Review of Cardiovascular & Respiratory Physiology

• Course occurs in the fall term of Year 1
• Course Directors – Gene Nattie and Andy Daubenspeck
• Course has 52 curricular hours
• Course was last reviewed in April 2013
Prior Review: Summary of Recommendations

- Session objectives need to be listed in course materials in the correct format, and match the session objectives in Ilios
- The course directors should consider adding additional session objectives to conference sessions to reflect what is assessed (e.g. participation)
- Narrative feedback needs to be provided for conferences
- Course directors should continue to reduce lecture hours in the course (target of ~40% lecture) and facilitate engaged learning during large group sessions
Prior Review: Summary of Recommendations

- Incorporate, if possible, activities where data is observed, measured and analyzed
- Improve the clarity of assessment questions (i.e. regarding wording/what is being asked)
- Improve the clarity and organization of course materials
- Provide additional opportunities (or recommend resources) for students to practice applying their knowledge prior to assessment
Prior Review: Summary of Recommendations

- Continue to address the issue of confusion regarding abbreviations and acronyms
- Strongly encourage faculty development, consultations with members of the Academy of Master Educators, etc. to improve teaching and course materials. Utilize the expertise (3 Academy Members) in your field.
Prior Review: Action Plan

1. We will be certain that the learning objectives listed in the course materials for each session match the session objectives listed in Ilios. [done]

2. Written narrative feedback will be provided to all students by conference leaders at the middle of the course and at its conclusion. [done]

3. We have revised the course by reducing the number of lecture hours by 11 and the total course hours by 1. Thus the revised schedule will consist of 40% lectures, down from 59%. [done]

4. We have added 10 hours of large or small group conferences, including a 1-hour session in the DHMC Simulation Lab and a session in which students measure blood pressure and heart rate on themselves in several conditions. [done]

5. Use of a single textbook (Costanzo) will be recommended [listed as a recommended text]

6. All notes for the course will be reviewed for clarity and consistency. Several iBooks are being prepared. Care will be taken to define all abbreviations used in lecture notes and slides, and a glossary will be provided. [done, but iBooks still reported as lacking clarity]

7. Conferences will be devoted less to explanation of physiological principles and more to their application than in past years. [done]

8. More practice questions, both with and without answers, will be provided during the week before each quiz. Quiz questions will be reviewed for clarity by student volunteers. [done]

9. In addition to critique of lectures by course directors, opportunities for faculty development for both large and small group teaching will be pointed out to all faculty members who participate in the course. [done]
<table>
<thead>
<tr>
<th>Course Objective</th>
<th>Program Objective Mapping</th>
</tr>
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<tbody>
<tr>
<td>1  Describe the physical arrangement and roles of the various components of the cardiorespiratory system.</td>
<td>MS.2</td>
</tr>
<tr>
<td>2  Explain the ionic bases for the resting membrane potential in a cardiac muscle cell and the development and propagation of an action potential across the myocardium.</td>
<td>MS.2</td>
</tr>
<tr>
<td>3  Explain the role of calcium in cardiac muscle tension development and relaxation following action potential excitation, and discuss the influences of the length-tension relationship, contractility and load upon muscle shortening.</td>
<td>MS.2</td>
</tr>
<tr>
<td>4  Explain the electrical and mechanical events of the cardiac cycle and show how muscle characteristics and cardiac geometry combine to determine cardiac pumping performance as displayed by cardiac cycle pressure-volume trajectories and ventricular function curves.</td>
<td>MS.2</td>
</tr>
<tr>
<td>5  Explain how the characteristics of vascular geometry and flowing blood determine the load upon the ventricles.</td>
<td>MS.2</td>
</tr>
<tr>
<td>6  Describe the manner in which tissue perfusion is regulated at a local level, how materials are exchanged in the microcirculation, and how specific tissue beds differ in their local regulation responses.</td>
<td>MS.2</td>
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<tr>
<td>7  Explain the short- and long-term regulation of arterial blood pressure under normal conditions and during conditions posed by gravity, blood loss, ventricular failure and other stresses.</td>
<td>MS.2</td>
</tr>
<tr>
<td>8  Describe the static and dynamic force requirements, produced by respiratory muscles or mechanical assistance, to produce gas flow in airways of normal individuals and how pulmonary disease affects these.</td>
<td>MS.2</td>
</tr>
<tr>
<td>9  Explain the fundamental principles of convective transport and gas exchange between alveolar air and pulmonary capillary blood, and the exchange in tissues following circulatory transport.</td>
<td>MS.2</td>
</tr>
<tr>
<td>10 Discuss the central control of breathing and the afferent and efferent nerves involved.</td>
<td>MS.2</td>
</tr>
<tr>
<td>11 Describe the changes in circulation and respiration at birth.</td>
<td>MS.2</td>
</tr>
<tr>
<td>12 Describe cardiorespiratory responses and adaptations to exercise.</td>
<td>MS.2</td>
</tr>
<tr>
<td>13 Discuss the impact of cardiorespiratory disease on well-being and the quality of life.</td>
<td>MS.2, CS.2</td>
</tr>
<tr>
<td>14 Communicate effectively with fellow students and faculty regarding principles of cardiorespiratory physiology.</td>
<td>CC.8, CS.6, CS.1</td>
</tr>
<tr>
<td>15 Meet professional responsibilities by providing thoughtful evaluations of course activities.</td>
<td>P.7</td>
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</table>
Course Objectives — Current Mapping

**MS = Medical Science; CC = Clinical Care**

### Matched Program Objectives

**MS.1** Describe the scientific method and illustrate how it informs the discovery and refinement of medical knowledge.

**MS.2** Apply core biomedical and social science knowledge to understand and manage human health and disease.

**MS.3** Use interdisciplinary basic science knowledge to appraise novel mechanisms of disease, and propose and assess diagnostic strategies, and treatments.

**MS.4** Practice self-directed inquiry through framing a discrete question, identifying and synthesizing the relevant literature, and applying the knowledge gained to clinical care, teaching, research, or population health.

**MS.5** Integrate medical science knowledge and the skills of critical thinking (observation, evaluation, inference, interpretation, and judgment) into sound clinical reasoning.

**MS.6** Recognize, tolerate, and manage uncertainty in medicine.

**MS.7** Describe the clinical implications of complexity and variability of human health, disease, and response to intervention.

**MS.8** Contribute to scholarship through the discovery or synthesis of medical knowledge and its communication to peers or the larger community.

**MS.9** Apply principles of epidemiology to the identification of health problems, risk factors, treatment strategies, resources, and disease prevention/health promotion efforts for patients and populations.

**CC.1** Establish mutually respectful student-patient-family relationships based on trust.

**CC.2** Elicit a medical history appropriate to the patient's concerns and clinical context.

**CC.3** Perform a physical exam appropriate to the patient's presentation and clinical context.

**CC.4** Evaluate the appropriateness of diagnostic tests and studies for a particular condition and clinical context.

**CC.5** Identify and interpret the results of frequently ordered laboratory, imaging, and other diagnostic studies.

**CC.6** Use clinical reasoning to synthesize relevant key patient findings into a concise and accurate assessment, including differential diagnosis.

**CC.7** Formulate a prioritized problem list, and develop and implement a management plan guided by the patient's social context, evidence-based medicine, and critical thinking.

**CC.8** Deliver oral presentations appropriate to the patient's presentation and clinical context.

**CC.9** Record clinical information that is accurate, organized, well-reasoned, and timely.

**CC.10** Demonstrate proficiency in performing select clinical and operative procedures under appropriate supervision.

**CC.11** Use information technology effectively and responsibly.

**CC.12** Engage patients in shared decision-making, incorporating values and preferences in discussions of management options and their expected benefits and harms.

**CC.13** Identify and address the various goals of patient care, including prevention, diagnosis, cure, chronic disease management, palliation, and end-of-life care.

**CC.14** Work effectively in various health care settings and systems.

**CC.15** Contribute to the coordinated care of the patient, including referral of patients, ensuring continuity of care throughout transitions between providers or settings, and following up on patient progress and outcomes.

**CC.16** Organize and prioritize responsibilities to provide care that is safe, effective, and efficient.

**CC.17** Accept and demonstrate responsibility in a graded fashion commensurate with one's roles, abilities, and qualifications.

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*Geisel School of Medicine at Dartmouth*
Course Objectives — Current Mapping

**PH = Population Health; CS = Communication Skills; EIM = Evaluation and Improvement in Medicine; PPLD = Personal, Professional and Leadership Development**

**Matched Program Objectives**

**PH.1** Differentiate between and critique measures used to evaluate health and disease at the individual and population level.

**PH.2** Assess the impact of social, environmental, behavioral, economic, cultural, and personal factors on the health of individuals, and the incidence and burden of disease in populations.

**PH.3** Examine the relationships between the medical system and other societal systems and entities that impact population health.

**PH.4** Collaborate with community partners to improve the health and well-being of a community.

**PH.5** Explain and exemplify the role of a physician in working to improve the health and safety of a community; promote social justice; and advocate for the public good.

**CS.1** Build rapport by listening actively, compassionately, and respectfully.

**CS.2** Demonstrate empathy for individuals’ concerns, and be respectful of others’ perspectives and personal, cultural, and religious values.

**CS.3** Address challenges to effective communication, including language barriers, cultural differences, health literacy, and authority gradients.

**CS.4** Promote positive behavioral change through strategies such as motivational interviewing and cognitive behavioral therapy (CBT).

**CS.5** Manage difficult conversations effectively with patients and their families.

**CS.6** Communicate accurately, succinctly, and in a timely manner with patients, their families, and with other healthcare professionals.

**CS.7** Translate complex biomedical concepts and advances into useful information to educate patients, families, peers, and others.

**EIM.1** Assess the balance between risk and benefit for any health care intervention and incorporate that balance into decision-making for individual patients and populations.

**EIM.2** Use individual, clinic, hospital, and community resources to provide safe, high quality, high value care.

**EIM.3** Analyze the structure, processes, and outcomes of a health care system and learn how the delivery of high quality and reliable care can be improved.

**EIM.4** Explain the context (financial, political, legal, historical, and cultural) in which medicine is practiced.

**EIM.5** Compare and contrast the health care delivered in different regions and countries, and analyze the causes and consequences of the observed variation.

**PPLD.1** Demonstrate critical and accurate self-assessment, reflection, and effective learning strategies to engage in lifelong learning and improve one’s performance.

**PPLD.2** Demonstrate resilience skills by taking responsibility for one’s own physical, emotional, mental, and social health and well-being, accessing appropriate assistance as needed.

**PPLD.3** Elicit, learn from, and offer constructive feedback.

**PPLD.4** Engage in active discussion and debate, taking advantage of different perspectives to advance knowledge and understanding, and improve decision-making.

**PPLD.5** Design, implement, and sustain a personal, professional, and leadership development plan aligned with one’s values and sense of purpose, with appropriate mentorship.

**PPLD.6** Identify and demonstrate the qualities, knowledge, skills, and attitudes to lead effectively at the level of one’s self, team, organization, and community.

**PPLD.7** Be a positive role model to fellow students in academic, clinical, research and/or service-learning contexts.
**Course Objectives – Current Mapping**

**P = Professionalism; CT = Collaboration and Teamwork**

**Matched Program Objectives**

**P.1** Place the patient's interests first.

**P.2** Behave respectfully, responsibly, and ethically towards patients, families, colleagues, members of the healthcare team, and the community.

**P.3** Demonstrate the ability to recognize and respond appropriately to commonly occurring ethical, legal, and statutory issues in clinical care.

**P.4** Respect and honor confidentiality.

**P.5** Recognize and address health care disparities which result from gender, race, religion, socioeconomic status, disability, sexual orientation, or ability to pay.

**P.6** Demonstrate awareness and manage the influence of one's personal values and biases.

**P.7** Demonstrate accountability for all professional responsibilities and commitments, and take responsibility for one's words and actions.

**P.8** Recognize and help resolve ethical conflicts created by competing values.

**CT.1** Foster a climate of collaboration, mutual respect, integrity, trust, and tolerance to facilitate optimal team performance.

**CT.2** Demonstrate the ability to effectively share and/or allocate responsibilities among team members.

**CT.3** Recognize and capitalize on different roles and strengths of team members to develop and address shared goals.

**CT.4** Develop organizational, time management, and communication skills to serve efficiently and productively in different roles on a team.

**CT.5** Manage conflict constructively.
Course Objectives – Comments

• The number of course objectives seems appropriate, and can be summarized as follows:
  – 6 focus on the cardiovascular system
  – 3 focus on the respiratory system
  – 4 are integrated objectives that involve both systems
  – 2 relate to student skills (communication/professionalism)

• The objectives indicate that the course content correlates well with the cardiovascular and respiratory sections of the USMLE Content Outline
Course Objectives – Comments

- CC.8 is not the best fit for Objective 14; in addition to CS.1 and CS.6, Objective 14 also maps to CS.2, CS.3 and CS.7
- The subcommittee suggests a revision to objective #15, based on the difficulty with assessing it in its current form (objective reads: “Meet professional responsibilities fully by providing thoughtful evaluations of course activities.”)
- The course directors agree with this sentiment and would like the revised version to focus on students’ responsibilities to their team (i.e. contributing to the learning of the group) and developing skills of communication to articulate their thoughts clearly
Course objectives are provided in the syllabus.

In a prior year, Objective #3 was revised (approved by MEC) and #6 was removed – the current version of the objectives on Ilios reflects this, however Canvas still has the old version of #3 and #6 (thus two course objectives need to be updated on Canvas)

Course objectives are written in the correct format using measurable verbs
Session objectives are provided in the course materials for most sessions. The following sessions did not appear to have objectives posted on Canvas: 9R, 12R, 15R, 16R, 17R, 32R, 34R, 38R, 40R although they are available on Ilios. Two sessions discussed goals of the session in paragraph form (37R, 39R), but a list of objectives was not provided.

Most session objectives are written in the correct format. The following objectives do not have measurable verbs and need to be corrected: all objectives for sessions 2 and 3, objective M for session 23R, objectives 8 and 10 for session 30R.
Issues of Redundancy

• We searched a number of important topics/terms
• Blood Pressure OR Hypertension
  – Taught in Cardioresp Physiology and Renal-Endocrine Physiology—course objectives and session objectives
    • Important redundancy but course directors should be certain no discrepancies and/or unplanned redundancy
    • Renal course directors found some discrepant approaches related to: 1) Roles of Angiotensin II, 2) Impacts of volume depletion vs dehydration on Hematocrit, and 3) Impacts of volume depletion on kidney function
    • Recommendation: Course directors meet to resolve discrepancies and have all content reinforce the other
  – Also taught in Y1 and Y2 On-Doctoring, Y2 SBM, Y3 Family Medicine
    • Appropriate reinforcement
Issues of Redundancy

• We searched a number of important topics/terms

• Ventricular Failure or Heart Failure
  – No Y1 redundancy
  – Also taught in Y2 On-Doctoring, Y2 SBM and Pharm, Y3 Family Medicine and Y3 Internal Medicine Clerkship
    • Appropriate reinforcement

• Ventilation, Gas Exchange, OR Resp Failure
  – No Y1 redundancy
  – Also taught in Y2 SBM, Y2 Pharm, and Y4 Advanced Medical Sciences
    • Appropriate reinforcement
Exploration of Health and Values

- Based on objectives and session titles it’s unclear if exploration of ethics/humanities is incorporated (or if appropriate for this course); course directors confirmed that content is currently not present
- Some sessions have potential for incorporation of Health and Values curriculum: Correlation Clinic on Toxic Shock Syndrome, Simulation center sessions, Neonatal Physiology session
- Course directors would welcome suggestions from VIG regarding how to incorporate these topics
Summary regarding Objectives

• Overall the objectives are well-written and distributed to the students; there are a few minor revisions needed for some session objectives and some sessions need objectives added to Canvas; mapping needs to be updated for objective #14 and objective #15 needs to be revised
• After searching multiple topics, redundancy was noted for the topic “blood pressure/hypertension” in the fall and winter terms of Y1 Physiology. While the committee feels that this is an important topic where redundancy is beneficial, there may be some inconsistencies regarding how the topic is presented in the two courses
• Currently the course does not contain Health and Values content
Course Learning Opportunities

- Lecture 20 hrs. (38%)
  [59% in prior review]
- Small Group Conferences 22 hrs. (42%)
  [31% in prior review]
- Interactive/flipped classroom sessions 3 hrs. (6%)
  [new since prior review]
- Two simulation sessions 2 hrs. (4%)
  [new since prior review]
- Correlation clinics* 2 hrs. (4%)
  [3% in prior review]
- Laboratory Demonstration/Exercise Lab 3 hrs (6%)
  [7% in prior review]

*these are active case presentation sessions with a live or recorded patient
Course Learning Opportunities

• The course directors are to be commended for the significant reduction in lectures since the prior review, and for incorporating more active pedagogical methods (e.g. simulation sessions)

• Although not unique to this course, small groups continue to possess varying qualities of instruction. The subcommittee recognizes that this is inherent in settings with multiple facilitators and it would be beneficial for students to learn to adapt to different styles

• While “rotating facilitators” over the term could equalize the student experience, the course directors feel that it is more beneficial to have the same group of students so they can get to know them, provide feedback and identify students that may need extra help
Summary regarding Pedagogy

• The number of lectures in the course is appropriate
• Based on a previous recommendation by the MEC, small group facilitators now retain the same group of students for the entire term allowing them to get to know the students well and provide feedback; the course directors feel this has been a positive change
• The course has introduced some innovative sessions using the simulation center that allow students to apply their knowledge and measure/analyze data
Assessment

• 5 Written Quizzes (50% of course grade)
• Final Exam (50% of course grade)
• Conference performance (must receive a pass in this portion to pass the course; option for oral exam if an initial grade of fail is given for conferences)
Assessment for Course Objectives

• Objectives 1-13 cover aspects of medical knowledge
  – assessed on quizzes/exams, during small groups and during simulation sessions

• Objective 14: Communicate effectively with fellow students and faculty regarding principles of cardiorespiratory physiology.
  – faculty may assess this during small groups, however feedback on small group performance is varied

• Objective 15: Meet professional responsibilities fully by providing thoughtful evaluations of course activities.
  – students are expected to complete end of term course evaluations, but completion of this activity is not assessed
Summary regarding Assessment

• Most of the objectives in the course are assessed by quizzes, exams and small group meetings
• Objective #15 is currently not assessed; the objective either needs to be revised (discussed previously on slide 9) or assessed
# Measures of Quality – AAMC GQ

“Indicate how well you think that instruction in Physiology prepared you for clinical clerkships and electives.” [1=poor; 2=fair; 3=good; 4=excellent]

<table>
<thead>
<tr>
<th>Course</th>
<th>Geisel mean 2010</th>
<th>Geisel mean 2011</th>
<th>Geisel mean 2012</th>
<th>Geisel mean 2013</th>
<th>Geisel mean 2014</th>
<th>All schools means 2014</th>
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# Measures of Quality – Step I

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*values reported for core disciplines are SD above the US/Can mean for Geisel mean scores
## Measures of Quality – Course Evaluation

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<th>Overall Quality AY 15-16</th>
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*scale [1=poor; 2=fair; 3=good; 4=very good; 5=excellent]*
Measures of Quality – Course Evaluation

scale [1=poor; 2=fair; 3=good; 4=very good; 5=excellent]

<table>
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<th>Cardio Phys 2014 (90%)*</th>
<th>Cardio Phys 2015 (96%)*</th>
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</table>

*student participation rate on course evaluation
## Measures of Quality – Course Evaluation

*student participation rate on course evaluation*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Resp Phys 2013 (91%)*</th>
<th>Resp Phys 2014 (90%)*</th>
<th>Resp Phys 2015 (96%)*</th>
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<tr>
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<td>3.62</td>
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Measures of Quality – Student Comments

Strengths:

• Students enjoyed the Simulation Center exercises, and found them to be very beneficial

“The opportunities to apply physiology concepts in an in-patient environment were some of my favorite sessions this term. I liked having the chance to draw on our knowledge and collaborate with my classmates.”

“I actually wish we could do more of these- even once every two weeks or so.”

• The Study Buddy Questions and Problem Sets were greatly appreciated

“The study buddy questions were great! They helped me see the big picture of the course and understand the details in the class better”
Suggestions for Improvement:

• While some found the iBook useful, the majority found it too lengthy and confusing to understand

“I thought the iBooks made concepts more convoluted than they needed to be by over explaining things.”

“Emphasis should be on key graphics and explanation of core concepts.”

• The Small Group Conferences cases were helpful to understanding concepts, but students were frustrated with the discontinuity between facilitators.

“Small groups were how I did the bulk of my learning and solidified lecture and reading information.”

“I wish small groups would rotate instructors, so we could differentiate our instruction.”

“The small groups are too large! There are so many students and I feel like we always run out of time.” [Note: one facilitator wasn’t able to participate at the last minute due to medical reasons and it resulted in larger groups]

“I think small groups should be optional.”
Suggestions for Improvement:

- Attendance for lectures was low, as many found them confusing. Feedback included improving lecture materials and having more flipped-classroom sessions.

“I have found that the lectures in physiology sometimes feel very confusing, even after pre-reading the iBook. I think it would be very helpful to include more sample problems during lecture or even just to simplify the explanations of key concepts using analogies.”

“More flipped classrooms would be great! Maybe like CTO have students complete a quiz before class. That would really give students a better gauge of how well they understand the material and force them to review the material before class.”

“Redo the slides so they aren’t just transcripts of the lectures.”

“Organization, presentation of material. It is not in the learning methods, but the way it is presented. The way power point slides are written, the way the professors explain the concepts, etc.”
Measures of Quality – Student Comments

Other Issues From Student Comments: Organization of resources:

“I love the number of resources that are available on canvas (there are lots!) but they perhaps could be better organized, so that we know what is essential for us to look at and what is simply supplementary.”

“As there are many iBooks for the course, in keeping track of all of the iBooks, I think it would be helpful to organize the iBooks by quizzes.”

Students like Kellogg better than Chilcott Lab for lecture [food is allowed in Kellogg]
Summary regarding Measures of Quality

• The ratings for the Physiology course have improved since the prior review and are in the good to very good range
• New activities and resources that have been added since the prior review (simulation exercises, study buddy questions) are very well received
• The subcommittee appreciates that the course has worked on improving its course materials and lectures, however there is still room for improvement
• Some students are concerned by the perceived lack of consistency between small group facilitators
Recommendations

- The course should fix minor issues with course and session objectives.
- The course should explore some potential inconsistencies in the teaching of blood pressure and hypertension with the renal physiology course to ensure the teaching of these topics is coordinated.
- The course should meet with the Health and Values VIG to discuss opportunities for incorporating these topics into the course.
Recommendations

• The course should continue to work on improving the clarity of course materials and course lectures.
• The course should convey to students the goals of the small group conferences to reduce concerns about “equal experiences” (i.e. goals are not only to clarify information, but to practice communication skills, contribute to others’ understanding and to learn to adapt to different teaching styles).
Action Plan

• To be determined after the new course directors are named