



## ACADEMIC RESEARCH TRACK (ART)

### *I. Overview*

ART is a program designed to enrich the curriculum of the Medical School of the University of Rochester so as to support students who are interested in pursuing careers in academic medicine:

The Academic Research Track will provide selected students, strongly motivated to pursue an academic career in medicine that encompasses research, with a broad and deep exposure to basic, clinical, educational or translational research, involving both didactic and mentored research experiences through an enriched medical school curriculum.

### *II. The Program in Brief*

The ART will be based in the Double Helix Curriculum, with additional requirements<sup>1</sup>:

- Attendance at series of monthly seminars, lectures and workshops (optional for those students also pursuing a Masters degree), throughout the years of training, consisting of
  - Lectures that describe and analyze research studies based on topics covered in the Double Helix Curriculum
  - Mini-courses or modules on topics related to medical research, including working in research teams; formulating a research question; choosing and evaluating measurements; study design, data collection, analysis and presentation; obtaining funding; and writing for publication. Other topics will include conflicts of interest and sources of bias.
  - Presentations by ART students who are developing, implementing or completing their own research projects
- Additional training in Ethics in Research through the course offered in the Graduate School
- Certification in human studies through the self-study Human Subjects Protection Program
- Completion of a mentored research rotation during the summer between years 1 and 2 (~eight weeks in duration), designed to provide exposure to research and to potential research mentors (optional but strongly encouraged). Funding is available through URMIC's Clinical and Translational Science Award (CTSA) – see below for details
- Completion of a 'year-out' to participate in a mentored research project – typically, between years 2 and 3 or between years 3 and 4

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<sup>1</sup> Students who are involved in research leading to a Master's degree – such as in existing programs in Public Health or in Neurobiology – may have additional requirements. The final decision regarding requirements for ART will require review by the ART Committee, but it is anticipated that to obtain ART certification with the MD degree, the requirements of ART must be met.

- Completion of a first-author manuscript describing the research and its results, in a form suitable for submission to a peer-reviewed journal. A master's thesis will suffice for this purpose for students who are participating in Masters Programs. See also Section V for related requirements for the Distinction in Research designation for the MD degree.

### *III. Administrative*

#### **A. General:**

- An Executive Committee will direct the ART program of study – see below for listing of individuals. These individuals will serve as core mentors for students throughout the program, as a complement to the research mentors.
- Students should alert the Director of the program of their interest prior to or concurrent with the development of a plan for research during the year out.
- After graduation, students are expected to respond to periodic communications for the ART Executive Committee and the CTSA or its Institute (CTSI) regarding their academic progress beyond medical school, to allow tracking of 'outcomes' of ART.

#### **B. Requirements:**

- Quality assurance will be an on-going process throughout the curriculum. In addition to the specific components outlined below, students will maintain high ethical and professional standards of behavior.
- Students will be expected to remain in good academic standing in the medical school curriculum. A yearly form will be used to declare the student's continued interest in the ART, and will require approval by the student's Advisory Dean. If there are concerns regarding performance or ability to continue the program of study, mentoring will be available.
- Students are expected to attend *at least 75%* of the scheduled ART seminars, unless exempt (e.g., Masters candidates).
- Students are expected to engage fully in their summer and year-out research projects; their mentors will work with the student to develop expectations and will evaluate performance.
- Members of the Executive Committee – and others, depending on expertise – will review the students' oral presentations and written components. The latter should be of publishable quality.
- Members of the Executive Committee have final 'sign off' on all components of each student's portfolio.

#### **C. Financial / Funding:**

- For students taking a year out, tuition for the Medical School is waived (payment of fees is required).
- Affiliated Masters Degree Programs also waive tuition for ART students in good standing; tuition is usually covered by the CTSA.
- Stipends: Some affiliated programs (please refer to the ART website <http://www.urmc.rochester.edu/smd/education/art/index.cfm>) have stipend support for students taking a year out for research in their designated areas (e.g., in Pediatrics). Many investigators in the Medical Center have independent funding that can support students. Finally, the Medical Center's CTSA, through the Clinical and Translational Science Institute (CTSI) provide stipend support to ART students doing a year-out for research in clinical or translational science. Additional funding is available to both student and mentor to cover some research expenses. See below (VI) for additional information.

#### IV. Curriculum:

##### A. **Overview:**

- Introductory seminars – a series of lectures, covering general areas of medical research (basic science, translational, clinical, health services, education) incorporated as one-hour blocks into the MMI course. Rationale: ALL 1<sup>st</sup> year students will get early exposure to encourage participation.
- Ethics and HSPP. The Ethics requirement is met by the Graduate Studies-approved coursework, which can also fulfill the Double Helix Curriculum's Medical Humanities selective requirement in the Second Year. Rationale: This is a requirement of NIH funding; all graduate students must complete the course.

HSPP training can be completed at any time as an on-line offering (see also below); but it must be completed prior to participating in any research involving human subjects.

- Mentored Research Projects: A 'rotation' (typically, eight weeks or more) between years 1 and 2; a year-out in-depth project
- Portfolio Building: ART students will build a portfolio during the course of study, to be evaluated by members of the Executive Committee. Elements include:
  - a) a first-authored written short (5-10 page) research proposal submitted by March before the year out, to include Hypothesis, Aims, and Approach;
  - b) a written publishable paper on the student's research, submitted by the end of their last year.
  - c) oral presentations, open to the public, within or outside of the University community, on their research; and
  - d) attendance at a minimum of 75% of ART seminars in the first two years (unless waived).

##### B. **1<sup>st</sup> and 2<sup>nd</sup> Years:**

There will be separate 1<sup>st</sup> and 2<sup>nd</sup> year curricula. These are designed to be taken sequentially, but can be taken concurrently. The seminars are open to all students and faculty; missed sessions can be 'made up' in another year.

We will present topics to help the development of a research career, taking care to address all potential areas of research – as far as possible – within each module. We regard this as a "Liberal Arts" approach to the basics of medical research careers. The core module will be supplemented by guest speakers, both from within and outside of the University of Rochester, on their area of research.

The proposed modules follow. The names in parentheses indicate the leaders for that topic (see below).

##### Year 1:

- Research as a human enterprise: developing research teams and mentoring relationships (Lyness)
- Formulating a Research Question; Research Models and Conceptualization (Hoeger)
- Measurements, Analysis (Lyness)
- HSPP certification by the end of year 1

Summer between Years 1 and 2: Mentored research rotation.

Year 2:

- Data Analysis and Presentation (Mullen)
- Finding the Money: Research Funding Sources, Process (Pearson)
- Writing for Publication (Gross)

### **C. Curriculum Building: Later Years**

3<sup>rd</sup> Year: Mentored research experience, plus lab-affiliated seminars and didactics; possible to-be-developed core seminars; Ethics course

End of 3<sup>rd</sup> year: Students present their research in written and half-hour oral formats for peers to critique

5<sup>th</sup> year (last year of medical school): Students participate in the required Process of Discovery course, but in addition to the usual course requirements, round out their research experience by critiquing other students' proposed research programs.

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## ***V. ART and Distinction in Research Designation***

Students who have elected to participate in ART will be required to complete the requirements of that program as determined by the ART committee. The requirements can be found in this document and on the ART website <http://www.urmc.rochester.edu/smd/education/art/index.cfm>. Students who meet all the criteria will receive a *certificate of completion for ART and this achievement will be noted on their transcript*. All ART students are strongly encouraged to submit their research work for consideration for the MD degree with Distinction in Research.

The University of Rochester allows for graduates of the Doctor of Medicine program at the School of Medicine and Dentistry to receive Distinction in Research. This designation is *noted on the diploma and on the official transcript*. Beginning in the 2007-2008 academic year and for subsequent years, the ART Executive committee (and others as needed) will review all submissions for consideration for Distinction in Research. Students who have not participated in ART are also encouraged to submit any research they completed during their matriculation to medical school for consideration. They will receive the same consideration as students who have participated in the ART program as submissions will be blinded for ART participation. The decision of the ART committee for the awarding of Distinction in Research shall be on or about March 1<sup>st</sup>.

Students who complete a Masters Degree *cannot* submit their Masters Degree work for Distinction in Research as the Masters Degree itself implies distinction. Similarly, students enrolled in the joint MD-PhD program cannot submit work done as part of their PhD degree for consideration for Distinction in Research.

Students are eligible for both Distinction in Research and Distinction in Community Service.

Learning Objectives: The successful completion of a research project often depends on the quality of preparation. With this in mind, ART students are strongly encouraged to seek active input from their mentors, who should have experience in research and mentoring. Projects that are likely to be successful in obtaining a Distinction in Research designation are those that are hypothesis-driven or hypothesis generating; that ask novel and relevant questions in the area of study; that are feasible; and that are likely to generate interpretable and meaningful data. We recognize that not all projects can be highly successful in a year's time – research is often unpredictable.

#### *VI. ART and CTSA Funding*

Stipend support for students doing a year out for research in clinical and translational research is available through the CTSA / CTSI. Currently there are seven slots per year; Masters tuition is covered for those students pursuing a Masters degree (just over half ART year out students have elected to pursue a Masters degree). All slots also support modest funding for the applicant and for the mentor to support the student's research, plus a travel allowance.

- The awards are competitive, based on the applicant's record and potential for a research career, on the relevance of the project to the mission of the grant (clinical and translational science) and on the quality of the project itself, including the quality of a detailed mentoring plan. The level of stipend support is based on NIH criteria, currently approximately \$21,000 per year. Support is awarded for a one-year appointment. More detailed information on the application process is available through ART.
- Participation in ART is required for funded scholars, unless pursuing a Masters degree.
- Several concurrent Masters programs are available: these include MPH, MS-CI (clinical investigation), MS-TR (translational research), MS-NBA (Neurobiology and Anatomy), and MBE (Biomedical Engineering).
- The NIH sets standards for Ethics training, which MUST be followed for students receiving CTSA funding. The student will be required to take either IND 501 or IND 503 to fulfill the training in research Ethics requirement.
  - Documentation of completion of the course of study is required.
  - Requirements are constantly being reviewed, and students are encouraged to seek counsel from their mentors or from members of the ART Executive Committee if there are questions about what constitutes an approved Ethics curriculum.
  - We require in addition HSPP certification, which in most cases will be attained as a matter of course if the research involves human subjects.
  - Awardees must also participate in protégé workshops and academic development seminars.
  - Participation in other CTSI activities is strongly encouraged.
- Some students may wish to pursue research opportunities outside of URM. While this is allowed, for students who wish CTSA support, rigorous documentation in the application for funding is required to justify the proposed research plan and thus to assure a quality research experience. It is anticipated that applications seeking funding for work done elsewhere will be approved as exceptional cases rather than as routine. In general, the following must be addressed:
  - The project should have an obvious and clear connection to on-going research at URM. For example, a project for which additional expertise, materials or environment is necessary – with such resources not available at URM – would benefit from such an arrangement. Indeed, the student could serve as the nidus for or to strengthen a collaborative effort.

- The mentoring team must include a URMC investigator in addition to the external mentor. The means of on-going communication among all mentoring members and the student must be specified.
- There may be restrictions in the support available to the student and the mentor for work done outside URMC. This applies primarily to the additional monies for support of the research itself and not to the student's stipend.
- Work done outside URMC but within the Upstate Academic Consortium (UNYTRN) will have the same application requirements, and is encouraged.
- The requirements outlined above will still apply, including the Ethics requirement.  
**NB:** *If a student chooses a year-out research experience that is not local, they are very strongly encouraged to take an equivalent course, approved by the NIH, at their hosting institution. Alternatively, they may complete an approved on-line course*

*Additional Years of Funding:* Some students may elect to pursue research for longer than one year. Typically, these will be students who elect to pursue either a certificate or, more likely, a Masters Program (e.g., MPH, MS-CI, MS-TR, MBA, MBE), for which the requirements may necessitate greater than one year to accomplish. The CTSI is therefore willing to consider applications for funding for greater than one year, according to the following guidelines:

- It is expected that the applicants for additional years of funding will have committed at the start of the first year of funding to an advanced program, typically a Masters Program. Students electing to pursue a second year of research, but not pursuing a Masters degree, may submit applications for continuing support, but the expectation should be that granting of such support would be exceptional.
  - Awarding of stipends and research support for the second year will be on a competitive basis. The criteria for additional funding will require demonstrated productivity over the first year of funding and a strong rationale and plan – from both applicant and mentor – justifying the request for an additional year of support.
  - There will be no funding available from the CTSI for work that extends beyond two years.
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## Detailed Curriculum

### Year 1, Module 1: Research as a Human Enterprise (Epstein)

#### Session 1: Research teams: collaboration, teamwork, leadership and supervision

Format: round table discussion with experienced researchers about how they built their success through teamwork. Collaboration with researchers from other departments and institutions

- I. Science
  - A. Organized observation with consensual validation
  - B. Research is not science if it is not opened to scrutiny by others
- II. What researchers do
  - A. Figure out what is important to know
  - B. Develop infrastructures that facilitate the advancement of knowledge
  - C. Advance knowledge
  - D. Communicate to others what they learned
- III. Research enterprises as collaborative endeavors
  - A. Shared mission
  - B. Designated roles and hierarchy
  - C. Leadership -- content expertise, inspiring others, setting examples
  - D. Supervision of research staff -- research assistants, technicians, data analysts,
  - E. Professionalism and mutual respect
  - F. Spin-off projects
  - G. Use of consultants and advisory boards
- IV. How a student can contribute
  - A. Developing and refining ideas for main or spin-off projects
  - B. Recruitment of subjects/participants
  - C. Conducting the research
    1. Technical procedures
    2. Observations and interventions with subjects
  - D. Communicating findings to the outside world
  - E. Helping the team to function better
- V. Pitfalls
  - A. Team issues
    1. Poor communication
    2. Too chaotic, too rigid
    3. Group-think – inability to think outside the box
  - B. Leadership issues
    1. Taking credit for others' work
    2. Too controlling, inadequate oversight
  - C. Unfocused research agenda
  - D. Diminishing resources

#### Session 2: Mentoring relationships

Format: Panel discussion with identified exemplary mentors (selected by students, residents and fellows each year).

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- I. Research careers, characteristics of successful researchers, and why researchers need mentors
- II. What is a mentor
  - A. Mentoring vs. collaboration vs. servitude
- III. What to expect from a mentor
- IV. Choosing mentors
  - A. How many mentors do you need?
- V. Working with mentors
  - A. Setting goals and clarifying expectations
  - B. Meeting frequency
  - C. Content of meetings
  - D. Giving and receiving feedback
  - E. Dealing with conflicts
- VI. Transitions in the mentoring relationship
  - A. From mentor to collaborator
  - B. When and how to terminate a mentoring relationship
  - C. Finding new primary or secondary mentors

**Sessions in Fourth and/or fifth year:**

Building a research program -- important relationships to cultivate, leadership and team building. Setting a focus, contact with funders. Interacting with university personnel, including ORPA, IRB, leadership.

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**Year 1, Module 2: Formulating a Research Question; Research Models and Conceptualization (Hoeger)**

- I. Conceptualizing the Research question
  - A. Concept of significance and relevance to design of the question
    - 1. Statistical
    - 2. Scientific
    - 3. Clinical
    - 4. Public health
    - 5. Sociopolitical
  - B. Developing the question
    - 1. Using existing literature-saying something new while connecting to what has been said
    - 2. Formulating and reformulating the question
- II. Framing the inquiry
  - A. Importance of a theoretical framework
    - 1. Examples of the same data analyses with and without a framework of theory
  - B. Establishing the credibility of the mechanism
  - C. Operational definitions-the difference between theoretical constructs and measured variables

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**Year 1, Module 3: Measurements, Analysis (Lyness)**

Session 1: Introduction and Overview: Qualitative Measurements

- I. Overview of Measurements
- II. Selecting what you want to measure
- III. Selecting how you are going to measure the constructs of interest
- IV. Measurements in Qualitative Research
- V. How can this process go wrong?

Session 2: Measuring Physical Properties Quantitatively

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- I. What kinds of things do we measure?
- II. How do we measure them?
- III. Examples and Studies
- IV. How can this process go wrong?

Session 3: Measuring Things that cannot be Quantified Directly (Psychometrics)

- I. Concept of latent variable
  - II. Types of higher-order constructs of interest (more than just “psych”)
  - III. Psychiatric symptoms
    - A. Mood or Anxiety
    - B. Psychosis – positive or negative symptoms
    - C. Agitation or Aggression
    - D. Suicidality (hopelessness)
    - E. Cognitive
  - IV. Psychosocial
    - A. Personality
    - B. Social support / network / conflict
    - C. Family
    - D. Religiousness
    - E. Doctor-patient relationship
  - V. Neurological Symptoms / Functioning
    - A. Motor
    - B. Sensory
    - C. Coordination
    - D. Gait
    - E. Pain
  - VI. General Functioning
    - A. Basic / Instrumental ADLs
    - B. Finances
    - C. Driving
    - D. School, work, or specific task performance (e.g., competency assessments in medicine)
    - E. Social functioning
  - VII. Attitudes / Viewpoints
    - A. Self-rated health
    - B. Health care preferences
    - C. Satisfaction with care
  - VIII. Issues in Designing a Measure
    - A. Reliability
      - 1. Inter-rater
      - 2. Stability of repeat measurements
    - B. Validity
    - C. Norms
    - D. Source of the information
      - 1. Self-report
      - 2. Informant-report
      - 3. Examiner-rated interview
      - 4. Performance test
  - IX. Answer choices
    - A. Number of choices
    - B. Likert vs. uni-directional
    - C. Anchor points (or not)
    - D. Intervals between choices, discontinuities
  - X. Knows vs. knows how vs. shows how vs. does; Can do vs. does do
  - XI. How can this process go wrong?
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**Summer between Years 1 and 2: Mentored research rotation.**

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**Year 2: Ethics and Professional Integrity**

All ART students must take the Ethics course required of graduate students. This course has recently been restructured and is given at set times. For ART students (and MD/PhD students), who must conform to the medical school schedule, there are two options: take the Ethics course when offered (presumably, during the year out for research); or prior to the year out. This course is also a requirement of the NIH for those students whose research is funded by the Clinical and Translational Science Award.

**Year 2, Module: Data Analysis and Presentation (Mullen)**

Session One

- I. What to measure? Definitive versus surrogate endpoints, hard versus soft endpoints, choosing appropriate controls
- II. Power, beta error and design of experiments
- III. Choosing appropriate statistical tests

Session Two

- I. Commonly used computer programs useful in statistics. Collection of data to facilitate analysis. Data transformation. Data capture from external hospital and government databases.
- II. Analysis of massive data sets: genomics, proteomics, metaanalysis
- III. When to consult a biostatistician

Session Three

- I. Presentation of data for publication or seminars: choice of tabular and graphical formats and the implications for impact and candor; “representative results” and “data not shown”
- II. Common errors and abuses of statistical analysis of biomedical research: sins of commission and omission

**Year 2, Module 2: Finding the Money: Sources, Process (Pearson)**

**Year 2, Module 3: Writing for Publication**

- I. Preparing a paper for submission (Lurie)
  - II. Writing for publication, an editor’s perspective (including a digression on Ethics in publishing) (Gross)
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**Year 3: Research Year (may be done another year if desired)**

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**Years 4 and 5:**

- Students present their research in written and oral formats for those interested members of the medical center community. The proposed format for these presentations is a “summer seminar” series in May or June, given by students completing their year out.
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**ART Executive Committee:**

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