupled Potassium Transporters and Potassium Channels.

Carson Thoreen, Our lab studies how the translation of mRNAs adapts to changes in the cellular environment (e.g. nutrient deprivation) and seeks to understand how these mechanisms contribute to normal and disease physiology.

Susumu Tomita, Revealing Molecular Mechanisms for Synaptic Strength Regulation.

David Zenisek, Physiology and Cell Biology of the Presynaptic Terminal.

Secondary Appointees:

Nii A. Addy, Neurobiology of addiction; In vivo electrochemistry; Behavioral pharmacology; Systems neuroscience; Neurotransmission; Signal transduction.

Nadia Ameen, Apical endocytosis and exocytosis; Protein traffic; Secretory diarrhea; Cystic fibrosis.

Peter S. Aronson, Molecular Mechanisms of Sodium Chloride and Bicarbonate Transport in the Kidney.

Angelique Bordey, Function of Glial Transporters at Gabaergic Synapses.

Thomas Brown, Synaptic Transmission, Neuronal Plasticity and Mechanisms of Memory.

Stuart Campbell, Biophysics, cell biology, tissue engineering and computational modeling.

Lloyd G. Cantley, Epithelial Morphogenesis.

Ivan De Araujo, We investigate the identity of the neural pathways mediating nutrient sensing within brain reward circuitries.

Marie Egan, Regulation of Ion Transport across The Airway Epithelia.

Barbara Ehrlich, Mechanisms of Intracellular Calcium Release.

Anne Eichmann, Vascular development and angiogenesis; guidance of vascular patterning; tip cells; axonal growth cones; vascular growth factors in the nervous system.

John P. Geibel, Optical Monitoring of Ion Transport Mechanisms in Epithelia.

Shuta Ishibe, Our laboratory is interested in defining the mechanism of proteinuria by studying podocytes, which are specialized cells that line the capillary loops and play a key role in maintenance of the glomerular filtration barrier.

Leonard K. Kaczmarek, Long-Lasting Changes in Neural Activity.

Richard G. Kibbey, Diabetes Mellitus Type 1 and Type 2.

George Lister, Study of factors affecting risk of infants for SIDS.

Pramod Mistry, Molecular mechanisms, phenotypic diversity and therapies of Gaucher disease in large patients populations and mouse models.

Patricia Preisig, Acid-Activated Signaling Pathway that Mediates the Physiological Response of the Renal Proximal Tubule to the Kidney's Need to Excrete Acid.

Mark Saltzman, CNS Drug Delivery and Tissue Engineering.

Joseph Santos-Sacchi, Auditory Physiology.

Gerald I. Shulman, Intermediary Metabolism in Humans.

Carolyn W. Slayman, Molecular Genetics of Cation Transporters.

Eid Tore, My laboratory uses a translational research approach to investigate the role of astrocytes, brain metabolism and gut microbiota in the causation of epilepsy.

Alda Tufro, podocyte biology, glomerular development and disease, specifically, molecular mechanisms in nephrotic syndrome and diabetic nephropathy.

Fred S. Wright, Ion Transport in Single Renal Tubules.

Xiaoyong Yang, Nutrient Sensing; Circadian Rhythms; Metabolism; O-GlcNAc Modification; Nuclear Receptors; Diabetes; Cancer; Aging; Systems Biology.

Lawrence Young, Cellular and Molecular Mechanisms of Metabolic Adaptation to Myocardial Ischemia.
Z. Jimmy Zhou, Visual System Physiology and Development; Synaptic Physiology of the Mammalian Retina; Neural Network Computation.

Chemistry Yale's Department of Chemistry offers a wide-ranging program of study and research leading to the Ph.D. degree. The program is supervised by approximately thirty-five faculty members working in six areas: Organic, Inorganic, Biophysical, Physical, Theoretical, and Chemical Biology. Students whose interests overlap two or more of these areas are encouraged to develop a special program of study for themselves. In addition, students may develop programs of study in conjunction with other University departments such as Molecular Biophysics and Biochemistry, Molecular Cellular and Developmental Biology, or with other schools within the University such as the School of Medicine. The Department is located primarily in Sterling Chemistry Laboratory and Chemistry Research Building on Yale's Science Hill as well as on West Campus.

Faculty Research Interests: http://www.chem.yale.edu/
Sidney Altman, Professor; Investigating the function of a new antibiotic that is made up of a basic peptide, derived from human T cells, that is covalently linked to a morpholino oligonucleotide that targets any specific gene inside cells.
Victor Batista, Professor; The development of rigorous and practical methods for simulations of quantum processes in complex systems as well as with applications studies of photochemical processes in proteins, semiconductor materials, and systems of environmental interest.
Richard Baxter, Assistant Professor; innate immunity in arthropods, host-pathogen interactions, and the development of new chemical entities for the control of vector-borne disease.
Gary Brudvig, Professor; photosystem II; EPR spectroscopy; metalloproteins; artificial photosynthesis.
Robert Crabtree, Professor; design and synthesis of inorganic, coordination, or organometallic molecules, often with multifunctional ligands, for solar energy and energy storage as well as green chemistry applications.
Jason Crawford, Assistant Professor; Small molecule signaling in host-microbe interactions
Craig Crews, Professor; Through natural product total synthesis, affinity reagent generation and biochemical methodologies, the Crews lab identifies natural product target proteins, which serve as the starting point for the rapid development of additional efficacious compounds. In addition, we have recently developed a new chemical genetic strategy (ProTacs) for the identification of key components of intracellular processes using small molecules.
Jonathan Ellman, Professor; The development of efficient new synthetic methods and the design and development of chemical tools to study enzymes
Ziad Ganim, Assistant Professor; Development of spectroscopic tools to study fundamental chemistry at the single molecule level, with applications to enzymes, catalysis and charge transfer
Nilay Hazari, Assistant Professor; Development of homogeneous transition metal complexes for the catalytic synthesis of fine and commodity chemicals.
Seth Herzon, Associate Professor; Synthesis and mechanism of action studies of complex antiproliferative natural products.
Patrick Holland; Professor; The Holland group studies compounds containing inexpensive metals like iron and cobalt, with the goal of understanding their reactions in detail and increasing their potential for use in catalysis.
Francesco Iachello, Professor; Our research efforts strive to develop and exploit advanced mathematical methods (algebraic methods) as a means of attacking problems of current interest in Physical Chemistry.
Mark Johnson, Professor; Capture and spectroscopic characterization of catalytic reaction intermediates using cryogenic ion chemistry: From instrument design to theoretical analysis of non-trivial anharmonic effects.
William Jorgensen, Professor; computer-aided drug design and organic synthesis for anti-HIV, anti-cancer, and anti-inflammatory agents.
J. Patrick Loria, Professor; Solution NMR studies of protein conformational motions.
James Mayer, Professor; Fundamental studies of redox reactions from coordination chemistry to nanoscale oxides to physical organic chemistry, with relevance to energy challenges and biochemical processes.
Scott Miller, Professor; Development of new methods for the synthesis and derivatization of complex molecules, involving reaction design, development, and application. A major focus of the lab is catalysis

Anna Pyle, Professor; Structure and function of nanomechanical proteins and large RNA molecules

Lynne Regan, Professor; Macromolecular interactions: Atoms to networks; The chemistry and physics of chromatin remodeling and gene activation.

James Rothman, Professor; We are broadly interested in the dynamics and biophysics of membranes and membrane proteins, and specifically in the mechanism of cellular membrane fusion, using a range of techniques from single molecule methods, sophisticated super-resolution microscopic methods in living cells, fluorescence spectroscopy, DNA origami, and molecular genetics

Martin Saunders, Professor; Our work has focused on three areas of organic chemistry. The recently discovered, soccer-ball shaped, sixty-carbon molecule Buckminsterfullerene and its larger relatives (the fullerenes)

Alanna Schepartz, Professor; Our lab seeks to elucidate the fundamental mechanisms that control interactions between proteins, trafficking of peptide mimetics, and the process of compartmentalization in living cells.

Charles Schmuttenmaer, Professor; Exploring dynamics in the far-infrared with terahertz spectroscopy.

Sarah Slavoff, Assistant Professor; We develop novel chemical and biochemical tools to elucidate cellular pathways of RNA translation, trafficking, and degradation, in order to gain a deeper mechanistic understanding of how human gene expression is regulated.

Dieter Söll, Professor; Our recent work has concentrated on the diverse roles of transfer RNA in various biological systems.

David Spiegel, Associate Professor; Associate Professor (joint with Pharmacology); Using organic chemistry to develop novel therapeutic paradigms, chemistry and biology of the human immune system

Thomas Steitz, Professor; Understanding, in terms of atomic structures, the molecular and chemical mechanisms by which proteins and nucleic acids achieve the biological functions of DNA, RNA and protein synthesis

Scott Strobel, Professor; How RNA catalyzes biologically essential chemical reactions, including protein synthesis. Fluoride biology. Biofuel and bioremediation applications for novel microorganisms isolated in the neotropics.

John Tully, Professor; Theoretical and computational chemical dynamics.

Patrick Vaccaro, Professor; Linear and nonlinear spectroscopic probes of molecular structure and dynamics, including fundamental studies of proton transfer, hydrogen bonding, and chirality.

Hailiang Wang, Assistant Professor; Research in the Wang group employs chemistry, materials science, nanotechnology and surface science to tackle the challenges in electrochemical energy storage and conversion.

Elsa Yan, Associate Professor; Biophysical chemistry of membrane protein GPCR function and protein-biomembrane interact

Kurt Zilm, Professor; High-resolution solid-state NMR technique development and studies of the structure and physical chemistry of macromolecular complexes and materials.

Experimental Pathology The Experimental Pathology Ph.D. Program emphasizes research on disease mechanisms, built upon a strong foundation of training in contemporary cell and molecular biology, pharmacology, and genetics. This Program has a broad goal of educating students on the mechanistic basis of human disease. Members of the Experimental Pathology faculty have strengths in the areas of cell, molecular and cancer biology, signal transduction, gene regulation/epigenetics, genome stability, mitochondrial function and disease, aging, cytoskeleton, virology, immunology, vascular and endothelial biology, bioinformatics, and the study of model genetic organisms (e.g. mice and yeast).

See: http://medicine.yale.edu/pathology/index.aspx for more information.

Faculty Research Interests http://medicine.yale.edu/pathology/people/index.aspx

Adebowale Adeniran, Oncologic Surgical Pathology; Cytopathology; Urologic Pathology; Biology of translocation Renal Cell Carcinoma (RCC)

Ranjit Bindra, cell-based screening for novel anti-cancer drugs, DNA repair

Marcus Bosenberg, melanoma cell biology and metastasis
Veerle Bossuyt, Breast and Gynecologic pathology; Cytopathology

Demetrios Braddock, molecular basis of sequence-specific single-stranded DNA recognition by KH domains of nuclear RNA

Richard Bucala, Mechanisms by which host immunity converts from a protective response to one producing disease and tissue pathology

Natalia Buza, Diagnostic and prognostic markers in endometrial, ovarian and breast cancer

Guoping Cai, Fine Needle Aspiration Biopsy; Cytopathology; Genitourinary Pathology; Pulmonary Pathology

Sandy Chang, Mouse models of cancer; DNA damage; Telomere biology

Keith Choate, Human Genetics; Genodermatoses; Gene Discovery; Genetic Mosaicism; Disorders of keratinization; Mosaic skin disorders

Young Choi, Immunopathology; Molecular Pathology; Cytopathology and Clinical Pathology; Breast Cancer; Immunopathology; Molecular Pathology

Paul Cohen, General surgical pathology; Thoracic surgical pathology; Gynecologic surgical pathology

Oscar Colegio, role of macrophages in progression of cutaneous squamous cell carcinomas

Jose Costa, molecular genetics of tumor progression

Shawn Cowper, Alopecia; Cutaneous lymphoma; Pathology informatics; Nephrogenic fibrosing dermopathy; Nephrogenic systemic fibrosis

Susan Fernandez, Cytology, Gynecologic Pathology Diagnostic Services

Carlos Fernandez-Hernando, cholesterol homeostasis; lipoprotein metabolism; post- transcriptional regulation; microRNAs; atherosclerosis; RNAi screening

Karin Finberg, Human Genetics; Genetic and Acquired Disorders of Systemic Iron Balance; Hepcidin Regulation; Hepatic BMP/SMAD Signaling

Gary Friedlaender, Biomolecules for bone repair; Fusions and bone regeneration; Musculoskeletal oncology; Medical education; Osteoporosis; Healthcare delivery

Anjela Galan, Malignant melanoma; Lyme disease; Bullous skin disorders

Patrick Gallagher, Neonatal hematology; Erythropoiesis; Inherited abnormalities of the erythrocyte including metabolic, membrane, and hemoglobin disorders; Sickle cell disease

Joanna Gibson, Gastrointestinal oncologic pathology; Liver oncologic pathology; Medical and transplant hematology; Medical gastrointestinal disease

James Gill, Forensic Pathology and Toxicology

Earl Glusac, Histologic mimickers of malignant melanoma

Bonnie Gould Rothberg, Molecular cancer epidemiology; Cancer prognosis; Melanoma; Skin cancer; Lung cancer; Pancreatic Neuroendocrine Tumors (PNETs); Tuberous Sclerosis Complex; Next generation sequencing

Liming Hao, Gastrointestinal pathology

Malini Harigopal, Cancer biomarkers; Breast; Thyroid; Immunohistochemistry; AQUA method of analysis in tissue microarrays and cytologic material

Shilpa Hattangadi, Histone modifications in chromatin condensation; hematopoietic; bone marrow failure disorders

Robert Homer, Lung pathology; Interstitial lung disease; immunopathology; Pathology of animal models of asthma; Pulmonary fibrosis; Acute lung injury

S. David Hudnall, Tumor immunology, chronic inflammation, tumor viruses

Pei Hui, Gynecological tumors including endometrial and ovarian cancers; Gestational trophoblastic disease

Peter Humphrey, precancerous conditions, urogenital neoplasms

Michael Hurwitz, cell migration; kinase signaling; phosphorylation; cytoskeleton; engulfment; apoptosis; C. elegans; cancer biology

Anita Huttner, neuropathology, tissue specific stem cells, musculoskeletal diseases

Dhanpat Jain, Inflammatary Bowel Disease (IBD); Liver tumors; Motility disorders of GI tract; Esophageal and gastric carcinoma

Ryan Jensen, BRCA2, DNA repair and DNA damage signaling, genetic instability, homologous recombination, breast and ovarian cancer
Samuel Katz, programmed cell death, hematopathology

Steven Kleinstein, computational biology and informatics, cancer immunology, patient-specific modeling, autoimmune diseases

Yuval Kluger, Signal processing and dimensional reduction of genome-wide data; Local and non-local genomic pattern recognition

Christine Ko, Adnexal tumors; Benign and malignant epidermal tumors

Diane Kowalski, Head and Neck Pathology; Cytopathology; Fine Needle Aspiration (FNA) technique

Diane Krause, human stem cells and hematopoiesis, functional effects of bone marrow transplantation

Michael Krauthammer, bioinformatics of molecular interaction networks; text mining

Gary Kupfer, genomic instability and cancer; Fanconi Anemia

Themis Kyriakides, biomaterials engineering in wound healing and angiogenesis

Rossitza Lazova, Spitz nevi; Spitzoid melanocytic neoplasms; Malignant melanoma; Melanocytic nevi on special anatomic sites; Atypical Spitzoid neoplasms

Angelique Levi, cytopathology, prostate cancer, GYN pathology, thoracic pathology

Janina Longtine, molecular and genomic diagnostics, molecular pathology

Joseph Madri, endothelial cell biology, cell-matrix interaction, and angiogenesis

Vincent Marchesi, Pathogenesis of Alzheimer's disease; Neurodegeneration; Amyloid abeta metabolism; Autoantibodies; Protein-folding

Jennifer McNiff, Histopathologic evaluation of inflammatory and neoplastic skin disease; Immunofluorescence studies

Wang Min, cytokine signaling and angiogenesis

Kisha Mitchell, Gastrointestinal; Liver Pathology; Forensic Pathology

Gilbert Moeckel, Progression of renal fibrosis; progression of chronic kidney disease; acute kidney injury; regenerative medicine; acute tubular injury repair

Ruth Montgomery, innate immunity, aging, West Nile virus, Lyme disease, CyTOF

Raffaella Morotti, pediatric pathology, inflammatory bowel disease

Jon Morrow, structure and function of the spectrin cytoskeleton

Peggy Myung, dermatopathology, skin and hair follicle regeneration

Don Nguyen, molecular determinants of lung cancer metastasis

Vinita Parkash, Surgical Pathology

Marguerite Pinto, Cytopathology/Surgical Pathology GYN

Jordan Pober, immunobiology of vascular endothelium; cytokine alterations of endothelium; signaling between T cells and endothelial cells

Katerina Politi, cancer biology, mouse models of cancer, lung cancer, epidermal growth factor receptor

Manju Prasad, Endocrine, Head & Neck Pathology; Genotype-phenotype correlation in tumors; Protein expression and biomarkers in tumor tissues, and their diagnostic & prognostic relevance

Yibing Quang, heart development and dysfunction, stem cells

David Rimm, role of cadherin in cancer and inflammatory diseases; quantitative biomarker analysis

Marie Robert, Gastrointestinal and liver pathology; Inflammatory bowel diseases; Barrett esophagus; Dysplasia associated with inflammatory bowel disease and Barrett esophagus

John Rose, virus replication and virus-based vaccine vectors

Kurt Schalper, translational immuno-oncology, lung cancer

Gerald Shadel, mitochondria in cell signaling, immune responses, disease and aging

John Sinard, translational medical informatics, ophthalmic pathology, software development

Jeffrey Sklar, molecular characterization of chromosomal aberrations in cancer

David F. Stern, growth factor and growth factor receptor oncogenes including HER2, DNA checkpoint controls

Yajaira Suarez, regulation of macrophage and endothelial cell functions by non-coding RNAs

Antonio Subtil, Alopecia; Atypical melanocytic lesions; Cutaneous lymphoproliferative disorders

Alexander Vortmeyer, Neuropathology; Hereditary Tumorigenesis; Applied Proteomics

Narendra Wajapeyee, mechanisms of genetic and epigenetic regulation of cancer
Zenta Walther, Epithelial polarity and proliferation control; Intestinal epithelial homeostasis; Intestinal barrier function; Innate immune signaling  
Brian West, Anatomic pathology of the gastrointestinal tract; Liver; Biliary tract and pancreas; Special emphasis on non-neoplastic diseases  
Serena Wong, GYN and breast pathology  
Mina Xu, Peripheral T-cell lymphoma, NOS; Classical hodgkin lymphoma; EBV-related lymphoproliferative disorders  
Qin Yan, epigenetic regulation in cancer and stem cells  
Wendell Yarbrough, head and neck cancer, mouse modeling of human cancer, human papillomavirus  
Xuchen Zhang, Liver and gastrointestinal pathology; Neoplastic and non-neoplastic pulmonary pathology; Acute and chronic oxidant-induced lung injury  

Genetics The Department of Genetics offers broadly-based training in the molecular genetics of model systems including viruses and microorganisms, yeast, nematodes and Drosophila, as well as a very strong program in human genetics that includes gene mapping, diagnostics, biochemical genetics and identification of disease genes. The breadth of expertise in various aspects of genetics provides students with a unique set of research opportunities, complemented by courses that focus on human genetics and the genetics of model organisms. The Department of Genetics began with a strong focus on human genetics, and has since grown to include research programs using a wide range of model genetic organisms while continuing its emphasis on human genetics. In addition to a strong graduate program, the Department also sponsors a Medical Genetics & Genetics Residency program leading to certification by the American Board of Medical Genetics. The department is located in the Medical School in the Sterling Hall of Medicine, the Boyer Center and the Anlyan Center for Medical Research and Education.

The program of study leading to the Ph.D. degree emphasizes a broad approach to the fundamental principles of genetics, development and molecular biology combined with extensive research training. The program is designed to permit close interaction between graduate students, postdoctoral fellows, and faculty, while also encouraging full participation in the larger community of biological scientists at Yale.

Faculty Research Interests [http://info.med.yale.edu/genetics/](http://info.med.yale.edu/genetics/)
Susan Baserga, Ribosome biogenesis, rRNA processing, Polymerase 1 transcription and processing  
Kaya Bilguvar, Cerebrovascular Disorders, Migrain Disorders, Neurodegenerative Diseases, Malformations of Cortical Development  
Martina Brueckner, Development of mammalian left-right symmetry; Etiology of heterotaxy syndrome; Genetics of congenital heart disease  
Sidi Chen, Cancer Systems Biology, in particular in vivo CRISPR/Cas9-mediated cancer modeling and genetic screening  
Keith Choate, Human Genetics, Genodermatoses, Gene Discovery, Genetic Mosaicism, Disorders of Keratinization  
Lynn Cooley, Molecular genetics of Drosophila oogenesis; focus on determining cellular mechanisms that underlie polarity and cell growth during development  
Chris Cotsapas, Determining the mechanisms underlying disease of the immune system  
Daniel DiMaio, Molecular biology of tumor viruses; Mechanism of viral carcinogenesis, Genetic techniques to study interactions between tumor viruses and their host mammalian cells  
Patrick Gallagher, Genetics of inherited disorders of the erythrocyte and the molecular control of erythropoiesis  
Joel Gelernter, Complex trait genetics; psychiatric genetics, population genetics, substance dependence and gene mapping
Antonio Giraldez, Regulation of gene expression during embryonic development using zebrafish as a model system

Peter M. Glazer, Gene targeting via triplex helix formation; and Tumor hypoxia, genetic instability and tumor progression

Valentina Greco, Organ regeneration in vertebrate systems, stem cells niche organization and cancer

Jeffrey Gruen, The genetics of communication disorders and learning disabilities, dyslexia, and language impairment

Murat Gunel, Molecular genetics and biology of brain aneurysms and cavernous malformations; molecular genetics of brain development

Marc Hammerlund, Study the genetics and cell biology of axon regeneration and degeneration using the model organism C. elegans.

Karen Hirschi, Tissue Specific Stem Cells, Signal Transduction and Cell Growth

Arthur Horwich, Protein folding, chaperones, ALS (Lou Gehrig’s disease)

Natalia Ivanova, Molecular control of cell fate decisions in embryonic and somatic stem cells.

Mustafa Khokha, Congenital birth defects, Establishment of Vertebrate Body Plan; Embryonic patterning and gene regulatory networks; Xenopus (frog) genetics

Kenneth Kidd, Genetics of complex human disorders, human genome diversity, human evolution and human population genetics

Smita Krishnaswamy, Computational biology, Epithelial-Mesenchymal Transition, single-cell analysis

Peining Li, Cytogenetic and genomic analysis, Dissection of genetic mechanisms for growth regulation, mental development, and cancer progression

Richard Lifton, Human genetics and genomics to identify rare mutations with large effect and elucidate biochemical mechanisms underlying diverse common diseases.

Janghoo Lim, Molecular genetic studies of neurodegenerative diseases; neural development and neurodevelopmental disorders

Haifan Lin, Stem cell RNA-mediated epigenetic programming, post-transcriptional regulation.

Jun Lu, Use of genomics to understand how microRNAs and other non-coding RNAs regulate mammalian cell fate in blood stem cells and embryonic stem cells, and how alterations in such regulations leads to human cancer

Maurice J. Mahoney, Clinical genetics; diagnosis and therapy of human fetal disease

Arya Mani, Identification of cardiovascular disorders that have strong familial pattern

Michael Nitabach, Neurophysiology; Molecular genetics; Systems Physiology; Animal Behavior

James Noonan, Human evolution; evolutionary dynamics of gene regulation; synthetic biology; applications of ultra-high throughput sequencing technologies; comparative and functional genomics in vertebrates.

In-Hyun Park, Investigation of genetic and epigenetic regulation of reprogramming, in vitro model of human neurodevelopmental disease

Valerie Reinke, Functional genomic analysis of global gene expression mechanisms; C. elegans germline development

Curt Scharfe, Development and implementation of new tools and genomic approaches for molecular testing and diagnosis. Cystic fibrosis, heart diseases, infant and newborn diseases, nutrition and metabolic diseases, virus diseases and mitochondrial diseases.

Margretta Seashore, Clinical genetics; inherited metabolic disorders, diagnosis and treatment

Nenad Sestan, Evolution and the Development of Neuronal Circuits of the Human Cerebral Cortex

Gerald Shadel, Research directed toward understanding the mechanism of gene expression in human mitochondria and its impact on human aging and disease.

Carolyn Slayman, Ion transport across membranes, H+-ATPase

Stefan Somlo, Genetic kidney and liver disease; Cilia function in tissue homeostases and polycystic function

Michele Spencer-Manzon, Enzyme replacement therapy for inborn errors of metabolism, developmental dyspraxia and neurodevelopmental disorders

Zhaoxia Sun, Polycystic Kidney disease, zebrafish genetics, kidney development
Joann Sweasy, Mechanisms of genomic instability and human disease and how it leads to the mutations that result in human disease such as cancer

Peter Tattersall, Genetics and biochemical analysis of parvoviral replication and virus:host interactions

Scott Weatherbee, Research the developmental genetic network underlying limb patterning and outgrowth using the mouse as a model system

Sherman Weissman, Genomics and Proteomics of Hematopoietic cells; Globin and histocompatibility in gene structure and function

Andrew Xiao, Focusing on elucidating epigenetic mechanisms for mammalian stem cell biology, cellular reprogramming (iPS) and embryonic development with an emphasis on chromatin biology

Tian Xu, Utilization of model organisms to understand cancer biology and developmental mechanisms

Hui Zhang, Congenital malformations, dysmorphology, developmental delays, CNS abnormalities

Hongyu Zhao, Statistical genomics, computational biology, genetic epidemiology, genome wide association studies, bioinformatics, next generation sequencing analysis

**History of Science and Medicine** As a field, HSHM prepares students for a better understanding of the world in which we live as well as for a wide variety of careers, including medicine, public health, academic life, museum work, journalism, law, industry, and public service. Students study under the guidance of a diverse and expanding faculty with expertise in many disciplines, periods, and societies. The links here invite you to explore the curriculum at the graduate and undergraduate levels; to examine the requirements for the BA, M.A, and Ph.D degrees; to view the research and teaching interests of the faculty; to get information about the conferences and colloquia sponsored by the Program; and to find the contact information of our faculty and staff.

**Faculty Research Interests:** [http://medicine.yale.edu/histmed/people/](http://medicine.yale.edu/histmed/people/)

**Paola Bertucci**, Enlightenment; cultural history of technology in the early modern world; cultures of collecting and display; artisanal knowledge; the early modern body, scientific travel and material culture.

**Henry Cowles**, Human Sciences and scientific medicine since 1800; mind and brain; historical and scientific methodology; pragmatism and evolutionary theory; experimentation in science, medicine, and the arts.

**Ivano Dal Prete**, Earth sciences (ca. 1300-1800); generation in the long eighteenth century; material culture of astronomy; science, religion and society in early modern Europe

**Joanna Radin**, History of biology, medicine, and anthropology since 1945; scientific expeditions, biomedical ethics, human subjects research, collections, and laboratories; history of global health; biomedical technology.

**Chitra Ramalingam**, Cultural history of the physical sciences (18th-century to the present), science and visual culture, visual studies, material culture studies, history and theory of photography, modern British history.

**William Rankin**, Physical and earth sciences since the mid-nineteenth century; military, industrial, and governmental science; history of cartography; science and architecture; visual studies; environmental history.

**Naomi Rogers**, History of 20th century medicine and public health in North America including health policy, health activism, alternative medicine, and gender and medicine; women’s studies including science and feminism, and feminist health movements.

**William Summers**, History of modern biology; geopolitics of disease; Asian science and medicine.

**Courtney Thompson**, History of psychiatry and mental illness; criminal science; phrenology and anthropometry; medicine and the law; gender in science and medicine; history of the body; the visual and material culture of science.

**John Warner**, 19th and 20th century U.S. Medicine and health; comparative history of medicine (U.S., Britain, France); cultural history of science and medicine.

**Immunobiology** The Department of Immunobiology at Yale, a multi-disciplinary group of investigators committed to understanding the cellular, genetic and molecular basis of immunological processes. The Immunology Graduate Program is designed to prepare students for independent careers in research and teaching.
in Immunology or related disciplines. The educational program emphasizes interdisciplinary training and
collaborative and interactive research, an approach based on the idea that solving difficult problems requires the
integration of individuals with common goals but differing expertise. Advanced technologies facilitate achieving
those goals. Specific areas of interest in basic immunobiology include: B, T and NK cell development,
activation and effector functions; costimulatory molecules in immune regulation; the innate immune system; the
role of cytokines in immunoregulation; intracellular signaling and the control of transcription in lymphocytes;
antigen processing and presentation; immunoglobulin and T cell receptor gene rearrangement; B and T cell
memory; the immunobiology of vascular endothelial cells; and B and T cell tolerance. Other areas of research
with direct clinical relevance are: autoimmunity (i.e. arthritis, SLE, multiple sclerosis, colitis), asthma, diabetes
and bone disease, infectious diseases (i.e. Herpes Simplex and West Nile viruses, Chlamydia and Legionella
bacteria, Leishmania parasite), transplantation and cancer.

Faculty Research Interests: [http://immunobiology.yale.edu/people/index.aspx#page1](http://immunobiology.yale.edu/people/index.aspx#page1)

**Jeffrey Bender**, Professor of Medicine and Immunobiology; Associate Chief, Cardiovascular Medicine. Inflammatory, immune, metabolic and hormonal effects on the endothelium.

**Alfred Bothwell**, Professor of Immunobiology. Human T-cell interactions in vascular sites and transplant models in humanized mice, tissue engineering, function of regulatory T cells and autoimmune mechanisms in diabetes, inflammatory bowel disease and intestinal cancer.

**Lieping Chen**, Professor of Immunobiology, Dermatology and Medicine (Medical Oncology). Lymphocyte costimulation; Molecular, biochemical and structural analysis of costimulatory (co-signal) molecules; the roles of co-signal molecules in the control of immune responses; immunotherapy of cancer, autoimmune diseases, infectious diseases and transplantation rejection by manipulation of co-signal pathways.

**Joseph Craft**, Professor of Medicine (Rheumatology) and Immunobiology. Propagation and regulation of systemic autoimmunity by T cells and the role of \( \gamma \delta \) T cells in host defenses

**Peter Cresswell**, Professor of Immunobiology and Cell Biology. Molecular mechanisms of antigen processing; assembly and intracellular transport of CD1 molecules, class I and class II MHC molecules; functions and mechanisms of action of antiviral and antibacterial interferon-induced proteins

**Madhav Dhodapkar**, Professor of Immunobiology and Medicine (Hematology); Chief, Section of Hematology, Dept. of Internal Medicine; Director of Hematologic Malignancies, Yale Cancer Ctr. Myeloma and related plasma cell disorders; human immune system's interaction with growing tumors in patients; preneoplastic monoclonal gammapathy and multiple myeloma, tumor and host related factors.

**Vishwa Dixit**, Professor of Comparative Medicine and Immunobiology. Immune-Metabolic Interactions; Aging and age-related inflammation; Obesity-associated inflammation and metabolic syndrome; Adipose tissue leukocytosis; Inflammasomes; Thymic involution and approaches for thymic rejuvenation; Neuroendocrine control of immune system

**Stephanie Eisenbarth**, Assistant Professor of Laboratory Medicine and of Medicine (Immunology). Pattern Recognition Receptors; NOD-like Receptors (NLRs); Dendritic Cells; T cells; Allergy/Asthma; Vaccines/Adjuvants; Red Blood Cell Alloimmunization; Autoimmune Diabetes

**Tarek Fahmy**, Associate Professor of Biomedical Engineering and Immunobiology

**Richard Flavell**, Professor and Chairman of Immunobiology, Professor of Molecular, Cellular & Developmental Biology. T cell tolerance and activation in immunity and autoimmunity. Apoptosis; regulation of T cell differentiation.

**Daniel Goldstein**, Associate Professor of Medicine (Cardiology) and Immunobiology. Investigation of the molecular mechanisms by which inflammation impacts transplantation tolerance; further investigation of how aging impacts innate and adaptive immune responses to viral infections, examination of how aging modifies inflammation and how this may impact vascular disease.

**Ann Haberman**, Assistant Professor of Lab Medicine and Immunobiology. B lymphocytes; Germinal center formation; Cell migration in vivo; Two-photon laser scanning microscopy
David Hafler, Professor of Immunobiology and Chairman, Department of Neurology. Autoimmunity with an interest in multiple sclerosis, and human T cell biology, and immunogenetics with genotypic to phenotypic analysis.

Kevan Herold, Professor of Immunobiology and Medicine (Endocrinology). Immune tolerance and autoimmunity, mechanisms of autoimmune diabetes and immune clinical therapies to restore tolerance, biomarkers of autoimmunity, role of RAGE (receptor for advanced glycation endproducts) in immune responses, beta cell replacement through growth of stem cells or transplantation.

Akiko Iwasaki, Professor of Immunobiology and Molecular Cellular and Developmental Biology. Mechanism of generation of antiviral mucosal immunity by dendritic cells.

Susan Kaech, Associate Professor of Immunobiology and Microbial Pathogenesis. Mechanisms of memory T cell development.

Paula Kavathas, Professor of Laboratory Medicine, Genetics and Immunobiology. Human Immune response to Chlamydia Trachomatis and host-pathogen interaction, structural biology CD8-MHC class I interaction, significance of CD8 signaling isoforms.

Martin Kriegel, Assistant Professor of Immunobiology and Medicine. Microbiome; Commensals; Lymphocytes; Autoimmunity; Th17 cells; Antiphospholipid syndrome; Beta2-glycoprotein; Lupus; Type 1 diabetes

Ruslan Medzhitov, Professor of Immunobiology. Innate immunity and control of adaptive immune responses by innate immune recognition.

Eric Meffre, Associate Professor of Immunobiology. Human B cell tolerance: from primary immunodeficiencies to autoimmune diseases.

João P. Pereira, Assistant Professor of Immunobiology. Molecular regulation of hematopoietic cell development and migration in lymphoid organs.

Jordan S. Pober, Professor of Immunobiology, Pathology and Dermatology. Immunobiology of vascular endothelial cells: cytokine actions and mechanisms; transplantation immunology; contributions of immunity to arteriosclerosis; tissue engineering.

Carla Rothlin, Assistant Professor of Immunobiology. Regulation of inflammation, homeostatic control of the immune system.

Craig Roy, Professor of Microbial Pathogenesis. Understanding the molecular and cellular events that enable microbial pathogens to evade host defense mechanisms.

David Schatz, Professor of Immunobiology. Biochemical mechanism and developmental regulation of V(D)J recombination and somatic hypermutation; lymphocyte development; genomic instability and lymphoid malignancies.

Interdepartmental Computational Biology and Bioinformatics The Interdepartmental Ph.D. Program in Computational Biology and Bioinformatics provides opportunities for research and training in this rapidly growing multi-disciplinary field. The systematic acquisition of data made possible by genomics and proteomics technologies has created a tremendous gap between available data and their biological interpretation. Given the rate of data generation, it is well recognized that this gap will not be closed with direct individual experimentation. Computational and theoretical approaches to understanding biological systems provide an essential vehicle to help close this gap. These activities include computational modeling of biological processes, computational management of large-scale projects, database development and data-mining, algorithm development and high-performance computing, as well as statistical and mathematical analyses.

Faculty Research Interests http://cbb.yale.edu/faculty.html

Murat Acar, Adaptive Gene Network Evolution and Cellular Aging

James Aspnes, Distributed algorithms

Julien Berro, My lab aims to uncover the mechanisms of force transduction at the molecular level using quantitative microscopy and computational approaches

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Joseph Chang, Probability, stochastic processes, sequential analysis, quality control, genetics, evolution, and bioinformatics

Kei-Hoi Cheung, Bioinformatics; interoperation of genomic databases

Damon Clark, The Clark lab uses behavior, physiology, and mathematical modeling to investigate how circuits of neurons perform fundamental computations

Ronald Coifman, Analysis tools for spectrometric diagnostics and hyperspectral imaging Forrest Crawford, Mathematical and statistical problems related to stochastic processes in biomedical and evolutionary science

Thierry Emonet, Modeling of biological systems

Donald Engelman, Developing a chemical understanding of membrane protein folding and oligomerization to use in interpreting evolution and function

Alison Galvani, Integrating epidemiology, evolutionary ecology and economics

Mark Gerstein, Bioinformatics, large-scale analysis of genome sequences, macromolecular structures, and gene expression data

Antonio Giraldez, The Giraldez lab investigates how gene expression regulates vertebrate development and the molecular mechanisms of Autism, using Zebrafish as a model system Murat Günel, My lab focuses on gene discovery in diseases of the human brain, specifically on abnormalities of its development, vasculature and tumors. We use next generation genomic technologies to identify disease causing mutations followed by in vitro and in vivo functional studies to understand underlying molecular mechanisms with the goal to help design better/novel diagnostics, therapeutics and non-invasive treatments

William Jorgensen, Computational chemistry

Douglas Kankel, Genetic and molecular analysis of visual system development in Drosophila

Steven Kleinstein, Disease/tissue/pathway/process modeling and simulation

Yuval Kluger, Computational analysis of high-throughput datasets generated from experiments involving cancer, hematopoiesis, and cell cycle genomics.

Michael Krauthammer, Bioinformatics of molecular interaction networks; text mining

Smita Krishnaswamy, Computational modeling and analysis of high throughput single-cell data in developmental systems, immunology and cancer

Haifan Lin, RNA-mediated epigenetic programming and post-transcriptional regulation of stem cells

Elias Lolis, Structural biology of proteins involved in inflammation and cancer

Jun Lu, Using genomics to understand the role of non-coding RNAs in mammalian development and disease.

Steven (Shuangge) Ma, Bioinformatics and statistical analysis of survival data

Perry Miller, Biomedical informatics

Andrew Miranker, Molecular mechanisms of protein folding, misfolding and pathological assembly into amyloid fibers

James Noonan, Evolutionary dynamics of gene regulation; synthetic biology

Corey O’Hern, Statistical mechanics and molecular dynamics simulation applied to biology

Anna Pyle, Computational biology on RNA

Lynne Regan, Protein structure, function and design

Valerie Reinke, Stem Cell Self-Renewal and Cell Symmetry

Gordon Shepherd, Experimental and computational studies of sensory transduction, synapses, dendrites, and microcircuits using the olfactory pathway as a model system

Avi Silberschatz, Bioscience database systems

Dieter Söll, Biochemical and genomic studies of the evolution of protein synthesis

Jeffrey Townsend, Functional genomics and evolutionary biology

Gunter Wagner, Developmental evolution of morphological characters; conceptual and mathematical work on the theory of evolution

Anita (Zuoheng) Wang, Development of statistical and computational methods to address problems in genetics

Heping Zhang, Statistical genetics and neuroimaging analysis

Hongyu Zhao, Statistical genomics and proteomics

Steven Zucker, Computational vision, biological perception, artificial intelligence, and robotics
Interdepartmental Neuroscience/Neurobiology Graduate Programs

Faculty Research Interests: http://medicine.yale.edu/neuroscience/index.aspx

Addy, Nii, Asst. Prof., Our research examines the neurobiological mechanisms of reinforcement learning and motivational control and seeks to identify how these mechanisms are altered in psychiatric illnesses. We are currently using in vivo electrochemistry, in vivo optogenetics and behavioral analyses to examine the role of cholinergic and dopaminergic mechanisms in preclinical models of addiction and depression.

Alan Anticevic, Asst. Prof., Schizophrenia; Psychotic disorders; Working memory; Emotion regulation; Substance abuse; Functional neuroimaging methods; Functional connectivity

Amy Arnsten, Prof., The Arnsten lab studies molecular influences on primate cortical function, with special emphasis on the high order prefrontal cortical circuits altered in schizophrenia and age-related cognitive disorders

Sviatoslay Bagriantsev, Asst. Prof., Our lab studies the molecular basis of temperature and mechano-sensitivity in the somatosensory system of vertebrates. Our goal is to identify molecules that detect cold, heat and various types of mechanical stimulation, and to understand how such molecules work. We use non-standard animal models and a range of experimental approaches: molecular biology, biophysics, biochemistry and behavioral paradigms.

Anton Bennett, Prof., How protein tyrosine phosphatases function in the control of normal cellular physiology

Hal Blumenfeld, Prof., Our laboratory investigates brain network mechanisms in normal consciousness and impaired consciousness during epileptic seizures. We use approaches from the neuronal level in animal models to the network level in human neuroimaging and behavior.

Angelique Bordey, Prof., My lab focuses on identifying the molecular and cellular bases of neuronal placement, morphogenesis, and connectivity that are dysregulated in the context of autism and epilepsy as seen in individuals with Tuberous Sclerosis Complex. We use a wide range of approaches from in vitro systems to in vivo approaches including in utero electroporation to manipulate neuronal development and functional imaging (e.g. MRI) in collaboration with several Yale investigators.

Will Cafferty, Asst. Prof., Using anatomical, electrophysiological, genetic and chronic in vivo two-photon imaging methodology, the Cafferty lab explores the extent of plasticity within intact spinal circuitry and investigates the capacity of these de novo circuits to restore function after spinal cord and brain injury.

Tyrone Cannon, Prof., My interests are in the genetics and neuroscience of schizophrenia and related disorders, with a particular focus on multimodal neuroimaging approaches in samples at risk.

Jessica Cardin, Asst. Prof., Cortical network interactions in visual sensory processing and the function of inhibitory interneurons

John Carlson, Prof., We are interested in the molecular and cellular mechanisms by which animals detect and discriminate odorants, tastants and pheromones. We use Drosophila as a model organism and use molecular, electrophysiological, and behavioral approaches to understand the workings of the cells and circuits that underlie olfaction and taste.

Sreeganga Chandra, Asst., Prof., Synapses need to be preserved throughout the life of an organism to provide for normal brain functions and behavior. Our research investigates the role of synaptic dysfunction and loss in neurodegenerative diseases.

Stephen Chang, Asst. Prof., How do we interact with others, and why? Our research is aimed at understanding the neural mechanisms responsible for social behavior. We apply both neurophysiological and neuroendocrinological approaches while non-human primates are actively engaged in social interactions.

Marvin Chun, Prof., Cognitive Neuroscience of Visual Attention, Perception, Learning, Memory, and Decision-making: Technologies used include functional Magnetic Resonance Imaging (fMRI), Neuropsychological Patient work, and Event-Related Potentials (ERP)

Damon Clark, Asst. Prof., The Clark Lab dissects Drosophila's visual motion circuits in order to understand how individual neurons contribute to circuit computations. We use genetic manipulations, psychophysics, targeted visual stimuli, two-photon microscopy, and computational modeling as our primary tools.

Lawrence Cohen, Prof., My laboratory is active in two areas. One is trying to understand the role of the olfactory bulb in odorant recognition. The second is developing better fluorescent proteins for monitoring membrane potential.
Daniel Colón-Ramos, Assoc. Prof., My laboratory is interested in the interplay between the cell biology of the synapse and behavior. Specifically, we want to understand how synapses are assembled and maintained to build the neuronal architecture underlying behavior, and how they are modified to store memories. We have developed tools in *C. elegans* to simultaneously examine molecular genetics, synaptic cell biology and calcium imaging in single neurons and *in vivo*. The combination of highly specific synaptic manipulation with analyses at three synergistic levels (cellular physiology, circuit function and animal behavior) allow us to uniquely probe the *in vivo* interplay between the cell biology of the synapse and the functional output of the nervous system, behavior.

R. Todd Constable, Prof., Technical aspects of functional MRI with particular emphasis in fMRI for Neurosurgical planning, and the application of fMRI and ERP to better understand language and memory systems in the human brain and the response to injury

Philip Corlett, Asst. Prof., The Belief, Learning and Memory (BLAM) lab studies the symptoms of mental illness in terms of formal learning theory. We use functional neuroimaging, psychotomimetic drugs, clinical cognitive neuroscience and computational modelling to examine the cognitive and neural mechanisms of delusions and hallucinations as well as substance abuse. Armed with a deeper understanding of these distressing symptoms we aim to devise, implement and optimize treatments that target the underlying neuropathology.

Kelly Cosgrove, Assoc. Prof., Neurochemical and molecular basis of addiction and psychiatric disorders using single photon emission computed tomography (SPECT) and positron emission tomography (PET) brain imaging

Michael Crair, Prof., Mechanisms of synapse and neural circuit development and plasticity

Ivan De Araujo, Assoc. Prof., Neurobiology of feeding

Pietro De Camilli, Prof., Membrane traffic in neuronal function. Lipid metabolism in the regulation of membrane dynamics and interactions

Jonathan Demb, Assoc. Prof., Neural circuit and synaptic function in mammalian retina.

Sabrina Diano, Prof., Role of thyroid hormones, steroid hormones, neuropeptides and UCPs in the homeostatic mechanisms of CNS in physio-pathological conditions

Marcelo Dietrich, Asst. Prof., Our research focuses on the molecular and cellular mechanisms that play a role in behavior and how these processes are regulated by energy metabolism.

Ralph DiLeone, Assoc. Prof., We study the molecular and neural pathways that underlie the regulation of ingestive behavior, body weight and drug addiction.

George Dragoi, Asst. Prof., The long-term goal of the lab is to map and dissect the neural circuits and decipher the neuronal codes underlying the formation of internal representations within hippocampal-neocortical networks that support innate and learned behavior. To achieve this goal, we will use large-scale electrophysiological recordings in behaving mice and rats, optogenetic stimulation and optical imaging of ensembles of neurons, and computational methods for decoding and modeling neuronal population activity.

Ronald Duman, Prof., Molecular, cellular, and anatomical sites which mediate the adaptive responses of mammalian neurotransmitter signal transduction pathways to psychotropic drugs, hormones, and environmental stimuli.

Barbara Ehrlich, Prof., Regulation of intracellular calcium signaling using electrophysiological, biochemical and molecular techniques.

Eid Tore, Asst. Prof., My laboratory’s research focuses on the discovery of novel diagnostics and therapeutics of epilepsy, one of the most common chronic neurological disorders in humans.

Thierry Emonet, Assoc. Prof., The lab is interested in understanding how identity and intensity of odor signals are represented in the brain. We use *Drosophila* as a model system to investigate the role of the temporal activation of the olfactory sensory neurons in odor coding. How do different receptors filter odor stimuli? Is there a logic in the diversity of response dynamics observed for different odors? How do dynamics at the sensory input affect odor information processing and behavior? We combine in vivo electrophysiological recordings from the sensory neurons, with measurements of odor signals, modeling and behavioral assays to investigate these questions.

Paul Forscher, Prof., Molecular mechanisms of neuronal growth and guidance

Jason Gerrard, Asst. Prof., Dr. Gerrard's research lab is focusing on understanding the neurological processes that underlie epileptogenesis, seizure activation and seizure propagation.
Elena Gracheva, Asst. Prof., Molecular basis of sensory physiology and thermoregulation. Mammalian hibernation as a model to dissect these processes.

Charles Greer, Prof., Mechanisms that influence axonal and dendritic growth and specificity of targeting in sensory systems.

Jaime Grutzendler, Assoc. Prof., The overall interest of our laboratory centers around cells in the so called "neuro-glio-vascular unit" (neurons, endothelium, astrocytes, pericytes, microglia and oligodendrocytes). Our goal is to learn about the dynamic properties of these cells and how cell-cell interactions are disrupted in brain injury, vascular and neurodegenerative pathologies.

Murat Gunel, Prof., Molecular genetics and biology of brain aneurysms and cavernous malformations; molecular genetics of brain development.

David Hafler, Prof., Neuroimmunology; multiple sclerosis; autoimmunity; genetics; immunobiology.

Marc Hammarlund, Asst. Prof., Axon regeneration and degeneration.

Michael Higley, Asst. Prof., The Higley Lab uses a combination of electrophysiology, 2-photon calcium imaging, and optogenetics, both in vivo and ex vivo, to investigate the organization and function of neural circuits. Recently, we have focused on the roles of GABAergic inhibition and neuromodulation in regulating neuronal activity in the neocortex.

Joy Hirsch, Prof., Current research interests of the Hirsch group are aimed toward understanding the role of functional specializations in the brain and mechanisms of cognitive control.

Tamas Horvath, Prof., Neuroendocrine regulation of homeostasis with particular emphasis on metabolic disorders, such as obesity and diabetes, and the effect of metabolic signals on higher brain functions and neurodegeneration.

Arthur Horwich, Prof., Chaperones in protein folding; ALS (Lou Gehrig’s Disease).

Jonathan Howard, Prof., Our lab is interested in the role of the microtubule-based cytoskeleton in cell shape and movement. A key question is the role of microtubule dynamics and intracellular transport in shaping dendritic arbors.

James Howe, Prof., Our overall interest is in how the kinetics and biophysical properties of glutamate-gated ion channels shape fast synaptic transmission in the mammalian CNS. We are currently especially interested in the impact of interactions with auxiliary subunits on glutamate receptor kinetics.

Fahmeed Hyder, Prof., A primary interest of the Hyder lab is to develop functional imaging techniques that relate neural activity to underlying laminar structure in health and disease. Another active interest in the Hyder lab is molecular imaging with magnetic resonance technologies where several disciplines connect, from chemistry and physics to material science and physiology.

Elizabeth Jonas, Assoc. Prof., Our lab is interested in the study of mitochondrial bioenergetics, biogenesis, morphology, mobility and mitochondrial ion channels. We study how these important features of mitochondria affect mammalian synaptic plasticity under physiological and pathological conditions.

Leonard Kaczmarek, Prof., The Kaczmarek laboratory investigates the question of how neurons become modified to produce prolonged changes in the behavior of an animal. Their work has focused on changes in the phosphorylation state and synthesis of ion channels, and their interactions with cytoplasmic signaling pathways such as those linked to protein synthesis and the Fragile X Mental Retardation Protein.

Kristopher Kahle, Asst., Prof., My research is devoted to identifying the genes and pathways that regulate ionic plasticity in the developing nervous system, and how genetically-encoded or maladaptive changes in these processes contribute to neurodevelopmental disorders and traumatic CNS injury.

Erdem Karatekin, Asst. Prof., The initial connection between the plasma membrane and a neurotransmitter-filled vesicle –the fusion pore– can flicker open and closed repeatedly before dilating (full fusion) or resealing irreversibly ("kiss and run" fusion). Fusion pore dynamics determine the kinetics and amount of neurotransmitter released, and how fast vesicles are recycled, but factors regulating pore dynamics are poorly known, because FPs are transient, and biochemically defined assays with single-pore sensitivity are lacking. We develop such assays and use them to unravel molecular mechanisms regulating fusion pore nucleation and dynamics.

Haig Keshishian, Prof., Factors governing the formation of synaptic connections during development.
Ken Kidd, Prof., Kidd Lab research involves human population genetics. We are examining DNA polymorphisms at many loci, including missense variants at genes of neurological relevance, in over 2000 individuals from a global distribution of over 55 populations.

In-Jung Kim, Asst. Prof., Our laboratory is interested in understanding how neural circuits form and function to elicit appropriate behavior, and how they can be modified by experience.

Hedy Kober, Asst. Prof., Using primarily fMRI and MRI to understand the neural mechanisms that underlie affect and cognitive control in both clinical and healthy populations.

Jeffrey Kocsis, Prof., Pathophysiology of axons and neurons.

Michael Koelle, Assoc. Prof., The mechanism of neurotransmitter signaling through G protein coupled receptors, focusing on serotonin signaling. His research uses a combination of genetics, optogenetics, calcium imaging, and biochemical studies to analyze how the activity of simple neural circuits in C. elegans is generated by neurotransmitter signaling.

Anthony Koleske, Prof., The biochemical mechanisms that control dendrite and dendritic spine formation, plasticity, and long-term stability.

John Krystal, Prof., Neurobiology; Pharmacotherapy; Genetics.

Alex Kwan, Asst. Prof., The neural basis of higher cognitive functions, such as working memory, that enable planning and decision-making. To dissect the neural circuitry underlying these cognitive processes, my lab uses a variety of optical approaches including two-photon calcium imaging and optogenetics to record and manipulate neuronal ensembles in behaving mice.

Daeyeol Lee, Prof., The functions of the prefrontal cortex and basal ganglia related to reinforcement learning, decision making, timing, and arithmetic in non-human primates using behavioral, neurophysiological, and computational methods.

Ifat Levy, Asst. Prof., The neural mechanisms of decision-making and valuation processes and changes in these mechanisms in development, aging and disease.

Chiang-Shan Ray Li, Assoc., Prof., My laboratory combines experimental psychology, brain imaging, and computational modeling of behavior to examine the neural processes of cognitive control. We investigate how these processes are compromised in individuals with neuropsychiatric conditions including cocaine and alcohol dependence.

Janghoo Lim, Asst. Prof., We are interested in studying the molecular and cellular basis of neural development and neurological disorders.

Paul Lombroso, Prof., Research in the Lombroso lab focuses on the role of a brain specific tyrosine phosphatase called STEP in a number of neuropsychiatric and neurodegenerative disorders. STEP levels are elevated in Alzheimer's disease, schizophrenia, fragile X syndrome and Parkinson's disease and the higher levels of STEP disrupt synaptic function and contribute to the cognitive deficits in these illnesses.


Gregory McCarthy, Prof., Neuroimaging and neurophysiological studies of face processing, animacy detection, and biological motion processing. Neuroimaging studies of emotional regulation and cognitive control.

David McCormick, Prof., Cellular basis for cortical and thalamic function.

Mark Mooseker, Prof., Molecular and functional analysis of the cytoskeleton, with current emphasis on myosin superfamiliy of actin-based molecular motors.

Evan Morris, Assoc. Prof., Use of PET imaging (of people and animals) with neuroreceptor tracers to understand and improve treatments for Parkinson’s disease, alcoholism, smoking, and drug abuse.

John Murray, Asst. Prof., Research in the Murray Lab focuses on investigating the dynamics and function of neural circuits, and their dysfunction in psychiatric and neurological disorders.

Angus Nairn, Prof., Dopaminergic signal transduction in the central nervous system.

Dhasakumar Navaratnam, Assoc. Prof., We work on the molecular basis of a number of physiological phenomena related to the hearing and balance organs.

Timothy Newhouse, Asst. Prof., My group works on applying techniques of synthetic organic and physical organic chemistry to problems in neuroscience. Two of the areas that we work on are the synthesis of neurologically active small molecules and developing photoswitch technology.
Michael Nitabach, Assoc. Prof., Our laboratory applies cellular, molecular, genetic, electrophysiological, and systems biology approaches to the question of how neuronal physiological properties determine the information processing characteristics of neural networks. As model systems for addressing this broad fundamental question, we study the neural circuits that control olfactory information processing, sexual courtship, sleep, and multisensory economic decision making in Drosophila melanogaster flies and Caenorhabditis elegans worms.

Marina Picciotto, Prof., The Picciotto lab investigates the molecular basis of complex behaviors, with a particular emphasis on the role of acetylcholine and nicotinic acetylcholine receptors and their role in psychiatric illness.

Vincent Pieribone, Prof., Information encoding in somatosensory cortex and optical probes of membrane potential.

Maria Mercedes Piñango, Assoc. Prof., Language-brain relations: cortical dissociations in language localization, time-course of language processing during real-time sentence comprehension.

Christopher Pittenger, Asst. Prof., Using genetic tools to examine the molecular and cellular mechanisms of striatum-dependent habit learning.

Marc Potenza, Prof., Pathological gambling; impulse control disorders; substance abuse; addiction; gender differences.

Pasko Rakic, Prof., Developmental neurobiology, genetic and epigenetic regulation of neural interactions.

Gary Rudnick, Prof., Dr. Rudnick’s laboratory studies the mechanism by which neurotransmitter transporters move their substrates across the membrane, are inhibited by conventional and unconventional re-uptake inhibitors, and are regulated by cellular signaling pathways.

W. Mark, Saltzman, Prof., Our laboratory is creating new technology, based on the use of biocompatible polymeric materials, for the controlled delivery of drugs, proteins, and genes. We also develop and study new polymeric materials that influence the growth and assembly of tissues. We are particularly interested in applying these materials and methods for treatment of brain diseases, such as brain tumors.

Gregory Samanez-Larkin, Asst. Prof., We examine how individual and age differences in motivation and cognition influence decision making across the life span.

Laurie Santos, Assoc. Prof., Social and physical cognition in non-human primates.

Joseph Santos-Sacchi, Prof., Role of outer hair cells in mammalian cochlear amplification.

Michael Schwartz, Assoc. Prof., Development and organization of connectivity in the mammalian cerebral cortex.

Nenad Sestan, Prof., Molecular control of neuronal identity and connectivity in the cerebral cortex.

Gordon Shepherd, Prof., Experimental and computational studies of sensory transduction, synapses, dendrites, and microcircuits using the olfactory pathway as a model system.

Fred Sigworth, Prof., Ion channel structure and gating mechanisms, with emphasis on new biophysical methods for electrical recordings and cryo-EM structure determination.

Satinder Singh, Asst. Prof., Structure/function of signaling molecules implicated in neuro-psychiatric and neurological diseases. My present focus is on the plasma membrane biogenic amine neurotransmitter transporters (SERT, NET, DAT).

Dana Small, Assoc. Prof., Neurophysiology of taste, flavor and feeding in humans.

Stephen Strittmatter, Prof., Molecular determinants of axonal guidance during development and regeneration. Cellular and molecular basis of neurodegeneration in Alzheimer’s Disease, Frontotemporal Dementia and Amyotrophic Lateral Sclerosis.

Jane Taylor, Prof., Neurobiology of addiction, depression and other neuropsychiatric disorders involving motivation, learning and cognition. Behavior and molecular approaches in mice, rats and monkeys.

Susumu Tomita, Assoc. Prof., Revealing molecular rules governing synaptic transmission.

Flora Vaccarino, Prof., The Vaccarino lab studies the development of the mouse and human telencephalon using mouse models and induced pluripotent stem cells. We are part of the PsychENCODE consortium, with the aim of comparing noncoding mRNAs and DNA functional elements in human fetal brains and iPSC derived from the same individual. The lab also uses next-gen sequencing and advanced neurobiological techniques to study somatic genomic variation in the brain and its implications for human development and disease.

Christopher van Dyck, Prof., Therapeutic neuroimaging and genetic studies of Alzheimer’s disease and cognitive aging.
Justus Verhagen, Assoc. Prof., The main focus of the Verhagen lab is to explore the neural basis of flavor perception.

Stephen Waxman, Prof., Molecular neurobiology of disease, with emphasis on ion channel function and dysfunction in spinal cord injury, multiple sclerosis, and stroke

Tian Xu, Prof., Mechanisms underlying neurodegeneration in Drosophila model

David Zenisek, Assoc. Prof., Presynaptic mechanisms of retinal neurons

Weimin Zhong, Assoc. Prof., Asymmetric cell division and the development of the mammalian neocortex

Jiangbing Zhou, Asst. Prof., Engineering nanoparticles and neural stem cells for systemic drug delivery to the brain and employing them to deliver therapeutics to treat brain cancer, stroke, and traumatic brain injury.

Z. Jimmy Zhou, Prof., Development of the mammalian retina under both normal and pathological conditions

Steven Zucker, Prof., Computational neuroscience of the visual system; Learning of high-order structure.

Medical Anthropology Medical anthropology encompasses the study of health, illness, and healing through time and across cultural settings. Medical anthropologists study human diversity, suffering, and resilience, as well as the medical systems in place to alleviate that suffering and address diverse human health needs. Around the world, medical anthropologists analyze the relations among health, illness, social institutions, culture, ecology, and political-economic power, combining biomedical perspectives with those that address social and cultural problems through health advocacy, activism, and research. Their work points to the differences in the ways bodies count: who falls ill and why; who has access to health resources; where healing is sought; and how we define our health and illness. Medical anthropologists have contributed to the study of the production of medical knowledge in fields ranging from reproduction to global health development to the new chronic and infectious diseases. They have examined questions of stigma, marginality, and the disabled body. They have probed critical issues of biopolitics, immigration, race, citizenship, and health disparities. They also look at the intersections of disease and environment, and the structural violence triggered by processes of globalization, neoliberalism, and global capitalism. In the midst of these macrostructural forces, medical anthropologists have examined the social construction of illness categories, the individual illness narratives used to articulate them, and the social and political hierarchies such categories may produce or maintain.

Medical Anthropology is now one of the largest subfields within Anthropology, both in the United States and abroad. In 2009, Yale University hosted the first international conference in Medical Anthropology, celebrating 50 years of the subfield’s existence and highlighting its interdisciplinary nature. More than 1,000 scholars from 48 countries attended the conference, bespeaking the importance of Medical Anthropology as a growing global discipline. Yale is also the home of the journal Social Science & Medicine’s Medical Anthropology Editorial Office, co-hosts a Medical Anthropology Colloquium with Harvard University, and supports a strong intellectual partnership with Yale’s Global Health Initiative (GHI). Currently, eight Yale faculty members—Vanessa Agard-Jones, Richard Bribiescas, Marcia Inhorn, Karen Nakamura, Catherine Panter-Brick, Joanna Radin, Claudia Valeggia, and Brian Wood—specialize in a dozen key areas of Medical Anthropology. They offer a broad range of courses in Medical Anthropology theory, research, methods, and applications. In addition, they lead interdisciplinary initiatives in collaboration with many affiliated faculty, centers, and departments across the Yale campus. Together, these faculty prepare doctoral students for careers in academia, as well as for applied research and interventions in global health, medical humanitarian organizations, and a variety of health-related professions.

Faculty Research Interests [http://anthropology.yale.edu/people/faculty](http://anthropology.yale.edu/people/faculty)

Richard Bribiesca, Professor of Anthropology and Chair of the Anthropology Department. A Principal Investigator of the Yale Reproductive Ecology Laboratory and Director of the Program in Reproductive Ecology. Evolutionary biology, life history theory, endocrinology of human and comparative life histories, including reproduction, aging, and metabolism; evolutionary medicine and contemporary health challenges. Field research among the Shuar people of Ecuador, Ache of Paraguay and populations in Venezuela, Japan, and the United States, as well as among various species of non-human primates.
Marcia C. Inhorn, William K. Lanman Jr. Professor of Anthropology and International Affairs and Council on Middle East Studies. Gender, health and feminist technoscience; reproductive health and technologies; masculinity studies; globalization and cosmopolitanism; science and technology studies; religion and bioethics; ethnographic research design and methodology. Field research in the Middle East, particularly Egypt, Lebanon, the United Arab Emirates, and the Arab diaspora.


Claudia Valeggia, Professor of Anthropology. A Principal Investigator of the Yale Reproductive Ecology Laboratory. Human reproductive ecology; reproductive endocrinology; maternal and child health; evolutionary demography; biodemography of aging; and health of indigenous populations. Field research in Latin America, particularly Argentina.

Brian Wood, Assistant Professor of Anthropology. Human ecology; the production and sharing of food; family formation; and demography. Field research in northern Tanzania among the Hadza, an indigenous hunter-gatherer population.

Affiliated Faculty

Vanessa Agard-Jones, Assistant Professor of Women's, Gender and Sexuality Studies, with secondary appointments in Anthropology and African American Studies. Black feminist theory; feminist science and technology studies; queer theory; environmental health; sovereignty and citizenship; experimental ethnographic writing. Field research in Europe and the Caribbean, particularly metropolitan France and France's overseas territories.

Joanna Radin, Assistant Professor of History of Medicine, History, and Anthropology. Cold War life and human sciences; technological systems; scientific collecting; the politics of the archive; colonialism; biomedical ethics; and science and technology studies.

Microbiology The Microbiology Graduate Program is an interdisciplinary PhD program of training and research in the study of microorganisms and the effects on their hosts. The faculty of the Program share the view that understanding the biology of microorganisms requires a multidisciplinary approach and therefore the Microbiology Graduate Program emphasizes the need for strong multidisciplinary training, including the study of cellular mechanisms for host pathogen interaction in the Department of Molecular Pathogenesis and the Emerging Microbial Diseases division of EPH. The faculty is composed of microbiologists in several academic departments, shares a commitment to understanding the biology of microorganisms through employing cellular, molecular, and genetic approaches. The program is designed to provide individualized education in modern microbiology and to prepare students for independent careers in research and teaching. Students can specialize in various areas, including bacteriology, virology, microbe-host interactions, microbial pathogenesis and parasitology, and microbial genetics, ecology, evolution, and physiology.

Faculty Research Interests http://medicine.yale.edu/bbs/people/microbiology.aspx

Murat, Acar, Asst. Prof., Study of genetic and phenotypic changes that cells implement and experience during the processes of Adaptive Gene Network Evolution and Cellular Aging

Serap Aksov, Prof., Trypanosomiasis, African; Tsetse Flies; Global Health

Susan Baserga, Prof., Yeast and ribosome biogenesis

Choukri Ben Mamoun, Assoc. Prof., Basic Research: Purine transport and metabolism in P. falciparum

Ronald Breaker, Prof., Diversity of structures and functions exhibited by RNA and DNA. Special interest in ribozymes and riboswitches

Richard Bucala, Prof., Mechanisms by which host immunity converts from a protective response to one producing disease and tissue pathology; Emergence of steroid resistance; Biochemical, biological, and genetic
characterization of the MIF cytokine family; MIF’s role in malaria and global infectious diseases

**Michael Cappello, Prof.**, Molecular parasitology; Hookworm pathogenesis & vaccine development; International child health

**Yung-Chi Cheng, Prof.**, Cancer and viral chemotherapy. Functional roles and properties of virus-specific proteins, and design of selective antiviral compounds. Exploring the mechanisms of drug resistance development

**Jason Crawford, Asst. Prof.**, Developing and systematically applying genome sequence-based methods for the discovery of genetically encoded small molecules from mutualistic and pathogenic microorganisms.

**Peter Cresswell, Prof.**, Biology; Cell Biology; Dermatology; Endoplasmic Reticulum; Immunity; Major Histocompatibility Complex

**Daniel DiMaio, Prof.**, Molecular Biology of Tumor Viruses; Mechanisms of Viral Carcinogenesis; Molecular Basis of Cell Growth Regulation and Senescence

**Erol Fikrig, Prof.**, Vector-borne diseases; Lyme disease; Human granulocytic ehrlichiosis

**Durland Fish, Prof.**, Ecology and prevention of vector-borne infectious diseases. Recent emphasis has been on tick-borne pathogens causing Lyme disease and human ehrlichiosis in the northeastern U.S.

**Jorge Galán, Prof.**, Pathogenesis of intestinal pathogens, *Salmonella enterica* and *Campylobacter jejuni*

**Andrew Goodman, Asst. Prof.**, Research central hypothesis: resident human-associated microbial communities play critical, unrecognized roles in health and disease

**Eduardo Groisman, Prof.**, Bacterial genetics; Signal transduction; Infectious diseases

**Jo Handelsman, Prof.**, Understanding diversity in microbial communities and their role in infectious disease

**Farren Isaacs, Asst. Prof.**, Focused on developing foundational cellular and biomolecular engineering technologies to understand and engineer biological systems.

**Akiko Iwasaki, Assoc. Prof.**, Innate immunity; Autophagy; Inflammasomes; sexually transmitted infections; Herpes simplex virus; human papillomavirus; respiratory virus infections

**Christine Jacobs-Wagner, Prof.**, Temporal and spatial mechanisms involved in bacterial physiology, with emphasis on chromosome dynamics, cell division, cell cycle regulation, cell morphogenesis and RNA biology

**Susan Kaech, Assoc. Prof.**, Mechanisms of memory T cell development

**Barbara Kazmierczak, Assoc. Prof.**, How environmental or commensal organisms--bacteria with which we come into daily contact--can become pathogens capable of causing severe, life-threatening infections.

**E. George, Miller, Jr., Prof.**, Mechanisms underlying viral persistence and reactivation

**Walther Mothes, Assoc. Prof.**, Viral spread and pathogenesis of HIV-1 and other retroviruses

**Melinda Pettigrew, Assoc. Prof.**, Infectious diseases of infants, children, and young adults

**Carla Rothlin, Asst. Prof.**, Regulation of inflammation; Homeostatic control of the immune system.

**Craig Roy, Prof.**, Using model pathogens *Legionella pneumophila* and *Coxiella burnetii*, studying how bacteria that replicate inside mammalian cells create specialized vacuoles that support pathogen replication

**Christian Schlieker, Asst. Prof.**, Mechanisms of membrane dynamics in relation to nuclear envelopathies and viral infection

**Clifford Slayman, Prof.**, Molecular mechanisms of charge-dependent transport across biological membranes directed toward two classes of proton pumps (P-type and V-type), a family of proton-coupled potassium transporters (TRK proteins), and a peculiar group of potassium channels which form as intramembrane
homodimers (TOKs). All of these are studied in microorganisms, especially fungi

**Dieter Soll, Prof.**, Diverse roles of transfer RNA in various biological systems, focusing on the evolutionary role of non-canonical components of the translational machinery

**William Summers, Prof.**, An essential aspect of science is an understanding of the ontological and epistemological aspects of scientific knowledge

**Joann B. Sweasy, Prof.**, Study of the relationship between mutations and cancer, centering on the mechanism of mutagenesis by a DNA polymerase, polymerase $\beta$(Pol $\beta$).

**Peter Tattersall, Prof.**, Induction of immunogenic cell death by oncosuppressive paroviruses, and characterizing the unique chromatin assembled during paroviral DNA replication

**Jeffrey Townsend, Asst. Prof.**, Evolutionary bioinformatics and high throughput experiments, specializing in developing experimental, computational, and theoretical advances in the phylogenomics and the evolution of gene expression

**Christian Tschudi, Assoc. Prof.**, Focusing on the protozoan parasite *Trypanosoma brucei*, applying RNA interference (RNAi) to identify genes essential for survival within the insect vector and mammalian host. In addition, high-throughput next-generation sequencing technologies (RNA-Seq) are used to analyze gene expression patterns

**Paul Turner, Assoc. Prof.**, Using microorganisms (RNA viruses, DNA viruses, bacteria) as model systems to address hypotheses in ecological and evolutionary theory, especially questions regarding the evolution of genetic exchange (sex), virus ecology and evolution, host-parasite interactions, and the evolution of infectious disease

**Sandra Wolin, Prof.**, Function of noncoding RNAs; how cells recognize and degrade defective RNAs, and how failure to degrade RNA affects cells and contributes to disease

**Yong Xiong, Assoc. Prof.**, Host immune responses to viral infections and the biosynthesis of medically important natural products by multi-enzyme complexes.

**Molecular Biophysics & Biochemistry** The Molecular Biophysics and Biochemistry (MB&B) Graduate Program is designed to prepare students for careers as independent investigators in the broad areas of molecular and structural biology.

Foci of faculty interest include the study of DNA dynamics, including replication, recombination, transposition and functional genomics; transcriptional regulation, from individual transcription factors to the control of lymphocyte activation, the interferon response and organismal development; RNA catalysis and ribonucleoprotein machines, including self-splicing introns and spliceosomes, mRNA stability, RNA editing and modification, ribosome structure and function, tRNA recognition and biosynthesis, and HIV reverse transcriptase; protein folding and degradation, including chaperone structure and function, protein design, ubiquitin-mediated proteolysis, amyloid fibril formation; and membrane biology and motion, including transmembrane signaling, growth factor receptors, and membrane channels. Additional faculty study neurotransmission in *C. elegans*, control of the cell cycle, and signal transduction. Structural and computational biology is a strong component of many of the research areas outlined above. The department is located in the Bass Center for Molecular and Structural Biology and the Gibbs Laboratory on the main campus, and in the Sterling Hall of Medicine and the Boyer Center at the Medical School. Additional labs are based on the West Campus. MB&B draws strength from the fact that its physical presence is split between Science Hill (close to MCDB, and the Departments of Chemistry, Physics and Geology) and the Medical School. Courses cover the molecular genetics of eukaryotes, macromolecular structure and function, enzyme mechanisms, genetic analysis, molecular cell biology, membrane structure and function, electron cryo-microscopy, X-ray diffraction, and genomics & bioinformatics.

**Faculty Research Interests:** [http://www.mbb.yale.edu/faculty/index.html](http://www.mbb.yale.edu/faculty/index.html)

**Karen Anderson**, Professor; Mechanistic enzymology, receptor-ligand interactions, structure-guided inhibitor design

**Susan Baserga**, Professor; Elucidation of the mechanisms underlying ribosome biogenesis in eukaryotes

**Richard Baxter**, Assistant Professor; Innate immunity in arthropods, host-pathogen interactions, new chemical entities for controlling vector-borne disease
Julien Berro, Assistant Professor; Molecular mechanisms of force generation and force sensing
Ronald Breaker, Professor; Nucleic acids biochemistry and engineering, riboswitch and noncoding RNA discovery and analysis.
Gary Brudvig, Professor; Photosynthetic water oxidation, metalloproteins, biological electron-transfer reactions, EPR spectroscopy
Enrique De La Cruz, Professor; Molecular basis of free-energy coupling and subunit cooperatively in non-muscle myosins
Daniel DiMaio, Professor; Tumor virus infection and action. Construction of artificial transmembrane proteins with novel biological activities.
Donald Engelman, Professor; Developing a chemical understanding of membrane protein folding and oligomerization to use in interpreting evolution and function.
Alan Garen, Professor; Cell surface molecules involved in tumorigenesis and normal development
Mark Gerstein, Professor; Bioinformatics, large-scale analysis of genome sequences, macromolecular structures, and gene expression data
Mark Hochstrasser, Professor; Mechanisms and functions of the ubiquitin-proteasome system
Jonathon Howard, Professor; Molecular basis of cell shape and motion
Michael Koelle, Associate Professor; Mechanism and regulation of neurotransmission through G protein coupled receptors
Anthony Koleske, Professor; Biochemical mechanisms that regulate neuronal motility and morphogenesis
William Konigsberg, Professor; Structure/function relationships with respect to a pol alpha class DNA polymerase from bacteriophage RB69
Patrick Loria, Professor; Solution NMR and biophysical studies of enzyme motions
Nikhil Malvankar, Assistant Professor; understanding how microbes use electrical charges for respiration and cellular communication and cause severe infections
I. George Miller, Professor; Molecular biology and immunology of the oncogenic human gamma herpes viruses, Epstein-Barr virus (EBV) and Kaposi Sarcoma-Associated Herpesvirus (KSHV)
Andrew Miranker, Professor; Molecular mechanisms of protein folding, misfolding and pathological assembly into amyloid fibers
Karla Neugebauer, Professor; Transcription and RNA processing in the nuclear landscape
Thomas Pollard, Professor; Molecular basis of cellular motility and cytokinesis
Lynne Regan, Professor; Protein structure, function, and design
Karin Reinisch, Professor, Molecular mechanisms underlying membrane trafficking and lipid homeostasis
David Schatz, Professor; Mechanism and regulation of V(D)J recombination and somatic hypermutation during lymphocyte development; mechanisms of DNA repair; functions of the RAG1, RAG2, and AID proteins
Christian Schlieker, Assistant Professor; Diverse functions of Ubiquitin and related modifiers in protein quality control
Matthew Simon, Assistant Professor; Chemical and molecular approaches to study chromatin biology, with a focus on large non-coding RNAs
Charles Sindelar, Assistant Professor; Determining the mechanisms of cytoskeletal motors and depolymerases using high-resolution cryo-EM, X-ray crystallography, and other biophysical methods
Sarah Slavoff, Assistant Professor, Biochemistry, Biophysics and Structural Biology: RNA Catalysis and Ribonucleoprotein Machines
Dieter Söll, Professor; Biochemical and genomic studies of the evolution of protein synthesis
Mark Solomon, Professor; Biochemistry and genetics of cell cycle regulation in yeast and mammalian systems
Joan A. Steitz, Professor; Structure and function of small RNPs in vertebrate cells
Thomas A. Steitz, Professor; Structural explanations at the atomic level for the mechanisms of replication, recombination, transcription, and protein synthesis using the tools of X-ray crystallography and molecular biology
Scott Strobel, Professor; The structural and functional basis of RNA catalyzed biological reactions
William Summers, Professor; History of molecular biology
Patrick Sung, Professor; Mechanisms of homologous recombination and DNA repair in eukaryotes
Shervin Takyar, Assistant Professor, Research focuses on the role of vascular non-coding RNAs in Th2 inflammation, lung injury and cancer
Corey Wilson, Assistant Professor; Protein Design and Biomolecular Engineering
Sandra Wolin, Professor; How RNAs fold and assemble into functional RNA-protein complexes within cells
Yong Xiong, Associate Professor; Structural and functional studies of human anti-HIV proteins

Molecular, Cellular & Developmental Biology Yale's Department of Molecular, Cellular and Developmental Biology offers a wide-ranging program of study and research leading to the Ph.D. degree. The program is supervised by approximately thirty-five faculty members working in seven areas: Biochemistry, molecular biology, and chemical biology; Genetics; Cell and developmental biology; Neurobiology; Plant sciences; Biotechnology; Genomics, Proteomics, and Bioinformatics. Students whose interests overlap two or more of these areas are encouraged to develop a special program of study for themselves. In addition, students may develop programs of study in conjunction with other University departments such as Molecular Biophysics and Biochemistry, Chemistry, Ecology and Evolutionary Biology, or with other schools within the University such as the School of Medicine. The Department is located primarily in the twelve-story Kline Biology Tower and in the Osborn Memorial Laboratories located on Yale's Science Hill. In addition, many of our faculty are located on West Campus.

Faculty Research Interests: http://www.biology.yale.edu
Shirin Bahmanyar, Asst. Prof., MCDB, organelle structure, lipid synthesis, nuclear envelope, lamins, high resolution microscopy, cellular dynamics, C elegans
Ronald R. Breaker, Prof. & Chairman, MCDB, The discovery and analysis of Riboswitches and ribozymes and engineering new RNA and DNA enzymes by in vitro evolution
John R. Carlson, Prof., MCDB, Olfaction and Taste in Drosophila and Malaria Mosquitoes
Sreeganga Chandra, Asst. Prof. of Neurology/CNNR and Mol Cell & Dev Biology, Presynaptic Biology; Synapse Maintenance; Parkinson's Disease; Neurodegeneration
Damon Clark, Asst. Prof. MCDB, Drosophila visual behaviors and circuitry; computational and modeling approaches to neural computation
Nicole Clay, Asst. Prof. MCDB, Plant innate immunity and bio-defenses
Lynn Cooley, Prof., Genetics, Molecular genetics of Drosophila oogenesis, control of oocyte growth, ring canals
Craig M. Crews, Prof., MCDB, Exploration and control of signal transduction pathways using chemical probes
Stephen L. Dellaporta, Prof., MCDB, Sex determination and cell death in plants
Thierry Emonet, Assoc. Prof., MCDB, We study how live cells and animals process information, interact, and make decisions using wet lab experiments and computational modeling.
Paul Forscher, Prof., MCDB, Molecular mechanisms of axon guidance: cytoskeletal protein dynamics and related signal transduction
Joshua Martin Gendron, Asst. Prof., MCDB, Plants, circadian clock, protein degradation
Jo Handelsman, Prof., MCDB, Studies the structure and function of microbial communities in soil and in insect guts using metagenomics, pathogenesis in a community context, chemical biology, and microbial signaling
Mark Hochstrasser, Prof., crossroads of biochemistry and genetics and takes advantage of the many research benefits offered by the yeast Saccharomyces cerevisiae as a model eukaryotic cell system.
Scott A. Holley, Assoc. Prof., MCDB, Molecular, genetic and embryological analysis of segmentation in the zebrafish
Valerie Horsley, Asst. Prof., MCDB, Study of the cellular and molecular mechanisms that control stem cell activity and function within the skin epithelium
Vivian Irish, Prof., MCDB, Developmental genetics of flowering in Arabidopsis; evolution of plant development

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Pharmacology Research in pharmacology involves a multi-disciplinary approach to understand the interaction of molecules with biological systems. These molecules may be as simple as electrons or ions, or as complex as phospholipids, nucleic acids, proteins, or clinically relevant drugs. Studies vary from a protein, to a signaling mechanism, to a virus particle or a whole organism – from bacteria to humans. Historically, the Department of Pharmacology at Yale was renowned for its contributions to neuropharmacology, cancer, and viral chemotherapy. More recently, the department has broadened its scope to include strengths in signal transduction mechanisms, vascular biology, structural biology (of proteins involved in cell signaling, inflammation, cancer, and Alzheimer’s disease), mechanisms of pain, enzyme and ion channel kinetics, and mechanisms of neurotransmitter transport and hormone storage release. New programs in the department include high throughput screening and rational drug design using techniques ranging from X-ray crystallography and modern image analysis. The ultimate goal is not only to gain insights into various biomedical mechanisms or diseases, but also to use this information to generate new therapies for use in the clinic. The faculty members listed below have been successful in generating both insights into biomedical mechanisms and in developing clinically approved drugs for human use.

Faculty Research Interests [http://info.med.yale.edu/pharm/faculty/](http://info.med.yale.edu/pharm/faculty/)

Karen S. Anderson, Professor; Molecular mechanisms and drug discovery for novel therapeutics for anticancer, antiviral, and antiparasitic molecular targets.

Anton M. Bennett, Professor; Regulation of signal transduction pathways by protein tyrosine phosphatases in physiological and pathophysiological signaling.
Titus Boggon, Associate Professor; Mechanisms of protein complex formation and kinase regulation for signaling cascades using primarily structural biology techniques.

David Calderwood, Associate Professor; Integrin Signaling and Cytoskeletal interactions.

Yung-Chi Cheng, Professor; Cancer and viral chemotherapy; molecular biology and biochemistry of virus and cancer.

Barbara Ehrlich, Professor; Cell regulation in intracellular calcium concentration.

Jonathan Ellman, Eugene Higgins Professor of Chemistry; New methods for small molecule drug discovery and their applications.

Ya Ha, Associate Professor; Structural Biology and Alzheimer’s Disease.

James R. Howe, Professor; Understanding how the structure of glutamate receptors determines their kinetic behavior.

Leonard K. Kaczmarek, Professor; Modulation of electrical activity in neurons that control long-lasting changes in behavior; the role of neuropeptides and protein phosphorylation, as well as messenger RNA and protein synthesis, in the control of neuronal ion channels.

Irit Lax, Associate Professor; Signal transduction by receptor tyrosine kinases.

Mark Lemmon, Sackler Professor of Cancer Biology; Molecular mechanisms of signaling by EGF receptor and its relatives, signaling by kinases, pseudokinases, and phospholipids, and understanding oncogenic mutations for personalized medicine.

Elias Lolis, Professor; Structural and mechanistic studies of proteins and their G-protein coupled receptors involved in inflammation and cancer.

Bryce Nelson, Visiting Professor, Protein engineering using phage display; isolation and development of antibodies for diagnostics and therapeutics.

Gary Rudnick, Professor; Mechanism and regulation of neurotransmitter transport; interaction of cocaine, ecstasy, and other drugs with neurotransmitter transporters.

Joseph Schlessinger, Professor and Chair; Mechanism of action and signal transduction pathways activated by receptor tyrosine kinases in normal processes and in disease. Development of novel targeted cancer therapies using crystallographic studies and molecular biology.

William C. Sessa, Professor; Biochemistry, cellular and molecular biology of tumor angiogenesis and atherosclerosis; regulation of signal transduction pathways that promote growth factor signaling in vascular cells.

Benjamin E. Turk, Associate Professor; Mechanisms of substrate recognition by protein kinases and proteolytic enzymes in cancer and infectious disease; small molecule and peptide library screening.

Dan Wu, Professor; Wnt; signal transduction; G protein, Chemotaxis; Cell migration; Cancer biology and therapeutics; Bone development; Chemoattractant signaling; Inflammation.

Public Health Programs of study are offered in the areas of biostatistics, chronic disease epidemiology, environmental health sciences, genetic epidemiology, health policy and management, and epidemiology of microbial diseases (infectious disease epidemiology, vector-borne diseases, immunology, parasitology, and virology). The Social and Behavioral Concentration (SBS), within the Chronic Disease Epidemiology department, offers students specialized instruction in the theory and methods of the social and behavioral sciences. All programs are under the faculty of the School of Public Health. For detailed information visit:

http://publichealth.yale.edu/

Faculty Research Interests

Serap Aksoy, Interaction of African trypanosomes with their vector, the tsetse fly; genetic modification of vector competence

Elizabeth Bradley, Health care needs of older adults, hospice and quality improvement efforts

Susan Busch, Health and mental health economics, access to care for low income families, valuing behavioral health interventions
Xi Chen, Social and economic behavior and their consequences in underdeveloped contexts. Examining social interactions on stigmatized behavior and early child health
Maria Ciarleglio, Hybrid Bayesian-frequent clinical trial design
Elizabeth Claus, Statistical genetics; risk models; genetic epidemiology; breast cancer and neurosurgery outcomes
Paul Cleary, Developing better methods for using patient reports to evaluate the quality of medical care
Ted Cohen, Mechanisms of emergence and transmission of drug-resistant TB
Zack Cooper, Variation in health care providers’ productivity within and across countries and understanding how competition, transparency and financial incentives operate in hospital and insurance markets
Forrest Crawford, Statistical methodology for learning from stochastic processes in genetics, evolution, epidemiology, neuroscience and public health
J. Lucian Davis, Tuberculosis diagnosis in resource-constrained settings domestically and internationally and the evaluation of strategies to improve health outcomes for patients with TB diagnosis
Andrew Dewan, Genome-wide association studies and genetic and environmental factors that interact and contribute to disease susceptibility.
Nicole Deziel, Developing and evaluation exposure estimates for application in environmental epidemiologic studies in the areas of pesticides, polycyclic aromatic hydrocarbons, and persistent organic pollutants
Robert Dubrow, Cancer epidemiology; HIV prevention; chronic disease prevention
Abigail Friedman, Behavioral and health economics and the implications for population level disparities
Alison Galvani, Modeling the evolution and epidemiology of infectious diseases
Nicola Hawley, Obesity and related non-communicable diseases
Robert Heimer, Hepatitis and HIV syringe exchange programs, molecular epidemiology of HIV and hepatitis
Josephine Hoh, Age-related macular degeneration, studies in populations with different ethnic backgrounds, gene mapping paradigm to study the genetic etiology of human illnesses.
Theodore Holford, Development and application of statistical methods in public health and medicine, particularly cancer epidemiology
Jeannette Ickovics, Community based longitudinal studies in HIV/AIDS
Melinda Irwin, Health promotion; exercise interventions; cancer biomarker
Anne Marie Jukic, Fertility, endocrinology, early pregnancy and pregnancy outcomes as related to environmental and nutritional risk factors
Danya Keene, Health inequality; health and place; stigma; social policy
Trace Kershaw, HIV/STD prevention and reproductive and maternal-child health epidemiology
Kaveh Khosnood, Epidemiology of infectious diseases particularly among injection drug users
Albert Ko, Epidemiology and global field studies on leprosy
Harlan Krumholz, Cardiovascular epidemiology
Brian Leaderer, Research on human exposure to air contaminants; asthma
Becca Levy, Aging and psychosocial epidemiology
Judith Lichtman, Cardiovascular disease in the elderly and epidemiology
Haiqun Lin, Statistical methods in longitudinal data and biomarker; frailty models; latent class models
Shuangge (Steven) Ma, Statistical analysis of interval censored survival data and bioinformatics
Xiaomei Ma, Cancer epidemiology
Robert Makuch, Modeling of biomedical time series data; methodological issues in clinical trials; regulatory affairs
Diane McMahon-Pratt, Immune effector mechanisms in Leishmania
Joan Monin, Emotional processes and how that affects health in older adult relationships
Chima Ndumele, Policy issue impacts on vulnerable populations and their access to health care resources
Ingrid Nembhard, Health care management, organizational behaviors and performance improvement.
Linda Nicolai, Behavioral aspects of HIV and STD prevention
John Pachankis, Psychological processes and social contextual factors explaining LGBT individuals’ unequal experiences with adverse mental health & physical health outcomes.
David Paltiel, Cost effectiveness studies; medical decision analysis; health policy modeling
Sunil Parikh, Translational studies of malaria in Sub-Saharan Africa
Peter Peduzzi, Development of statistical methods for the design, conduct, and analysis of clinical trials and research on aging
Rafael Perez-Escamilla, Domestic and global community/public health nutrition issues and community outreach and workforce development efforts to help translate findings into improved practices and health outcomes at the community level
Melinda Pettigrew, Molecular and epidemiological approaches to infectious diseases in infants and young children
Virginia Pitzer, Mathematical modeling of the transmission dynamics of imperfectly immunizing infections
Harvey Risch, Cancer etiology and prevention
Mark Schlesinger, Health Policy research, especially assessments of Federal programs for children and the elderly
Jason Schwartz, Translation of regulation and policy in medicine and public health
Fatma Shebl, The role of inflammation and infection in cancer risk. Hepatitis C virus infection and transmission
Jody Sindelar, Applying economic principles to health issues
Jeffrey Townsend, Genome-wide genome expression variation using modeling
Christian Tschudi, Biology, genetics, genomics and high-throughput sequencing of neglected tropical diseases.
Anita (Zuoheng) Wang, Statistical Genetics, Bioinformatics and Genomics
Joshua Warren, Statistical methods in public health with an emphasis on environmental health problems by introducing spatial and spatiotemporal models in the Bayesian setting to learn more about the associations between environmental exposures and congenital anomalies
Daniel Weinberger, Vaccine effectiveness; bacterial evolution; strain dynamics
Reza Yaesoubi, Medical decision making and model-based evaluation of health policies by incorporating mathematical and computer simulation models, to guide resource allocation and decision making in public health and health delivery systems.
Daniel Zelterman, Categorical data analysis, goodness of fit tests; mixture models; statistical methods in cancer research
Heping Zhang, Development of biostatistical methods and applications for large complex epidemiological studies; statistical genetics and neuroimaging analysis
Hongyu Zhao, Applications of probability and statistics to molecular biology and genetics
Yong Zhu, molecular epidemiological approach to study genetic susceptibility markers and their interactions with environmental exposures in human disease development

Sociology The Department of Sociology at Yale University provides concentrations in the fields of Comparative and Historical Sociology, Cultural Sociology and Social Theory, and Social Stratification and Life Course Research. In addition, our faculty publish and teach in the areas of Gender and Sexuality, Political Sociology, Sociology of Religion, Economic Sociology, Urban Sociology and Ethnography, and Chinese Society.

Faculty Research Interests http://sociology.yale.edu/people/faculty
Julia Adams, State formation, gender and family, social theory, early modern European politics, colonialism and empire
Jeffrey Alexander, Theory, culture, and politics
Rene Almeling, Gender, markets, medicine, and genetics
Elijah Anderson, Social organization, the urban underclass, interactional social psychology, race relations, qualitative methods
James Baron (SOM), Human resources, organizational design and behavior, social stratification and inequality, work, labor markets and careers, economic sociology, entrepreneurial companies
Scott Boorman, Models for evolutionary biosociology, blockmodel algorithms for the empirical description of social networks, the theory of complex statutory evolution, and analysis of social processes that involve alternatives to rational choice
Nicholas Christakis, Social networks and biosocial science
Paul Cleary (EPH), Developing better methods for using patient reports about their care and health status to evaluate the quality of medical care and studying the relationships between clinician and organizational characteristics and the quality of medical care
Deborah Davis, Historical and comparative sociology, inequality and stratification, contemporary Chinese society, and methods of fieldwork
Emily Erikson, Social networks, social theory, comparative-historical research, and economic sociology
Ronald Eyerman, Cultural and social movement theory, critical theory, cultural studies and the sociology of the arts
Philip Gorski, State-formation, nationalism, revolution, economic development and secularization with particular attention to the interaction of religion and politics
Lloyd Grieger, Family/Gender/Sexuality; Health, Medicine, and Biosocial Interactions; Methods, Social Stratification.
Sigrun Kahl. Welfare states, povery policy, moral economy, religion and politics.
Marissa King. Technological innovation and spatial diffusion, medical sociology, autism research.
Vida Maralani, Social stratification and demography
Andrew Papachristos. social networks, neighborhoods, street gangs, and interpersonal violence.
Vicki Schultz (Law), Employment discrimination law, civil procedure, feminism and law, and gender and work
Philip Smith, Social and cultural theory, cultural sociology and criminology.
Olav Sorenson. Economic geography, economic sociology, entrepreneurship, organizational ecology, the sociology and management of science and technology, and business and corporate strategy.
Frederick Wherry, Economic Sociology
Jonathan Wyrtzen, State formation, colonialism and empire, ethnicity and nationalism, urban and rural contentious politics, and Islamic social movements