

**ES.010: Chemistry of Sports:
Understanding how exercise affects
your body chemistry**

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Goals of the Course

- Apply the principles of chemistry to studying sports
- These principles include:
 - Atomic and molecular interactions
 - Thermodynamics
 - Acid/base chemistry
 - Bonding
 - Electrochemistry
- There will be weekly reading of scientific literature related to the topic of the week

Goals of the Course

- The seminar is designed to look at the science of a triathlon/sports from a molecular/chemical/biological point of view.
- We will be able to use our own bodies to see how exercise affects the system, through observations written in a training journal.
- The end of the term will have us all participate in a mini-triathlon in the Z center pool/Mac court/Charles River Esplanade on Wednesday May 9th.

To get your 6 units of credit

You must:

1. Attend 85 % of class meetings (which means you can miss 2 meetings over the course of the term)
2. Participate in the class discussions.
3. Do the readings before coming to class
4. Maintain a physical exercise program over the course of the term to apply the classroom knowledge to your own body.

To get your 6 units of credit

You must:

5. Do a literature review for a given week based on material posted on course website (in pairs)
6. Participate in the mini-triathlon during the second last class.

Literature review

- Every week there are papers to read. One week a pair of students will lead the discussion of the literature that is posted on the course website and do a on-line search to see new trends in that area to spark the discussion

Literature review – pick a partner

Chemistry of sports discussion topics

Week #	Date	topic	literature summary	article hunt
1	6-Feb-13	Getting organized	patti	patti
2	13-Feb-13	Injury prevention		
3	20-Feb-13	Training your body		
4	27-Feb-13	Fueling your body		
5	6-Mar-13	Swimming	not assigned	not assigned
6	13-Mar-13	Running clinic	not assigned	not assigned
7	20-Mar-13	Physics of cycling		
8	27-Mar-13	spring vacation, no class	not assigned	not assigned
9	3-Apr-13	wind tunnels		
10	10-Apr-13	Chemistry of cheating		
11	17-Apr-13	legal manipulation of body		
12	24-Apr-13	chemistry of clothing		
13	1-May-13	triathlon preparaton		
14	8-May-13	mini-triathlon	not assigned	not assigned
15	15-May-13	Build a better athlete	everyone	

PE Points details

Supervised workouts

Combination of bike (spinning in the MAC court), swimming in the Z center pool and running around the indoor track to give you the feel of training for a triathlon.

PE Points details

Date	Where	Time	purpose of workout
Thursday February 7	Z center	TBA	fitness testing get a baseline of fitness level
Thursday February 14	Mac Court	4 pm	Getting on the bike - introduction to spinning
Thursday February 21	Z pool	4 pm	work on distance work - swim at least 1500 yards
Thursday February 28	Mac Court	4 pm	bike - intervals to get heart rate up
Thursday March 7	Mac Court	4 pm	bike - - longer distance sets - then try and run
Thursday March 14	Z pool	4 pm	work on drills/longer distances - at least 2000 yards
Thursday March 21	Mac Court	4 pm	bike - intervals to get heart rate up - do 5 minutes of run at end
Thursday March 28	No workout due to spring break		
Thursday April 4	Z pool	4 pm	distance swim -do at least 2500 yards
Thursday April 11	Mac Court	4 pm	Running intervals with proper form
Thursday April 18	Mac Court	4 pm	bike - - longer distance sets - go for a run afterwards.
Thursday April 25	Mac Court	4 pm	bike, intervals to get heart rate up
May 9th to May 14th	Fitness testing to see how the term went		

Anyone interested in getting PE points for the course?

You are welcome to come to the workouts even if you don't want PE points

Syllabus

For details see attached detailed syllabus

Highlights:

1. Pre and post class fitness testing – more details later in class
2. Final assignment – do a mini-triathlon at the Z center on May 1st (short course pool) or 8th (long course pool)

Syllabus

Highlights:

First part of the course is designed to give you the tools to become a more efficient working machine that does what ever sport/exercise you want to through injury prevention, nutrition and training

Question:

What sports/exercise do people do?

Syllabus

Experts come to visit the class:

1. Coach Bill Paine from MIT masters swimming will give us a master swim class at the Z center pool (March 6th)
2. Mike Blanchard from Newton Running shoe company will give us a running clinic (March 13th)
3. Dr. Kim Blair – Bike riding optimization with a trip to the MIT wind tunnel (Apr 3th)

Training Journals

- Part of research is to document your experiments
- Since you are using your own body as the experimental device, you need to document how the experiment is going
- You will keep a training journal throughout the term.

Training journals

Things that you want to think about for your training journal

- Think about the entire term as preparation for the race in the first weekend of June
- Write down distance, time, intensity of each of your workouts for each day
- Indicate how the workout went for instance felt great, was unable to focus
- Keep track of your eating habits and how it relates to your physical performance
- Keep track of the amount of sleep you get
- Keep track of hydration
- Review on a weekly basis to gauge how your training is going

Make your own training journal

- Class activity

Potential Training schedules

- These are all posted on the class website:
- They are from the book Essential Week-by-Week Training guide by Matt Fitzgerald
- You need to read chapters 1 and 2 and then the specific chapter/fitness level for the event you are training for.
- Or there is a 8 week plan for people to prepare for a sprint triathlon (which is basically what we are doing)

Fitness Testing

- One of the goals of the course is to improve your fitness over the term
- To help gauge this, we are going to do a pre- and post-course fitness tests
- These tests are going to be done at the Z center and are called Fitness Assessments

Fitness Assessment

What will be done:

- Age
- Resting heart rate
- Resting blood pressure
- Weight
- % body fat using calipers to measure skin folds
 - For females - tricep, hip and thigh
 - For males - chest, abs and thigh
- Flexibility - sit and reach
- Push-ups (either straight leg or modified (on knees))
- Aerobic conditioning VO_2 - bike test

Measuring blood pressure

Image removed due to copyright restrictions.
See [image](#) of how to measure blood pressure.

- a) Pressure in the cuff is increased to close both the arteries and veins. No sounds is audible
- b) Pressure in the cuff is gradually lowered until the sound of a pulsing flow of blood through the constriction in the artery is heard. At this time, pressure in the cuff is just below the peak systolic pressure in the artery
- c) Pressure is further lowered until the sound becomes continuous. At this time, the cuff is just below the diastolic pressure in the artery.

Bike Test

YMCA Sub Max Cycle Ergometer Test

The test:

Ride at 50 rpm at a given resistance and state the perceived level of exertion (on a scale of 1 to 10)

Increase resistance but maintain 50 rpm and keep going until about 75-85% of heart rate max (70% of heart rate reserve) is reached.

Once test is completed, do a cool down

Max VO_2

VO_2 is the maximum rate at which an individual can consume oxygen

Why test VO_2 ?

Why $\dot{V}O_2$?

- $\dot{V}O_2$ is an important determinant of the peak power output and the maximal sustained power output or physical work capacity of which an individual is capable.
- It depends on the capacity of the cardiovascular system.
- It has emerged as the single most important criterion of physical fitness.

Reference: Brooks, Fahey and Baldwin, Exercise physiology 4th edition, pp 5-7

Fitness Assessment

- Goal is to look at your baseline fitness and see if you can improve it over the course of the term
- This is accomplished through a regular exercise program

Fitness Assessment

Signing up for the fitness assessment: budget on
45-60 minutes

Times available:

Sign up on the excel sheet

Need to fill out the fitness assessment form
before you leave today.

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