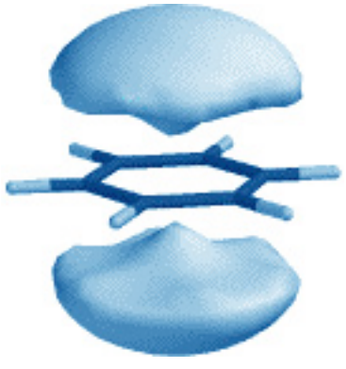
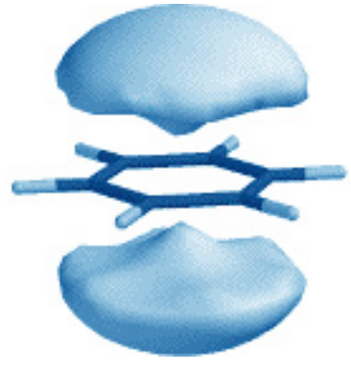


Chem 342



Organic Chemistry II

Spring 2004

cook.chem.ndsu.nodak.edu/chem342

Please pick up a syllabus near the entrance

Syllabus

- Office Hours
  - Mon, Wed - 9:00-10:00 am or give me a call
- Dunbar Hall 360A
- Phone - 231-7413
- Email - gregory.cook@ndsu.nodak.edu
- AIM/iChat - gregcook@mac.com

Grading

- 500 point scale
  - three 100 point midterm exams
  - a 200 point comprehensive final
- Quizzes
  - Six 21 point quizzes
  - Top 5 quizzes will be added for total of 105 potential points
  - If higher, this will automatically replace your lowest midterm exam score

Grading

- **A** 85-100%
- **B** 75-84%
- **C** 60-74%
- **D** 45-59%

Web Page

cook.chem.ndsu.nodak.edu/chem342

Course Outline

- NMR Spectroscopy
- Conjugated Dienes
- Aromaticity - Chemistry of Benzene
- Alcohols and Phenols
- Ethers and Epoxides
- Carbonyl Chemistry
- Amines
- Biomolecules

Course Content

- Functional group chemistry
  - General Properties
  - Reactions
- Why is this important?

My Philosphy Toward Organic Chemistry

- Like a foreign language
- Vocabulary
  - Terms
  - Structures
    - Functional Groups
- Grammar
  - Electronic properties
  - Reactivity

Tips For Learning Organic Chemistry

- Read ahead before coming to class
- COME TO CLASS
- Rewrite your notes
- Do the suggested problems - do them again
- Flash cards can help

Tips For Learning Organic Chemistry

- Study with a friend or form a study group
- A set of molecular models can help
- DON'T Fall Behind
- DON'T Fall Behind
- DON'T Fall Behind
- Organic Chemistry is an integral part of Biology and Biochemistry. Life exists because of Organic Chemistry.

Chapter 13 - NMR Spectroscopy

- Basis of NMR
- How functional groups affect NMR
- How protons affect nearby protons
- How to interpret NMR and assign structure

How to determine the structures of molecules?

- Probe physical properties
- Elemental Analysis
  - atomic composition (relative ratios)
  - empirical formula
- Mass Spectrometry
  - molecular formula
  - element identification (isotopes)
  - connectivity

How to determine the structure of molecules?

- Vibrational (Infrared) Spectroscopy
  - functional groups
- Electronic (UV-VIS) Spectroscopy
  - conjugation
- X-Ray Crystallography
  - 3D positions of atoms

NMR Spectroscopy

- Atom Connectivity
- Functional Group Identification
- Stereochemistry
- Higher Order Structure

Identification of a Natural Product

High Res. Mass Spectrometry

210.0764 4.4% $C_{11}H_{13}N_2{}^{37}Cl$

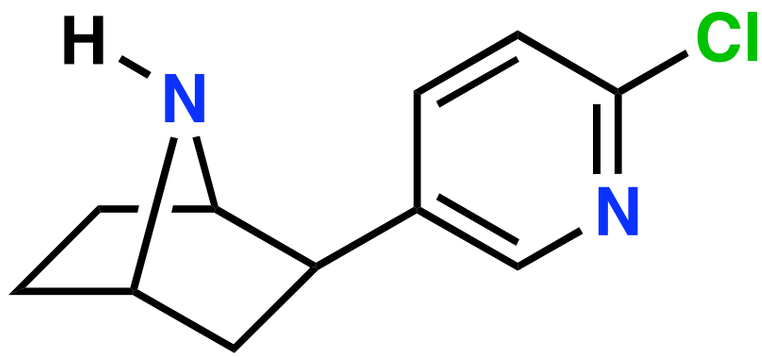
208.0769 15.5% $C_{11}H_{13}N_2{}^{35}Cl$

UV Spectroscopy

217 nm and 250-280 nm indicates pyridine ring

IR Spectroscopy

1428 and 1112 cm^{-1} suggests a pyridine ring

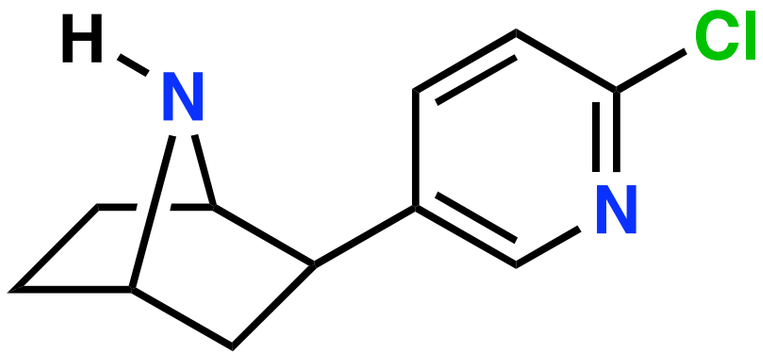


Epibatidine

J. Am. Chem. Soc. **1992**, *112*, 3475

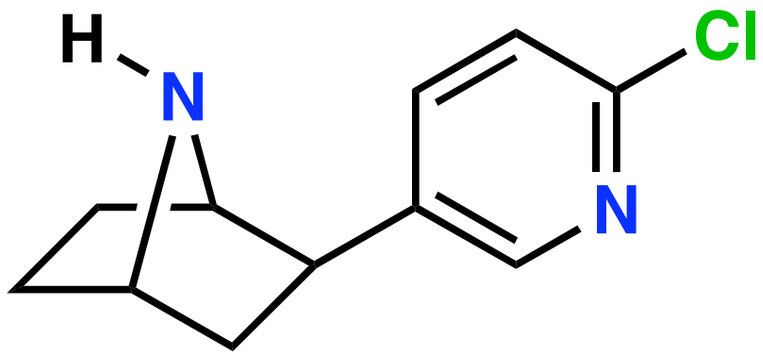
Isolated from the Ecuadorian tree frog - *Epibatis Tricolor*

Analgesic activity 500 times greater than morphine.



Epibatidine

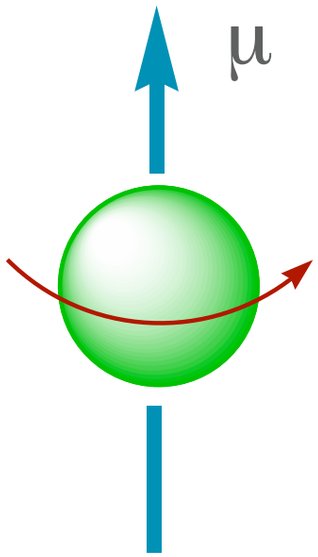
J. Am. Chem. Soc. **1992**, *112*, 3475



Epibatidine

J. Am. Chem. Soc. **1992**, *112*, 3475

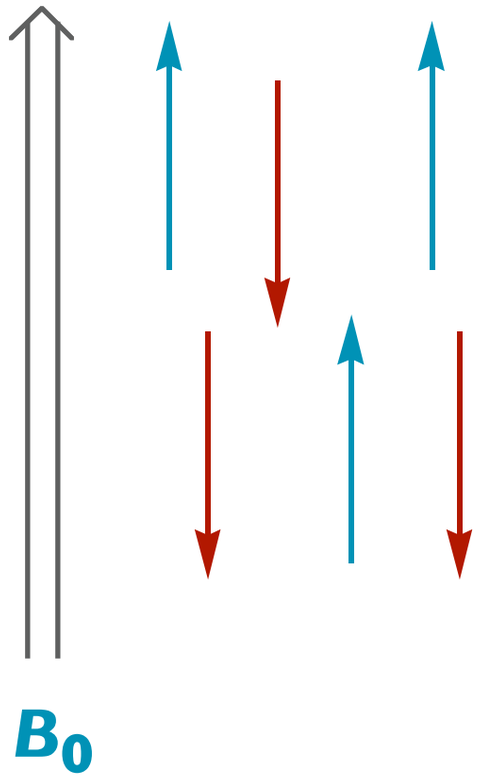
Nuclear Magnetic Resonance



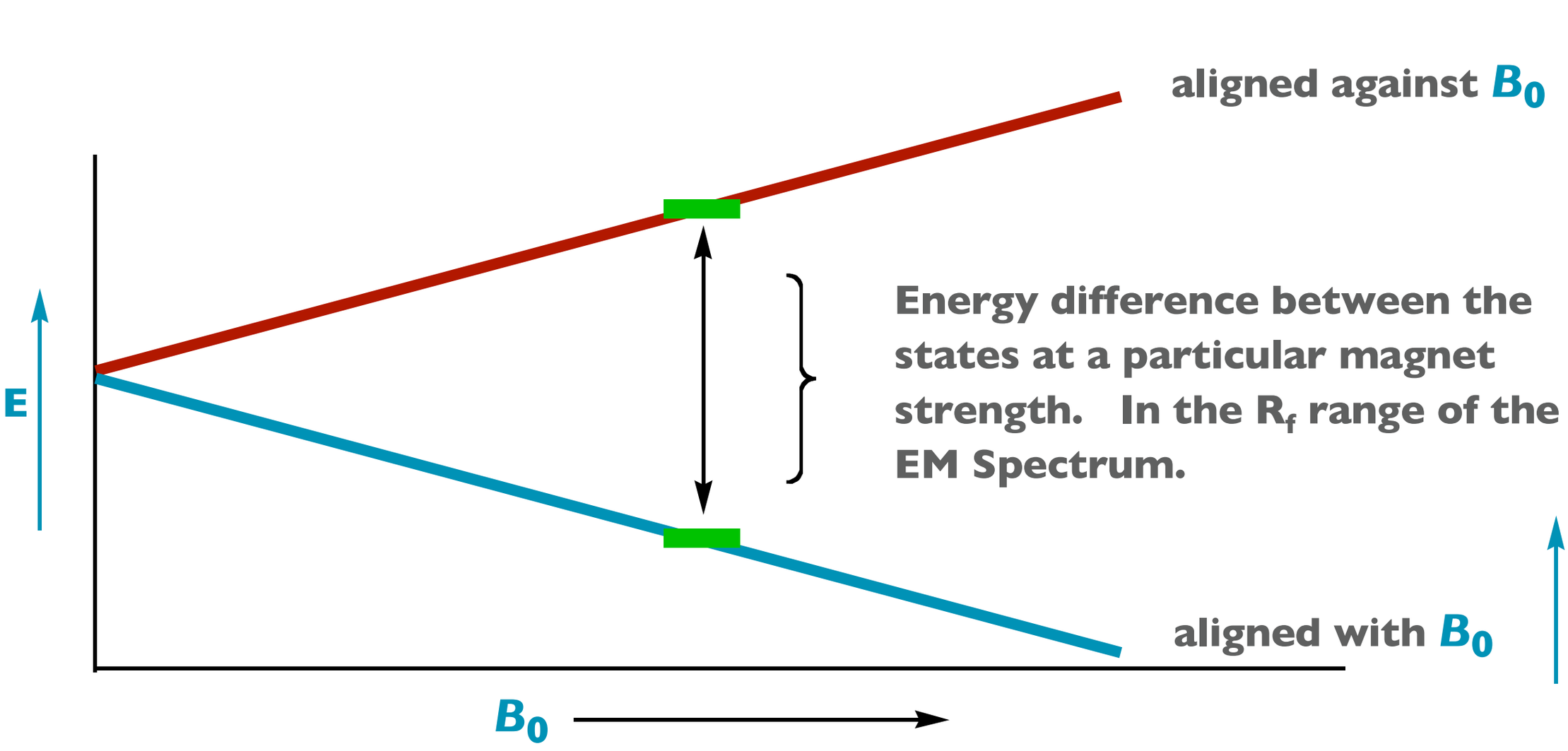
A spinning charged particle generates a magnetic field.

A nucleus with a spin angular momentum will generate a magnetic moment (μ).

If these tiny magnets are placed in an applied magnetic field (B_o), they will adopt two different states - one aligned with the field and one aligned against the field. The energy difference between these two states is what we are observing with NMR.



Nuclear Spin States



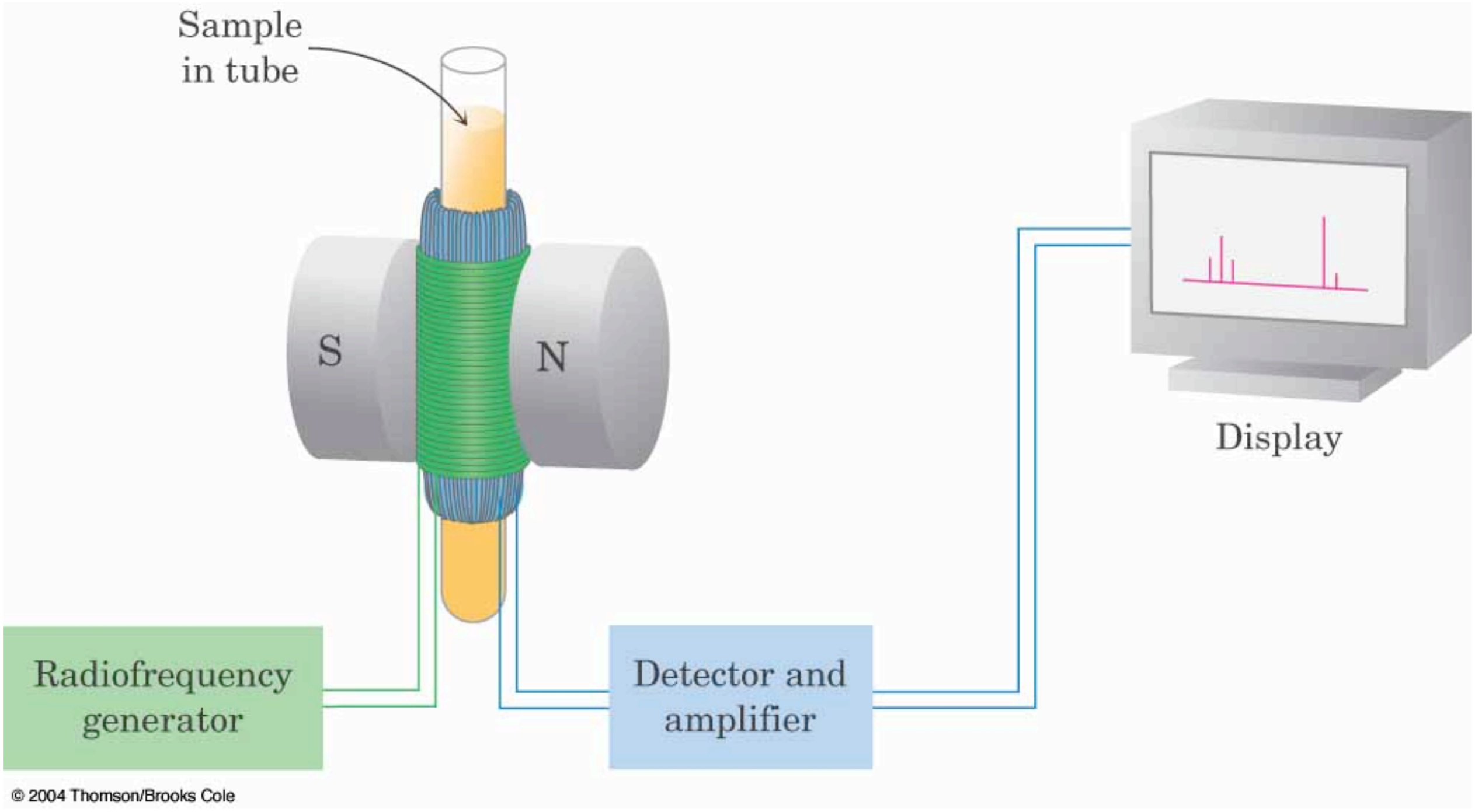
Energy difference between the states at a particular magnet strength. In the R_f range of the EM Spectrum.

When EM waves at this energy are directed at the nuclei - it will absorb. Spins will flip from lower energy to higher energy. At that energy, nuclei are "In Resonance".

NMR Active Nuclei

- Many nuclei are "NMR Active"
  - Spin Quantum Number $I \neq 0$
  - ^{1}H -- $I = ½$; ^{13}C -- $I = ½$
  - ^{12}C, ^{16}O -- $I = 0$ -- Can't be observed
- Other nuclei that are NMR active
  - ^{2}H (D), ^{14}N, ^{19}F, ^{31}P

NMR Instrumentation



NMR is the basis for MRI