Cleveland Clinic Lerner College of Medicine

of

Case Western Reserve University

Overview of the Five-Year Curriculum

"Fostering a passion for scientific inquiry, skills for critical thinking, and clinical expertise"

Cleveland Clinic Lerner College of Medicine
of
Case Western Reserve University

Overview of the Five-Year Curriculum

Revised July 2015

Cleveland Clinic Lerner College of Medicine
of
Case Western Reserve University

Overview of the Five-Year Curriculum

Table of Contents

Figures:

Cleveland Clinic Lerner College of Medicine
of
Case Western Reserve University

Overview of the Five-Year Curriculum

Introduction

Cleveland Clinic Lerner College of Medicine of CWRU (CCLCM or College Program) is one of three distinct programs leading to the MD degree in the Case Western Reserve University (CWRU) School of Medicine. CCLCM builds on the strengths of two leading academic institutions in Cleveland – Cleveland Clinic which is one of the top five hospitals in the United States with a history of excellence in clinical care of patients, training health professionals, and research, and CWRU School of Medicine, ranked in the top tier among US medical schools for NIH funding and its educational programs. In 2002, Cleveland Clinic and CWRU formed an historic partnership to collaborate in education and research through creation of the CCLCM with support from a transformational donation from Al and Norma Lerner. As stated in the affiliation agreement between the two institutions, "the principal purpose and educational mission of the College shall be to attract and educate, in specially designed programs, a limited number of highly qualified persons who seek to become physician investigators and scientists who will advance biomedical research and practice." ***Every aspect of CCLCM – from admissions criteria and goals for financial aid to curriculum structure, student assessment, student advising, curricular evaluation, the learning environment, and faculty development programs – has been specifically designed to create the physician investigators of tomorrow.*** Our goals are to select students with a desire to pursue careers as physicians and researchers, to educate them to be excellent doctors, to nurture their curiosity about science and medicine, to provide them with substantive research experience and core research skills, and to offer financial support to ensure that excess debt does not preclude their ability to follow careers in research and medicine.

Training the Physician Investigators of Tomorrow: A Synopsis of the Program

Recognizing the critical shortage of physicians engaged in research, our faculty created an educational program that provides medical students with the necessary skills and knowledge to enter academic residencies and pursue successful careers as expert doctors and basic, translational or clinical investigators – without requiring them to complete an advanced degree in addition to the MD. We expect our graduates to be scientifically inquisitive, to be life-long learners, to be independent thinkers with excellent teamwork skills, to have broad-based research knowledge and skills as well as strong clinical acumen, and to be reflective practitioners of medicine and science who take a critical approach to self-assessment and self-improvement. All three components of the curriculum – basic science, clinical and research (Figure 1) – in addition to the advising and assessment processes have been created to support the development of these attributes in our medical students.

The **basic science curriculum** applies adult learning principles in a graduate education setting, building on problem-based learning (PBL) to create an early link

between clinical problems and basic science learning and to help students develop their skills in hypothesis generation, self-identification of learning objectives, oral presentation and teamwork. Almost all faculty-student contact time involves some form of active learning – graduate school-style seminars and problem sets requiring student preparation rather than lectures, case-based anatomy sessions using prosections and cross-sectional images rather than full cadaver dissections, interactive lab sessions rather than demonstrations, and journal clubs. To support this educational model, curriculum schedules provide extensive time for independent study (Figure 2a). The basic science curriculum is organ-system based, with the disciplines of anatomy/embryology, biostatistics/epidemiology, cell biology, histology, imaging, immunology, pathology, pharmacology, physiology, infectious disease, oncology, genetics, bioinformatics, evidence-based medicine, health care systems, and ethics designated as curricular threads woven through every organ-based basic science course. Learning objectives for the basic science disciplines were used to determine the organ system curriculum structure in the first two years, with the goal of providing a logical, coherent two-year curriculum in each of the threads basic to medicine. Courses in Year 1 focus on normal human structure and function; in Year 2, courses focus on pathophysiology of disease. Later, in Years 3 through 5, students revisit advanced basic science concepts in their core clinical rotations, clinical electives, and CCLCM specific pullout sessions on Friday afternoons.

The **clinical curriculum** begins at the same time as the first basic science course in Year 1. At its foundation is a continuity teaching and learning experience with a primary care preceptor and his/her patients throughout the first two years. Students spend one half-day every other week in Year 1 and one half-day every week in Year 2 with the same Internal Medicine or Family Practice preceptor. During Year 1, students learn core clinical skills in doctor-patient communications and physical diagnosis in sessions linked to the basic science courses (e.g., learning the cardiac and lung exams during the Cardiovascular and Respiratory Sciences course) and then hone these skills with real patients in their preceptors' offices on alternate weeks. Once they have mastered the basics of the history and physical, they begin to apply their skills to more complete evaluations of ambulatory adult, pediatric and geriatric patients with direct observation and feedback from their preceptors.

In Year 2, students spend a half-day every week with their preceptor and a second half-day each week in sessions focused on building advanced clinical skills or clinical activities designed to complement concomitant basic science systems topics (e.g., a rotation in heart failure clinic lab during the week devoted to learning about heart failure). By the end of Year 2, students are capable of performing a complete history and physical and confidently evaluating adults with common outpatient problems and are well prepared to start required clinical rotations. The other key component of the clinical curriculum in Years 1 and 2 is the weekly Foundations of Medicine Seminar Series. This course focuses on principles of professionalism and ethics and their application to medical practice, the role of humanities in medicine and health care systems providing a setting for students to reflect on their experiences and observations of the health care system. In Years 3 through 5, students in CCLCM participate in the same core clinical experiences with students in CWRU's University Program. Friday afternoon sessions in Years 3-5 bring CCLCM students together regardless of clinical location and focus on CCLCM-specific topics in research, human values, and professional development as physicians and researchers.

Our faculty identified close **mentoring and advising** relationships as critical in their own career development and designed the advising system to help ensure that students have multiple opportunities to develop such relationships. At the beginning of medical school, each student is assigned a physician advisor who serves as the student's partner in navigating and mastering the curriculum throughout all five years.

In addition entering CCLCM students are assigned a research advisor who serves as a resource for students to guide them in developing their research skills and choosing research experiences including choice of Year 2 research summer activities, thesis projects, grant support, etc. The research advisor follows a student's research from a distance and is "assigned" no more than two students per year.

"Dean's Chats" is a new series to be started in the 2015-16 academic year. These sessions will be offered to all CCLCM students and will serve as a forum for students to meet and interact with Cleveland Clinic health care leaders and learn the complexities of managing health care and health care systems through the eyes of senior leaders. There will be 4-6 "Dean's Chats" in 2015-16 hosted by the CCLCM Executive Dean.

CCLCM uses a unique approach to **student assessment** designed to enhance student learning and to promote self-directed learning. There are no grades for any course or rotation, and no class ranking. Instead, each student is expected to attain a defined level of achievement in each of 9 competencies. CCLCM's defined competencies encompass the 6 core competencies defined for all US residency programs by the ACGME (Accreditation Council for Graduate Medical Education) as well as research, personal development, and teamwork and interprofessional collaboration. Starting on the first day of medical school, students begin collecting evidence of their progress in each of the 9 competencies and reflecting on how the evidence demonstrates their development as doctors and researchers – the two interrelated professional roles for which they are preparing.

We recognize that assessment drives learning – but that a curriculum designed to foster self-directed learning and achievement of competencies will be ineffective if assessment focuses on what the "teacher" said in class and factual recall. We have therefore chosen a student-centered, student-driven approach to assessment with strong support from faculty members (the physician advisors) who know the students well and guide them as they develop skills and self-confidence as self-directed learners. Each physician advisor works with a limited number of students and follows those same students throughout all five years of the program.

Students gather a broad range of types of evidence over their five years of study and work as partners with their physician advisors to review the evidence and their reflections, to create individual learning plans to address areas of relative weakness, and to tailor their learning experiences to build on their areas of particular strength. Evidence of achievement and reflections on progress in their professional development are collected in electronic Student Portfolios and used to document readiness for promotion and graduation from the program. By training our students in accurate self-assessment and developing their reflective ability, we intend to send them out of medical school already skilled in the kind of independent, self-directed learning habits that will be required of them as residents and throughout the rest of their professional lives.

CCLCM's Foundation: A Comprehensive Integrated Research Curriculum

The **research curriculum** begins on the first day of medical school with the basic and translational research block and extends throughout all five years of the CCLCM (Figure 1). Every student participates actively in a "bench" project in the first summer, prepares an oral presentation describing the project in the format used at most scientific meetings, and develops a mock research proposal that extends the summer research project to the next research question. At the end of the summer students formally present their research project and findings to students and preceptors. Linked with the summer research curriculum is a core curriculum in basic biochemistry, cell biology, molecular biology and genetics (Figure 2b). In addition, students learn the basic principles of research design and data analysis, and critical appraisal and interpretation of the basic science research literature in a journal club. Each student reads and interprets a research article related to the topic of the week working with a faculty content expert. The student summarizes key points of the article and presents a critique followed by an open discussion with the other students and faculty in the group. The goals of the journal club are to increase understanding in a specific area of research linked to the basic science curriculum, provide students with the skills to critically review the literature, and to present literature in an organized and thoughtful way.

The second summer is devoted to clinical research. Course work focuses on applied medical biostatistics and clinical epidemiology including appropriate design and analysis of various kinds of clinical research protocols (Figure 2b). Each student participates actively in an ongoing clinical research project and writes an original clinical research protocol to extend the summer research project to the next research question, prepares an oral presentation describing the proposed research protocol, and formally presents this proposal at the end of the summer. Each student also presents a research article on the Year 2 clinical research journal club in a process similar to the basic science journal club in Year 1.

During the remainder of Years 1 and 2, students participate in Advanced Research in Medicine (ARM), a weekly series of highly interactive research seminars linked to the content of the basic science courses. In Year 1 ARM 1 is designed to provide students opportunities to interact with a wide range of successful investigators to help them understand the "process of discovery" – the sequence of hypotheses, experiments, links to prior studies or other fields of investigation, serendipities, successes and failures that lead to new research findings. ARM 1 also helps students appreciate the interaction between basic and clinical research – how basic science discoveries translate into changes in the clinical care of patients and how clinical observations or research findings result in new directions in basic science research. In ARM 2, students participate in presentations which are linked to the basic science content each week but are more focused on current research projects, development of critical thinking skills, and writing well-constructed research questions.

By the end of Year 2, each student has experienced basic and clinical research first-hand, has met a large number of investigators with different research interests, has developed essential research skills, and is ready to choose an advisor to supervise and support his/her research project with the guidance of his/her research advisor. After approval by the Research Education Committee, a Thesis Committee made up of the project advisor and two or more additional faculty supervises and approves the student's

research proposal, progress, and final master's level thesis that must be defended by February 15 of Year 5. Final revised thesis and final paperwork is due no later than March 1 of the student's fifth year.

The last three years of the curriculum are specifically designed to provide flexibility to students in scheduling their research and clinical rotations. Working together, the student, research advisor, project advisor, and physician advisor tailor the curriculum to the student. Students complete their research projects in one 12- to 15-month block of time usually in Year 4 of the curriculum. Every student regardless of the overall schedule will continue to engage in clinical experiences at least one half-day per week during his/her research year – to ensure that students maintain clinical skills and contact with patients, develop a deeper appreciation of the connection between advances in biomedical research and patient care, and have the opportunity to reflect on their ongoing development as ***both*** physicians and researchers.

Throughout all five years of medical school, research topics are integrated with basic science and clinical content. Learning objectives for PBL cases in the basic science courses include identifying the latest advances in what is known about the basic science underlying a specific disease, with students encouraged by their facilitators to think about how they could go about finding the answer. Some of the core basic science concepts are learned from studying journal articles rather than textbooks, so students appreciate the research that led to current accepted basic science knowledge. Evidence-based medical practice is emphasized in the clinical curriculum and students are expected to identify clinical questions for which the evidence is lacking and think about ways to obtain it.

Many US medical schools require students to complete a scholarly or research project or thesis for graduation, and there is evidence that participation in some kind of research in medical school is a predictor of pursuing a career in academic medicine. Combined MD-PhD training programs have been successful in creating academic physicians, but the course of study extends over 7 to 9 years and the majority of those graduates pursue basic science rather than clinical or translational research. By creating a medical school program that *not only* requires a substantive research project and master's level thesis, *but also* incorporates a comprehensive curriculum in research, we provide our students with an environment that fuels their enthusiasm for scientific inquiry and the practical research skills that will prepare them for successful careers as physician investigators.

Curriculum Timeline: Years 1 and 2

Students begin Year 1 with a one week Orientation in which they are formally welcomed to the profession of medicine by the Deans and their physician advisors. The week includes individual meetings with the student's summer research preceptor and physician advisor, an introduction to the unique assessment system and the Student Portfolio, and an introduction to the summer curriculum and its expectations. A White Coat Ceremony that commemorates the entry of all students in both the CCLCM and University Programs into the CWRU School of Medicine highlights the week.

The **Basic and Translational Research Block** occupies the first 10 weeks of Year 1 (Figure 1) and includes a course reviewing core concepts in cell biology, molecular biology and biochemistry. Scheduled classes occur 4 days a week for 2 hours, with the remainder of each day devoted to independent study and hands-on experience in the lab of the student's summer research preceptor (Figure 2b). This block sets the stage for active learning in the rest of the curriculum using small group discussions to prepare students for Problem-Based Learning (PBL). Each week during the basic science courses has a conceptual "theme" within which more detailed learning objectives fall. All assignments and scheduled activities are designed to help students master the core concepts for the week. Mastery is defined as being able to explain the concepts and to apply them to new or different problems or situations, rather than simply "listing" all the factual details. Sessions for the core basic science course are usually held on Monday, Wednesday and Friday mornings and students are expected to study background material before class and self-assess their understanding of the readings. They then work together in class to solve problems related to what they have studied. Tuesday mornings are typically devoted to focused discussions and presentations related to the science topics discussed that week or introduce students to key concepts in areas such as genetics, biochemistry, and bioinformatics. Thursday morning sessions focus on a self-care curriculum as well as class meetings and other orientation to the CCLCM.

Students meet each Friday for a journal club aimed at enhancing skills in critically assessing the basic science research literature presenting literature in a concise organized manner and leading a discussion on the paper and topic. Students are divided into two groups of 16 students each. Each week 2 students from each group present an article assigned by the Journal Club leader related to the theme of the week. The other students in the group are expected to read the articles carefully and come prepared with questions. Each presenter works with a faculty mentor to review the paper and presentation before journal club. Using feedback from faculty and other students on their presentations and on the questions they ask of others, students begin to hone their communication skills and develop confidence participating as speakers in this setting.

The primary focus of the Year 1 Basic and Translational Research Block is the summer research project. Students are assigned to a summer research preceptor with attention to individual preferences for either specific research areas or specific preceptors. An on-line compendium of research opportunities facilitates student identification of preceptors. They are expected to engage fully in all activities in the preceptor's research group, such as special lab meetings or journal clubs, in addition to working on their defined project. At the end of week 1, they submit a draft plan for their summer research project and review it with their preceptor to set the expectations for the summer. During the summer students also develop a brief "mock" research proposal that extends their research project. At the end of week 5, they submit a draft outline of their brief research

proposal. The final document is due in week 9. During week 10, students present their projects orally in the format used at many scientific meetings – a 10-minute presentation with audiovisuals followed by 5 minutes for questions. Thus, in addition to actually working on a "bench" project, students are guided by their preceptors in developing a number of other key skills. Students receive feedback from their preceptors, other members of the lab team, and peers on their contributions in the lab and their written and oral presentations.

In July of the first summer, students schedule their first formal meeting with their physician advisors to review the evidence in their Student Portfolios, to discuss their reflections on their development in their new professional roles, and to review their learning plans to address any specific weaknesses or gaps they have identified. Over the summer they review feedback on their activities in small group and journal club, lab work, mock grant proposal, oral presentations and scientific writing. This evidence is provided by their summer preceptors, peers, and self-assessments of their mastery of the core basic science concepts. Just as the interactive learning in class sets the stage for research and the rest of the curriculum, the first summer sets the stage for student success in the unique assessment process used in CCLCM (see page 11).

Each week of the Year 1 and 2 basic science courses is organized around a theme that provides a focus of learning for the students and an opportunity to integrate when possible the basic science, clinical, and research curriculum components. For example, the theme of one week of the Gastrointestinal System 1 course is "Liver, Gallbladder, and Pancreas". The PBL case focuses on a male who takes an overdose of acetaminophen and alcohol and subsequently develops liver failure. Students learn normal liver function as they explore this case. (All PBL cases used in the curriculum are based on real cases at the Cleveland Clinic.) The case provides the frame work for the anatomy and other seminar sessions which focus on liver, gallbladder and pancreas anatomy, histology, drug elimination, and genetics. Friday's Advanced Research in Medicine session is a meeting of the Liver Transplant Selection Committee attended by all the students where research, bioethics, and clinical care are integrated in the discussion of actual liver transplant applicants.

The first basic science course in Year 1, **Cardiovascular and Respiratory Sciences 1 (CRS1)**, is a 7-week course in which students learn basic concepts of the normal structure and function of these systems. There are 14 hours of scheduled curricular time each week in the basis science courses, including 6 hours devoted to PBL cases and 8 hours devoted to other activities such as labs, seminars, and problem sets.(Figure 2a). Throughout Year 1, anatomy, imaging, and embryology are integrated into the basic science courses with information presented in two ways – self-directed learning modules that cover basic anatomical information (and are available online), and Case Directed Anatomy Sessions on Monday mornings for which students study clinical cases designed to introduce anatomical concepts and facts before coming to the lab. In the lab, students rotate among a number of stations using cadaver prosections prepared by residents and senior CCLCM students to demonstrate anatomy relevant to the cases and radiological images such as 3-dimensional CT scans. For example, a case of a patient who has suffered a penetrating injury to the chest may be used to focus students on the anatomical structures that might be injured and their relationship to one another.

Histology is also integrated into the basic science courses, with students using a computer based virtual microscopy system rather than a mechanical microscope to look at

slides. This allows students not only to scan slides but also to see slide annotations and related gross and radiographic images. Specific learning objectives for histology are included in PBL cases in addition to seminars devoted to histology. The goal is for students to understand the gross and histological structures of each organ system in relation to its function, rather than as isolated anatomical facts. For example, during the week in CRS1 devoted to the theme, "The Heart as a Pump," students learn the structure and anatomical relationships of the 4 chambers of the heart and heart valves and the histological appearance of myocardial cells while they are studying the physiological concepts of preload, afterload and contractility.

In addition to Anatomy/Embryology, Imaging, and Histology, the other "threads" in Year 1 include cell biology, pharmacology, physiology, bioinformatics, evidence-based medicine, genetics, health care systems, and ethics, building on the core concepts from the summer in specific relation to each organ system. In CRS1, students learn not only the molecular structures and functions of α- and β-receptors but also the pharmacology of endogenous and exogenous agonists and antagonists of these receptors as they study myocardial contractility and physiological regulation of blood pressure. They learn the biochemical pathways involved in aerobic and anaerobic production of ATP as they study determinants of oxygen delivery to myocardial cells, concepts they will revisit and build upon during subsequent courses when they study skeletal muscle metabolism during exercise and the role of the liver in maintenance of normal blood glucose levels. They study physiology of the heart, lungs, red blood cells and plasma as an integrated system providing oxygen and removing carbon dioxide, supporting metabolic needs of the entire body. During each course, students return to the core concepts they mastered in previous courses, using those concepts as a framework for building their understanding of the human organism as a whole. The basic science curriculum continues with **Gastrointestinal System** (4.5 weeks), **Endocrinology and Reproductive Biology** (4 weeks), **Renal Biology** (3 weeks), **Musculoskeletal Sciences** (3 weeks), **Neurosciences** (5 weeks), and **Hematology, Immunology and Microbiology** (7 weeks). Each basic science course focuses on normal structure and function, building on concepts from previous courses and preparing students for concepts in future courses.

Starting in the fall of Year 1, Friday journal clubs are replaced by **Advanced Research in Medicine 1**, a weekly series of research seminars in which students are exposed to a wide range of basic and clinical research topics in interactive discussions with accomplished investigators to focus on the process of discovery. Presentations are linked closely with the basic science curriculum in order to reinforce core basic science concepts, help students feel confident in questioning the investigators based on what they are learning at the time, and illustrate the process whereby new biomedical discoveries change clinical practice.

Foundations of Clinical Medicine (FCM) begins at the same time as the first basic science course and continues throughout Years 1 and 2. The guiding principle is that early exposure to patients, with direct observation by experienced faculty physicians, is optimal for real time assessment and feedback of student clinical skills. FCM has 3 interrelated components – clinical skills training, patient care experiences, and Foundation of Medicine (FM) Seminar Series. The FM Seminar Series is a five-year continuum addressing professionalism, the role of humanities in medicine, ethics, and health care systems.

Core clinical skills are learned in the other two components: clinical skills and longitudinal clinic. Training occurs every other week from September through January and is coordinated with the organ system under study. On alternate weeks, students learn and practice basic patient communication and examination skills with standardized patients in the classroom followed the next week by conducting histories and physical exams with real patients and writing chart notes under the supervision of their longitudinal preceptors. Starting in February, students are exposed to special aspects of the history and physical for geriatric and pediatric patients, while continuing to work on basic skills every other week with their preceptors. They also begin to take on more patient care responsibility in preparation for their weekly clinics with the same preceptor in Year 2. An Objective Structured Clinical Examination (OSCE) with feedback from preceptors is used to help students chart their progress in mastering core skills.

Year 2 begins with the 9-week **Clinical Research Block**. Students work with a preceptor in an active clinical research environment on an ongoing project, continuing to develop their skills in building relationships with members of a research team. They also write a mock clinical research proposal that extends the research question on which the student is working during the summer. Scheduled coursework occupies 2 hours each weekday (Figure 2b) and includes a rigorous immersion in Medical Biostatistics with students using statistical software to analyze real data sets and a Clinical Epidemiology course focusing on formulation of scientific questions, study design, clinical trials, and legal and ethical issues in research including human subjects' protection. The coursework requires significant class preparation for students, thus there is an equal balance in time and effort between the class work and research project in the Year 2 summer. Journal club sessions on Fridays focus on articles from the clinical research literature, with students using knowledge gained from Biostatistics and Epidemiology to help them analyze the papers. Feedback from peers and faculty facilitators help students enhance their presentation skills and ability to critically read and present scientific papers. Students complete the second summer with a comprehensive range of clinical research skills and knowledge, complementing their basic research experience in the first summer and preparing them to engage in basic, translational or clinical research for their thesis.

For the remainder of Year 2, students return to the same organ-system based basic science curriculum they studied in Year 1, this time focusing on learning the pathophysiology of common diseases. Immunology, Pathology, Oncology and Infectious Disease/Microbiology are integrated with the other threads throughout the Year 2 basic science curriculum. The first basic science course is **Musculoskeletal Sciences** (2 weeks), followed by **Neurosciences** (3 weeks), B**ehavioral Sciences** (3 weeks), **Endocrinology and Reproductive Biology** (4.5 weeks), **Cardiovascular and Respiratory Sciences** (7 weeks), **Hematology** (4 weeks), **Gastrointestinal System** (4 weeks), and **Renal Biology** (4 weeks). Anatomy and embryology seminars are conducted less often during Year 2, usually 1-3 sessions per course. The clinical curriculum continues to be closely linked to the basic science courses. Students spend one half-day every week in their primary care longitudinal preceptor's office. An additional clinical half-day is added and students see patients who demonstrate the pathophysiology being studied that week. Some of the additional half-days are devoted to learning advanced clinical skills (the gynecologic and urologic exams, evaluation of geriatric and pediatric patients with common problems). An exposure near the end of Year 2 to the acute care setting helps to prepare students for Year 3. The Foundations of Medicine Seminar Series continues in Year 2. Students also participate in two OSCEs, one at the beginning of Year 2 to help students identify skills to address over the year and the

second at the end of Year 2 to help students document their skills for their portfolio and to prepare for the USMLE Step 2 CS Examination. After classes end in mid-May, students have 6 weeks available to study for and take the USMLE Step 1 Examination.

By the end of Year 2, students have engaged actively in both basic and clinical research, learned and practiced a wide range of research skills and usually have selected a research advisor for their thesis projects. They have extensive experience in self-directed learning both independently and in teams and have mastered core basic science concepts related to human health and disease. They are comfortable "doctoring" adult outpatients and competent in the complete history, physical examination, oral and written presentations, and basic clinical skills such as reading EKGs. Perhaps most important, they have learned to accurately assess their own strengths and weaknesses and create learning plans for themselves – preparing them to succeed in the next three years of the curriculum and a lifetime of professional practice.

Curriculum Timeline: Years 3 through 5

The last three years are purposely designed as a flexible continuum of core clinical rotations, clinical and other electives, and research – to allow each student to individualize the curriculum to address his/her own career goals, learning needs and research interests (Figure 3). Each student plans the last three years with the advice of his/her physician and research advisors. Required clinical rotations are the same for students in both the CCLCM and University Programs and include experiences in internal medicine, family medicine, pediatrics, surgery, obstetrics and gynecology, psychiatry, neurosciences, emergent care and geriatrics. Students may elect core rotations at any of CWRU's affiliated medical centers – the Cleveland Clinic, the Louis Stokes VA Medical Center, MetroHealth Medical Center and Case Medical Center/University Hospitals of Cleveland – but are encouraged to take all core rotations at the Cleveland Clinic.

Every CWRU student must pass the CWRU Clinical Skills Examination, the USMLE Step 1, the USMLE Step 2 CK (Clinical Knowledge) and the USMLE Step 2 CS (Clinical Skills) Examinations to graduate from the CWRU School of Medicine. Students take OSCEs similar in format and content to the USMLE Step 2 CS Examination as part of routine assessments of their clinical skills beginning in Year 1 and are well prepared for the CWRU Clinical Skills Examination and USMLE Step 2 CS Examination by the time they have completed the required clinical rotations. These examinations must be completed by the end of Year 4. Students must take the USMLE Step 2 CK Examination by December 31st of their 5th year.

Students spend 12 to 15 months during the last three years on their mentored research project, including preparation and defense of a masters' level thesis. Students complete their research in one block of time; usually after the required clinical rotations are completed. Students submit a research proposal to the Research Education Committee which must approve the project prior to the student beginning the project. During time devoted primarily to research, students spend one half-day each week in related clinical activities. Students must complete all required thesis research rotations by December 31 of Year 5 and defend the Research Thesis within 3 months of completing their research but no later than February 15 of Year 5. Within these guidelines, students and their advisors are encouraged to be as creative as possible in designing the final 3-year continuum. Research may be conducted with faculty research advisors at any CWRU campus or in some instances with advisors at other institutions (e.g., the NIH) with

approval from the Research Education Committee. Student research may focus on clinical, translational or basic research. Some students may wish to engage in health services research, research in biomedical ethics, or other areas relevant to the advancement of biomedical science and the care of patients in addition to the more "traditional" research areas.

CCLCM students also participate in Advanced Research in Medicine and Foundations of Medicine Seminars in Years 3 – 5. All CWRU students return to their home program on most Friday afternoons during core and elective clerkships. The focus of the CCLCM FM Seminars is to help students examine humanities, ethics, and advanced communication skills and adjusts to learning and patient care in a variety of inpatient and outpatient settings. The ARM series builds on the research curriculum in Years 1 – 2 with Year 3 sessions focused on developing research skills and in Years 4-5 on "Hot Topics" and current topics in medical research.

The Student Portfolio: Competency-Based Assessment and Reflective Practice

CCLCM's approach to student assessment is based on two key educational concepts – "competency-based assessment" and "reflective practice." Competency-based assessment emphasizes the need for every student to achieve a range of outcomes by participating in learning experiences, utilizing helpful resources, and reviewing regular feedback. Students are not compared to one another but to faculty-defined standards of achievement. A full range of assessment methods are used to assess student achievement. Reflective practice emphasizes that learning is dependent upon the integration of reflection and experience. Professionals learn by reflecting on their experiences and by using these reflections to identify learning needs and implementing plans to develop new knowledge and skills. We have designed an assessment process that helps our students develop their reflective practice skills – the ability to accurately describe, analyze and evaluate their performance and to identify and follow through on effective learning plans. We are committed to helping every student achieve our competency standards and develop reflective practice skills through frequent formative assessments and close advising. Thus the student assessment system is part of the curriculum and supports the learning process; it is not just an intermittent step to determine if a student is ready to progress to the next level of learning.

Evidence of achievement for each of CWRU School of Medicine's competencies (Figure 4) is collected and managed in an electronic portfolio. Students and their advisors share access to the e-Portfolio database of evidence and thus can track and document student progress in meeting our nine competencies. A broad range of types of evidence are collected from the learning experiences in the research, basic science, and clinical curriculum (Figure 5).

During research blocks, research preceptors, journal club facilitators, other members of the lab team, problem solving session facilitators, and student peers provide written assessments of both individual work and teamwork in the lab, written and oral presentations, and critical thinking and reasoning skills. Written research proposals and reports and the final thesis are also included in the e-Portfolio database.

During the basic science courses, students complete online quizzes called **S**elf **A**ssessment **Q**uestions (**SAQs**) that cover the breadth of knowledge for each week's theme at the level of factual recall and simple application of the facts. Faculty design the SAQs so that students who are actively participating and studying should expect to know at least 80% of the answers; the individual results of the SAQs are available only to each student, but students are encouraged to contact the course director for help with any difficulties they are having. Students have the option of repeating the SAQs to assess their retention of this basic science knowledge. At the end of each week, students complete open book **C**oncept **App**raisal**s** (**CAPPs**) designed to determine if they have mastered the concepts for that week well enough to apply them to new or different problems or situations in a brief, well-organized, clearly written essay. CAPPs are designed to assess depth of knowledge in key concept areas. A faculty assessor reads each CAPPs response anonymously and provides comments about the strengths and areas of improvement. PBL facilitators and peers provide assessments of performance in PBL sessions and self-assessments are also collected.

Assessments in the clinical curriculum include written feedback on performance from preceptors and other faculty physicians and residents, results of OSCEs, patient logs

documenting breadth of clinical exposure, patient journals in which students record their reflections on specific patients and their problems, self assessments of videotaped interviews with patients (both standardized and real), and feedback from patients and other health care providers.

Students are expected to meet regularly with their physician advisors to discuss their progress. Several times each year in Years 1 and 2, they are required to review their assessment evidence in relation to expected levels of achievement in the 9 competencies and write Formative Portfolios composed of structured reflective essays on how the evidence demonstrates their development as doctors and researchers. Based on this analysis, they develop learning plans to address areas needing improvement. The essays include judgments on whether previously established learning goals have been achieve and reflections on the process of achieving these goals. Students discuss these materials with their physician advisors during Formative Assessment meetings. During the last three years, students submit learning plans on a bi-annual basis, and meet with their physician advisor to review their progress. Students are expected to assume more and more responsibility and independence in accurate self-assessment, in developing learning plans and following through on addressing their own learning needs, and in recognizing and building on their own strengths.

At the end of Years 1, 2 and 4, students assemble a Summative Portfolio for review by the Medical Student Promotions and Review Committee that determines if the evidence presented by the student indicates a level of achievement sufficient for promotion to the next year of the program (or graduation). Students are expected to choose not only their best examples of their work, but more importantly evidence demonstrating their growth across the year in specific competencies. We want to reward students who recognize areas needing improvement, identify an approach to addressing them, and can show that they have achieved that skill as well as those students who excel in specific areas throughout the year. Graduates of CCLCM not only achieve a defined level of achievement of each of the 9 competencies, they also develop their reflective ability to accurately assess their own strengths and areas needing improvement. The assessment process is designed to enhance student learning and the portfolio process enables students to document their progress in the achievement of defined competencies.

Graduation Requirements Summary

The official list of graduation requirements is provided in the Student Handbook. A medical student who has satisfactorily completed all the required work in CCLCM may be granted the degree of Doctor of Medicine (M.D.) with Special Qualifications in Biomedical Research by Case Western Reserve University, provided that:

1) He/she has been registered for the CCLCM at Case Western Reserve University School of Medicine for at least five academic years and not more than six years.

2) CCLCM Medical Student Promotions and Review Committee approve his/her record of performance including thesis, and the faculty recommends him/her to the CWRU Board of Trustees for graduation.

3) He/she has discharged all financial obligations to Case Western Reserve University and to the CCLCM.

4) He/she has passed the U.S. Medical Licensing Examination (USMLE) Step 1, USMLE Step 2 Clinical Knowledge (CK) and Step 2 Clinical Skills (CS).

5) He/she has passed the CWRU School of Medicine Clinical Skills Examination.

6) The Research Thesis and Defense has been completed within 3 months after completing research or by February 15th of the 5th year, whichever is earlier.

7) In Years 3-5 every CCLCM student completes a total of 146 weeks in the following activities:

- 48 weeks of required clinical experience
    - o 40 weeks: Basic Cores I, II, III, and IV
    - o 8 weeks: Two Acting Internships

- 48 weeks of research
- 2 weeks of Capstone Course
- 34 weeks of electives (minimum 20 weeks clinical and maximum of 12 weeks non-clinical)
- 14 weeks of vacation/resident interviews

Cleveland Clinic Lerner College of Medicine
of
Case Western Reserve University

CURRICULUM STEERING COUNCIL – MEMBERSHIP 2015-2016

James Young, MD	Executive Dean, CCLCM; Professor of Medicine; Institute Chair, Endocrinology and Metabolism Institute; Staff Cardiovascular Medicine, Physician Director, Institutional Relations and Development; Staff Transplantation Center; Staff Critical Care Center
TBD	CCLCM Student, Class 2020
TBD	CCLCM Student, Class 2019
Yi (James) Gao	CCLCM Student, Class 2018
TBD	CCLCM Student, Class 2017
Bogdan Kindzelski	CCLCM Student, Class 2016
Jonathan Weimer	CCLCM Student, Class 2016
Beth Bierer, PhD	Director, Program Evaluation, CCLCM; Associate Professor of Medicine, CCLCM; Staff, Education Institute, CC
Elaine Dannefer, PhD	Director of Medical Student Research and Assessment, CCLCM; Professor of Medicine, CCLCM; Staff, Education Institute, CC
Diane DeCamillo, RN, MSN	Administrator, CCLCM
Brigid O'Connor	Department Supervisor, CCLCM
Richard Drake, PhD	Director of Anatomy Education, CCLCM; Professor of Surgery, CCLCM; Staff, Education Institute, CC
Kathleen Franco, MD	Associate Dean for Student Affairs and Admissions, CCLCM; Professor of Medicine, CCLCM; Staff Department Psychology, Psychiatry CC
Linda Graham, MD	Assistant Dean for Research Education, CCLCM; Professor of Surgery, CCLCM; Staff, Departments of Vascular Surgery and Biomedical Engineering, CC
Alan L. Hull, MD, PhD	Associate Dean for Curricular Affairs, CCLCM; Professor of Medicine, CCLCM; Staff, Education Institute and Department of General Internal Medicine, CC
J. Harry Isaacson, MD	Assistant Dean for Clinical Education, CCLCM; Associate Professor of Medicine, CCLCM; Staff Education Institute and General Internal Medicine, CC
Christine Moravec, PhD	Director, Basic Science Education, CCLCM; Professor, Department of Molecular Medicine, CCLCM; Staff Research Scientist, Kaufman Center for Heart Failure, CC
Patricia Thomas, MD	Vice Dean for Medical Education, CWRU
Amy Wilson-Delfosse, PhD	Associate Dean for Curriculum, University Program; Professor of Pharmacology, CWRU

Cleveland Clinic Lerner College of Medicine
of
Case Western Reserve University

Curriculum Overview Years 1-5

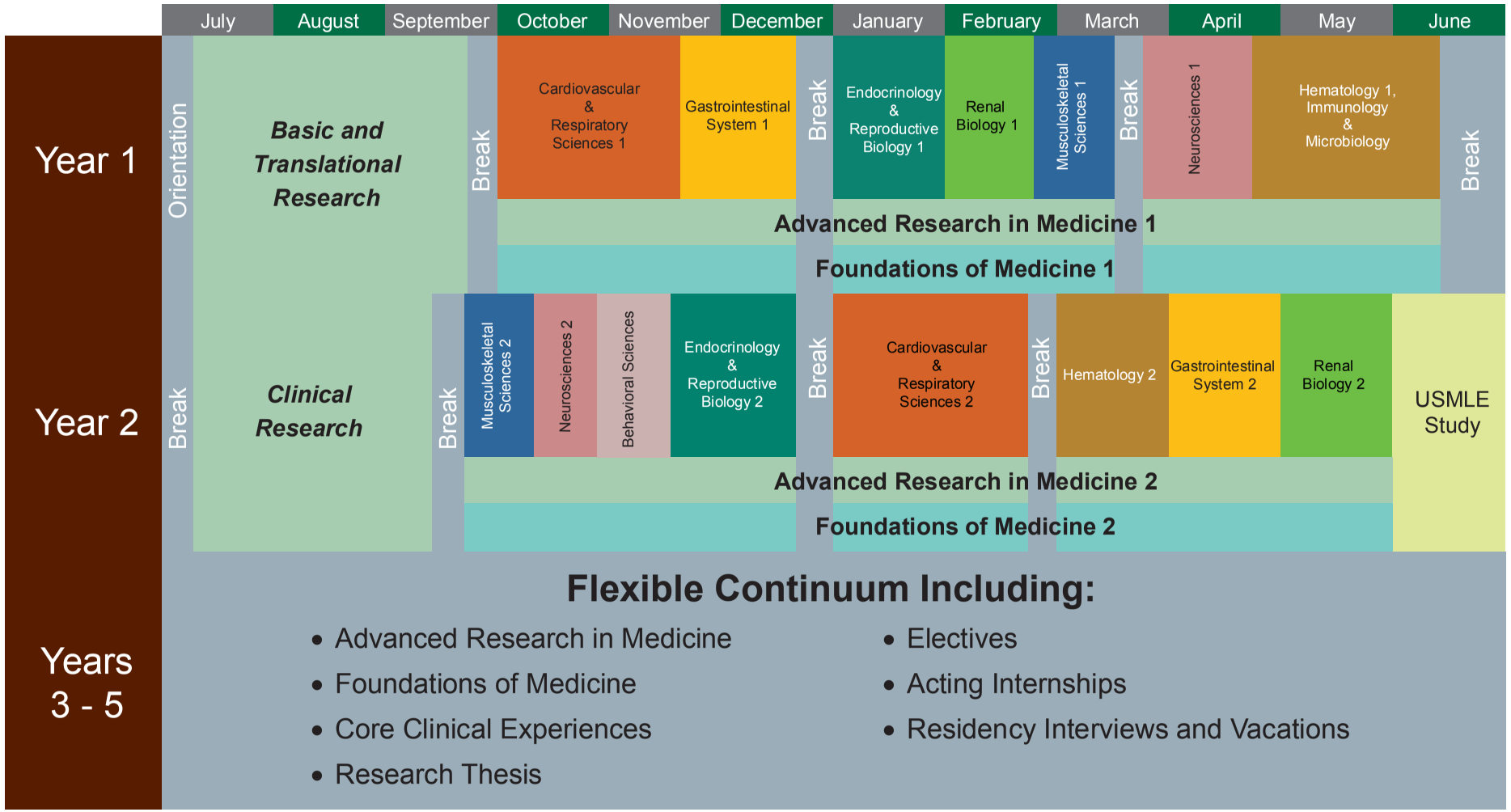


Figure 1

Cleveland Clinic Lerner College of Medicine
of
Case Western Reserve University

Year 1 - Curriculum Schedule

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 am – 10:00 am	Anatomy Lab	Foundations of Medicine Seminars	Seminar	**Independent Study**	Seminar
10:00 am – 12:00 pm	PBL Day 1	Seminar	PBL Day 2		PBL Day 3
1:00 pm – 5:00 pm	**Independent Study** or Clinical Program	**Independent Study** or Clinical Program	Clinical Program (one afternoon per week) or Independent Study	**Independent Study** or Clinical Program	Advanced Research in Medicine **Independent Study**

Year 2 - Curriculum Schedule

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 am – 10:00 am	PBL Day 1	Anatomy Lab or Seminar	PBL Day 2	**Independent Study**	PBL Day 3
10:00 am – 12:00 pm	Seminar	Foundations of Medicine Seminars	Seminar		Seminar
1:00 pm – 5:00 pm	**Independent Study** or Clinical Program	Clinical Program (two afternoons per week) or Independent Study	Clinical Program (two afternoons per week) or Independent Study	**Independent Study** or Clinical Program	Advanced Research in Medicine **Independent Study**

Figure 2a

Cleveland Clinic Lerner College of Medicine
of
Case Western Reserve University

Basic and Translational Research Block
Summer Year 1 Curriculum Schedule

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 am – 10:00 am	Fundamentals of Molecular Medicine	Fundamentals of Molecular Medicine	Fundamentals of Molecular Medicine	Meetings	Fundamentals of Molecular Medicine
10:00 am – 12:00 pm	Research Experience				Journal Club
1:00 pm – 5:00 pm					

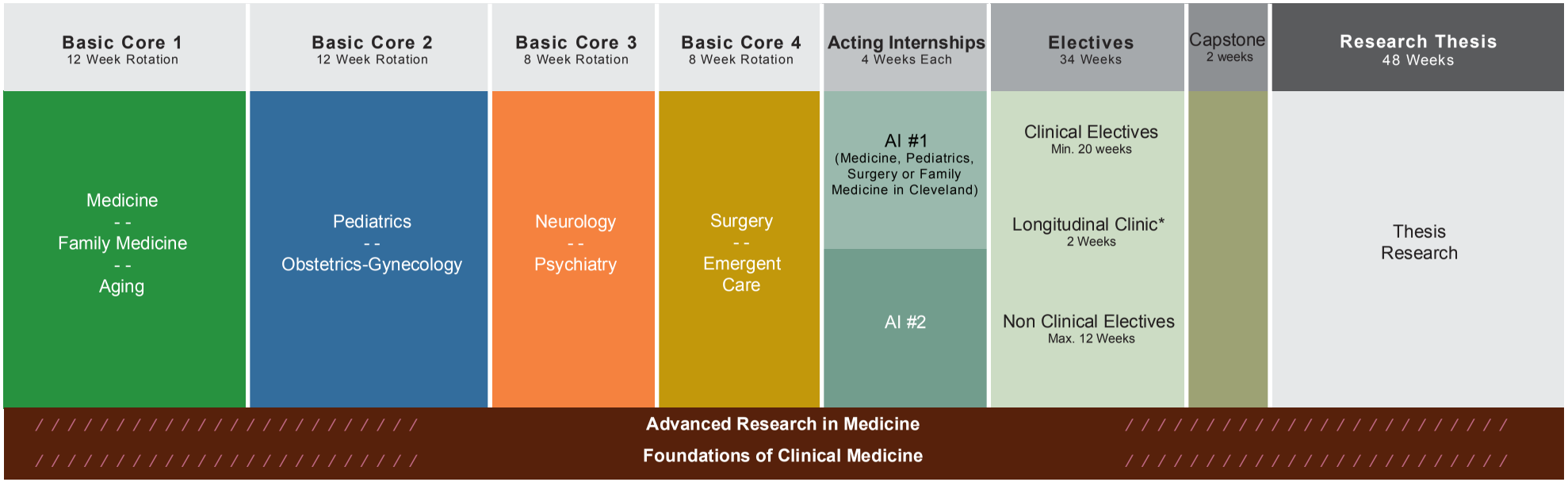
Clinical and Research
Summer Year 2 Curriculum Schedule

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 am – 10:00 am	Epidemiology	Biostatistics	Epidemiology	Biostatistics	Journal Club
10:00 am – 12:00 pm	Research Experience				
1:00 pm – 5:00 pm					

Figure 2b

Cleveland Clinic Lerner College of Medicine
of
Case Western Reserve University

Clinical and Research Curriculum Years 3 - 5



72 Clinical Weeks Required:
- 48 weeks from Basic Cores and Acting Internships
- 20 weeks minimum from Clinical Electives
  - 2 weeks from Year 1 and Year 2 Longitudinal Clinic*
  - 2 weeks from Capstone

Figure 3

Cleveland Clinic Lerner College of Medicine
of
Case Western Reserve University

CCLCM and University Program Competencies and Definitions

Competency Label	Competency Definition
Research and Scholarship	Demonstrates knowledge and skills required to interpret, critically evaluate, and conduct research.
Patient Care	Demonstrates proficiency in clinical skills and clinical reasoning; engages in patient-centered care that is appropriate, compassionate and collaborative in promoting health and treating disease.
Knowledge for Practice	Demonstrates knowledge of established and evolving biomedical, clinical, epidemiological and social-behavioral sciences, as well as the application of this knowledge to patient care.
Interpersonal and Communication Skills	Demonstrates effective listening, written and oral communication skills with patients, peers, faculty, and other health care professionals in the classroom, research, and patient care settings.
Professionalism	Demonstrates commitment to high standards of ethical, respectful, compassionate, reliable, and responsible behaviors in all settings, and recognizes and addresses lapses in behavior.
Systems-based Practice	Demonstrates an understanding of and responsiveness to health care systems, as well as the ability to call effectively on resources to provide high value care.
Teamwork and Interprofessional Collaboration	Demonstrates knowledge and skills to promote effective teamwork and collaboration with health care professionals across a variety of settings.
Personal and Professional Development	Demonstrates the qualities required to sustain lifelong personal and professional growth.
Reflective Practice	Demonstrates habits of ongoing reflection and analysis to both identify learning needs and continuously improve performance.

Approved:
CWRU Committee on Medical Education 4/30/15
CCLCM Curriculum Steering Committee 4/17/15

The Cleveland Clinic Lerner College of Medicine
of
Case Western Reserve University

Student Portfolio System

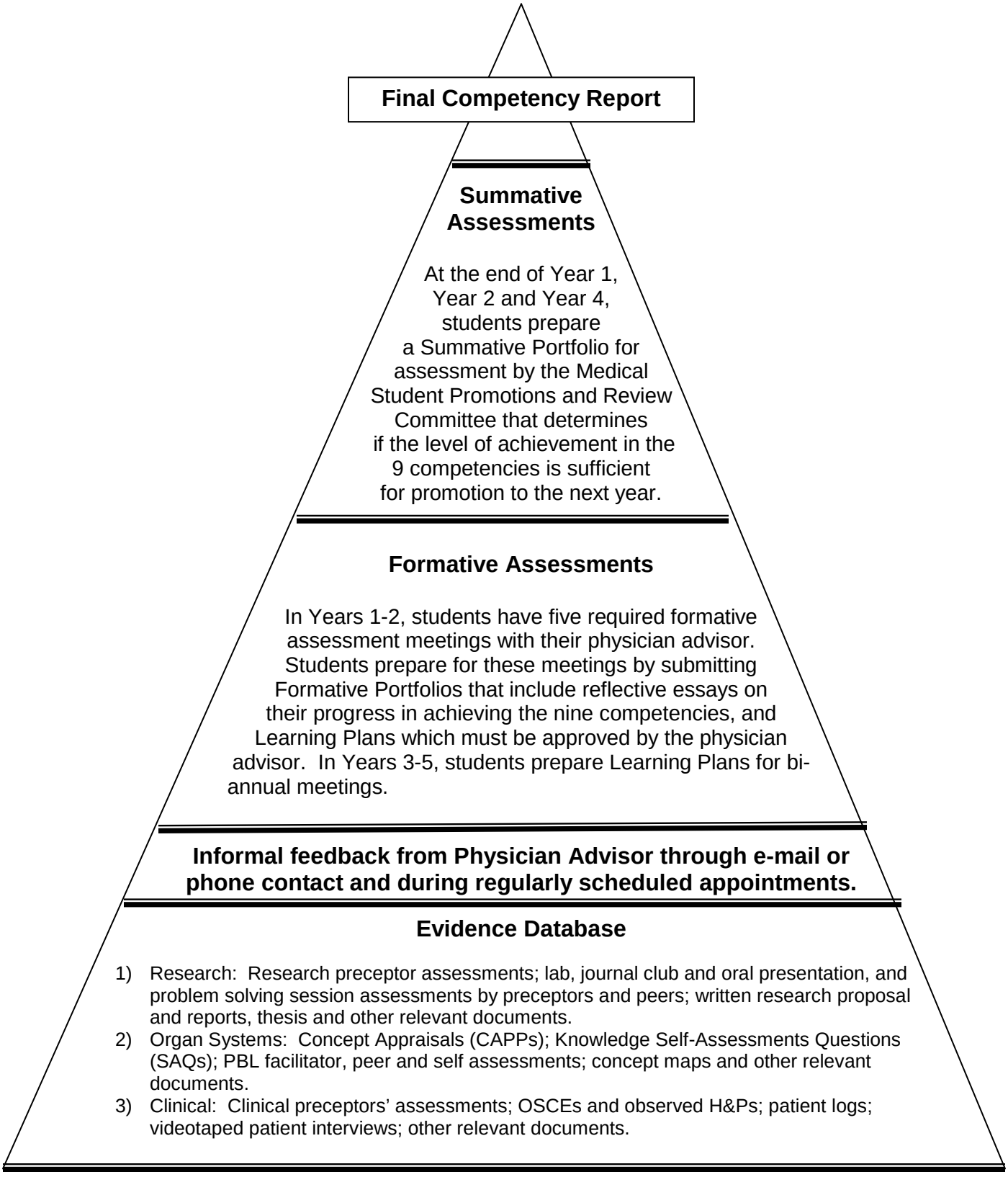


Figure 5

http://www.clevelandclinic.org/cclcm/