

Lecture 1: Introduction

[[Banging sound of a popping mini-balloon]]

What happened?

In about 1/1000 of a second, a bubble about 0.5 cm across popped. That released about 0.2 milligrams of air, to expand into the air around it. The energy released was about 0.02 Joules, about the amount released when a paper clip hits the ground, if dropped from head height. (Alternately, your body releases 5000 times that much heat every second.)

- The air in the bubble did not cross the room.
- The air from the bubble did not even cross the table.
- The air at your ear moved back and forth about 5 microns ($5\ \mu\text{m}$), which is 1/10 the width of a human hair.

Yet everyone in the room turned around!

This is the phenomenon of sound.

As we will learn, the air in the bubble pushed the air next to it. This air pushed the air next to it, and so on. A “ripple” phenomenon went across the room, and that is what people responded to.

People far from the bubble actually received more sound from reflections off the wall, floor, ceiling, people, and so forth, than they received directly from the bubble. Nevertheless, no one had any trouble telling where the sound came from. This reflects the remarkable properties of your ear.

This course has three main goals:

1. To study sound;
 - what it is,
 - how it is characterized,
 - how it travels.
2. To study the ear;
 - its anatomy,
 - how it works,
 - how the ear-brain system determines (some of) our notions of music.
3. To study musical instruments;
 - how they work,

- why their sounds are “musical,”
- why they sound different from each other.

Some definitions we will encounter:

Physics: The study of nature using the scientific method and mathematical tools.

Psychophysics: The study of the physical basis of perception and the functioning of the nervous system (though we will concentrate on the physical basis of hearing and will not go into the nervous system very much).

Let me answer ahead, some questions you may have about the course.

Will this be a physics course?

Yes – but – I will *not* assume more than high school background in physics or mathematics (though you may find it helpful if you have more). In particular, I *will* assume you know algebra and have seen logarithms, though you may be rusty with them. I will *sort of* assume trigonometry. I will *not* assume calculus or Freshman physics. **Don’t panic.**

Will this be an anatomy / physiology course?

No - I am not qualified to teach one – but – we will discuss anatomy of the ear in some detail, and of the throat in rather less detail, and particularly the ear anatomy will be important in the course.

Will this be a music course?

No – but – many musical concepts will come up, and a good background in Western musical theory and a familiarity with some musical instruments will come in handy. In particular I will *almost* assume a familiarity with rhythmical marking, and will *hope for* familiarity with musical scales and musical intervals.

Will this course be “hard”?

I don’t think so, but I am biased. It may depend on your background. It is not intended to be a hard course, though it is also not intended to be an easy “A”. I expect everyone to learn something new, though, including myself!

What is the instructor’s background?

I have an advanced formal education in physics. In music, I played the ’cello through college and sat 3’rd, 2’nd, and 1’st in the Pomona College Symphony Orchestra, but I am now hopelessly out of practice. I have some familiarity with musical theory (I know what a Dominant VII chord is, but not what a French VI chord is). I have no real expertise in human anatomy or neurology. I have been at McGill since September 2002, and have taught this course since September 2003.