

# Chem 221

## Instrumental Analysis

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Spring 2012

MWF 12:50-1:40

B203 Angell

## January 18, 2012

### ➤ Syllabus

➤ **ALL class materials will be available *online only* at: [www.uvm.edu/~jgoldber/courses/chem221](http://www.uvm.edu/~jgoldber/courses/chem221)**

### ➤ Assignment!

Send me an email message (this week!) with the following information:

- Academic level (undergrad? Grad?)
- Major/grad program
- Previous coursework in analytical chemistry
- Conflicts with three evening exams?
- Suggestions for office hours?

# What is Analytical Chemistry?

- "Analytical chemistry is what analytical chemists DO!"
- "The study of methods for determining the composition of substances."
- Two areas:
  - 1) *Qualitative Analysis (what?)*
  - 2) *Quantitative Analysis (how much?)*

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# The Chemical System

First, we need something to study:

Chemical  
System

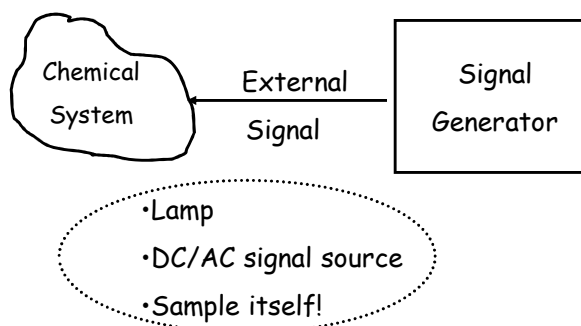
• Can be anything:

- Coal
- Blood
- Gas
- Food
- Reaction mixture

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# The Signal Generator

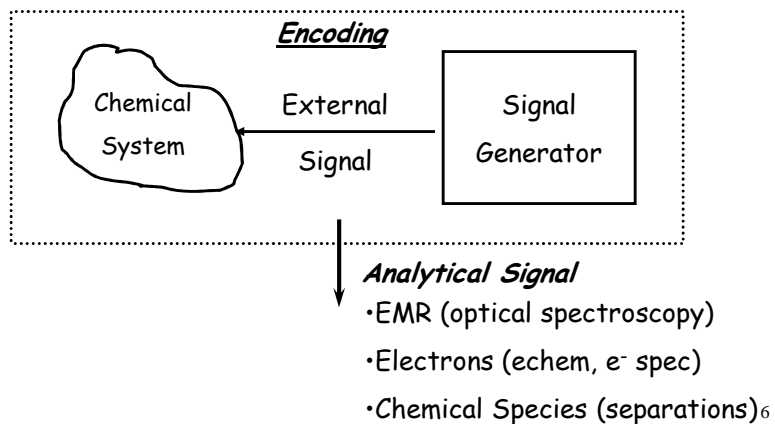
- Interacts with the *Chemical System* to produce an *Analytical Signal*:



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# The Analytical Signal

- Produced by the interaction of the *signal generator* with the *chemical system*: **ENCODING**



## Decoding the Analytical Signal

- How do we decipher the *chemical information* encoded in the *analytical signal*?
- **Four Steps:**
  1. *Disperse* the analytical signal (selectivity)
  2. *Convert* to an *electrical* signal
  3. *Process* the electrical signal
  4. *Output* the resultant signal

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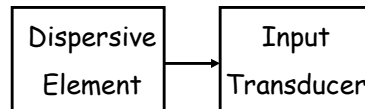
## Dispersive Element

- Enables the *selective* measurement of the analytical signal
- **Examples:**
  - ✓ *Monochromator* (optical spectroscopy)
  - ✓ *Magnetic Field* (mass spectrometry)
  - ✓ *Chromatographic Column* (separations)

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# Input Transducer

- Converts the *analytical signal* to an *electrical signal*:



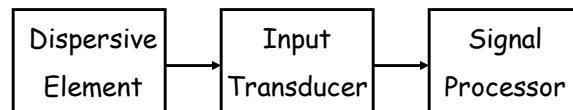
## Examples:

- **Photomultiplier tube (PMT)**  
(photons → electrons)
- **Electrode**  
(chem potential → electrical potential)

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# Signal Processor

- *Buffers* input and output transducers (*impedance matching*)



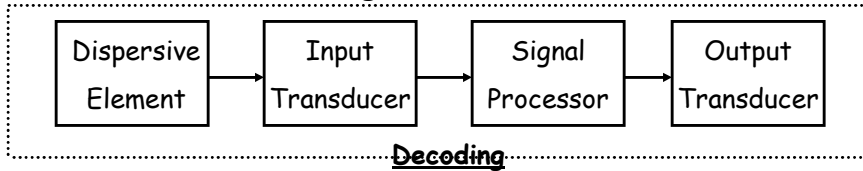
## Examples:

- Amplification
- Modulation/waveshaping
- Current-to-voltage conversion
- ADC and/or DAC
- AC-to-DC conversion
- Math (log, FT, integration)

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# Output Transducer

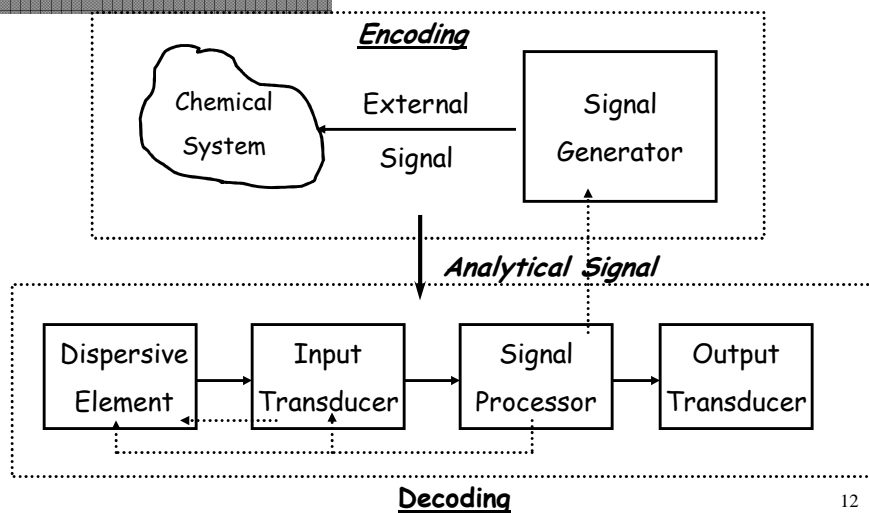
- Converts electrical signal into a "human-understandable" signal



- Most often, a computer
- Also does much of the signal processing

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# The General Instrument



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