

## IRON DEFICIENCY ANEMIA/ ANEMIA OF CHRONIC DISEASE

### ANEMIA

*Causes - Decreased Production*

- Cytoplasmic production of protein
  - Usually normocytic (MCV 80-100 fl) or microcytic (MCV < 80 fl)
- Nuclear division/maturation
  - Usually macrocytic (MCV > 100 fl)

### ANEMIA *Definition*

- Decrease in the number of circulating red blood cells
- Most common hematologic disorder by far

### ANEMIA

*Causes - Cytoplasmic Protein Production*

- Decreased hemoglobin synthesis
  - Disorders of globin synthesis
  - Disorders of heme synthesis
- Heme synthesis
  - Decreased Iron
  - Iron not in utilizable form
  - Decreased heme synthesis

### ANEMIA

*Causes*

- Blood loss
- Decreased production of red blood cells (Marrow failure)
- Increased destruction of red blood cells
  - Hemolysis
- Distinguished by reticulocyte count
  - Decreased in states of decreased production
  - Increased in destruction of red blood cells

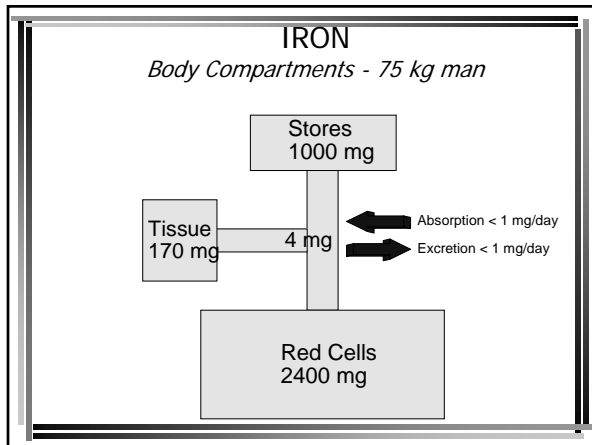
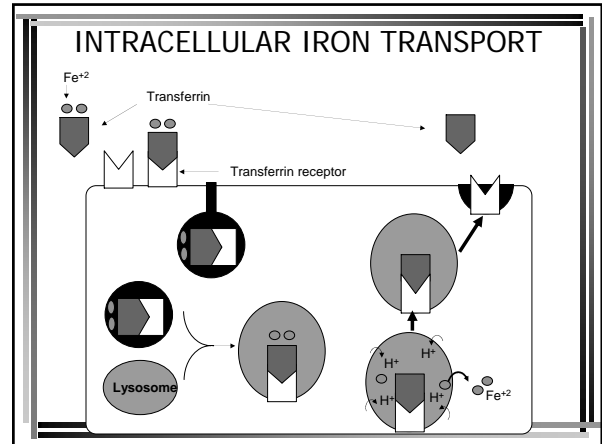
### IRON DEFICIENCY ANEMIA

*Prevalence*

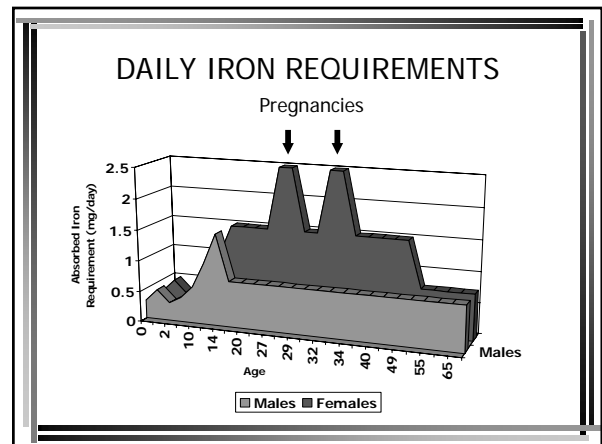
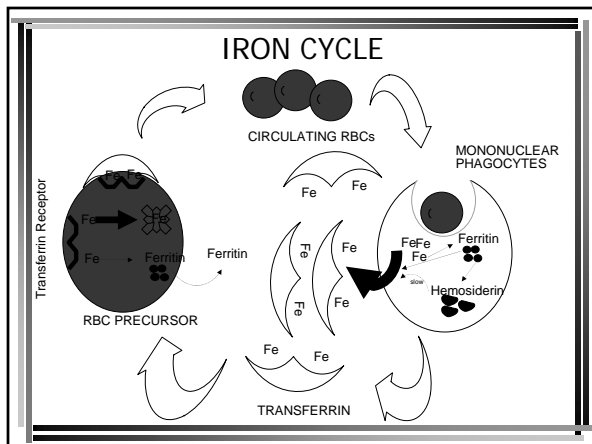
Country	Men (%)	Women (%)	Pregnant Women (%)
S. India	6	35	56
N. India		64	80
Latin America	4	17	38
Israel	14	29	47
Poland			22
Sweden		7	
USA	1	13	

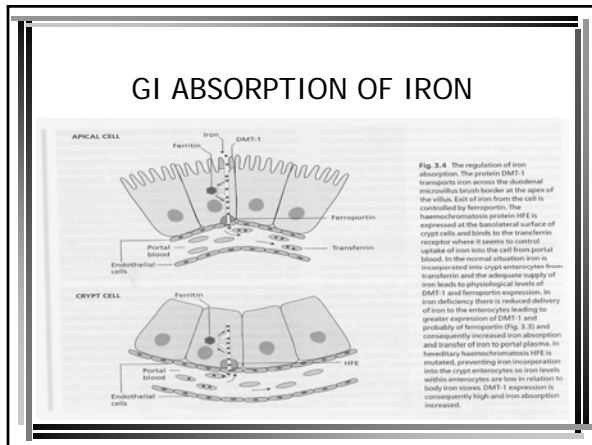
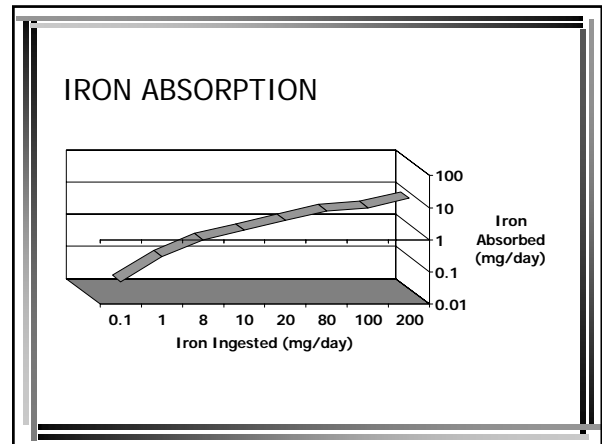
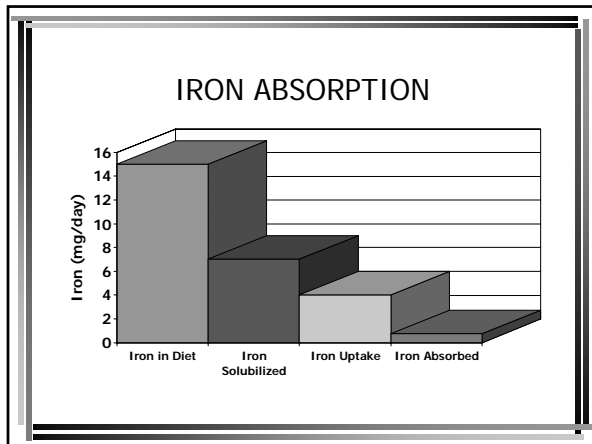
### IRON

- Functions as electron transporter; vital for life
- Must be in ferrous ( $Fe^{+2}$ ) state for activity
- In anaerobic conditions, easy to maintain ferrous state
- Iron readily donates electrons to oxygen,  $\rightarrow$  superoxide radicals,  $H_2O_2$ ,  $OH\cdot$  radicals
- Ferric ( $Fe^{+3}$ ) ions cannot transport electrons or  $O_2$
- Organisms able to limit exposure to iron had major survival advantage

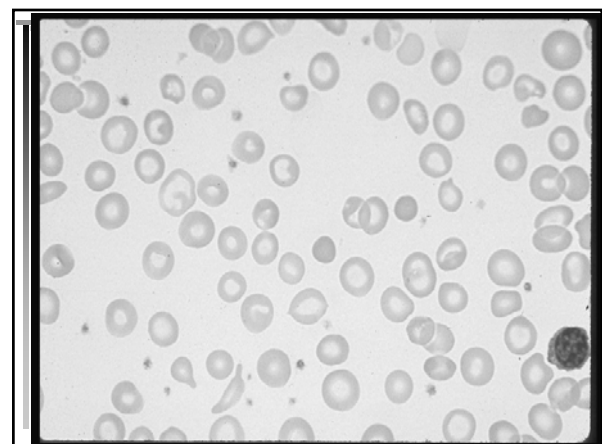
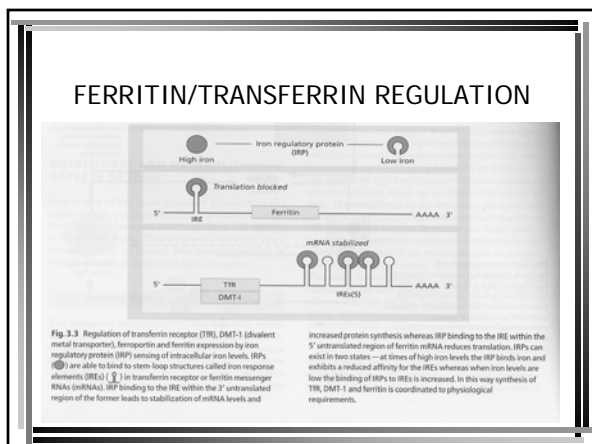


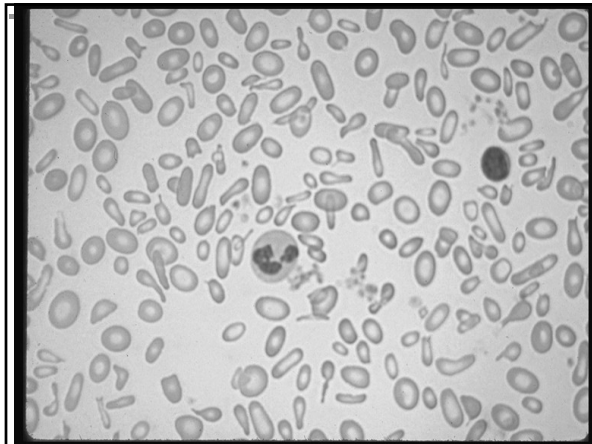
- ### IRON
- Causes of Iron Deficiency*
- Blood Loss
    - Gastrointestinal Tract
    - Menstrual Blood Loss
    - Urinary Blood Loss (Rare)
    - Blood in Sputum (Rarer)
  - Increased Iron Utilization
    - Pregnancy
    - Infancy
    - Adolescence
    - Polycythemia Vera
  - Malabsorption
    - Tropical Sprue
    - Gastrectomy
    - Chronic atrophic gastritis
  - Dietary inadequacy (almost never sole cause)
  - Combinations of above





- ### IRON DEFICIENCY ANEMIA
- Progression of Findings*
- Stainable Iron, Bone Marrow Aspirate
  - Serum Ferritin - Low in Iron Deficiency
  - Desaturation of transferrin
  - Serum Iron drops
  - Transferrin (Iron Binding Capacity) Increases
  - Blood Smear - Microcytic, Hypochromic; Aniso- & Poikilocytosis
  - Anemia

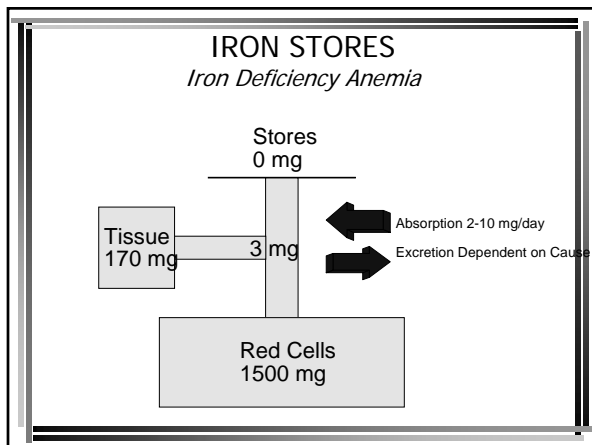




### IRON

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### IRON REPLACEMENT THERAPY

Response

- Usually oral; usually 300-900 mg/day
- Requires acid environment for absorption
- Poorly absorbed

### IRON DEFICIENCY

*Symptoms*

- Fatigue - Sometimes out of proportion to anemia
- Atrophic glossitis
- Pica
- Koilonychia (Nail spooning)
- Esophageal Web

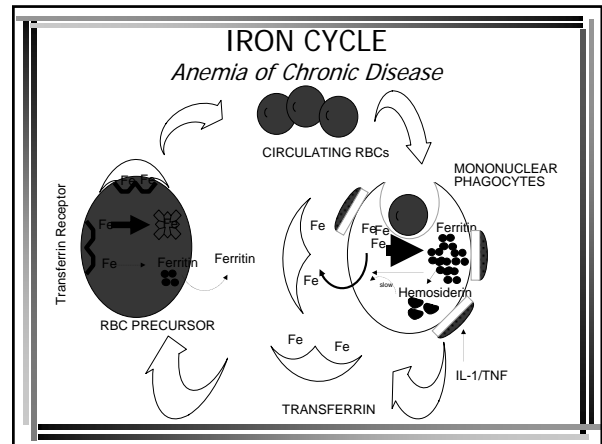
### IRON THERAPY

Response

- Initial response takes 7-14 days
- Modest reticulocytosis (7-10%)
- Correction of anemia requires 2-3 months
- 6 months of therapy beyond correction of anemia needed to replete stores, assuming no further loss of blood/iron
- Parenteral iron possible, but problematic

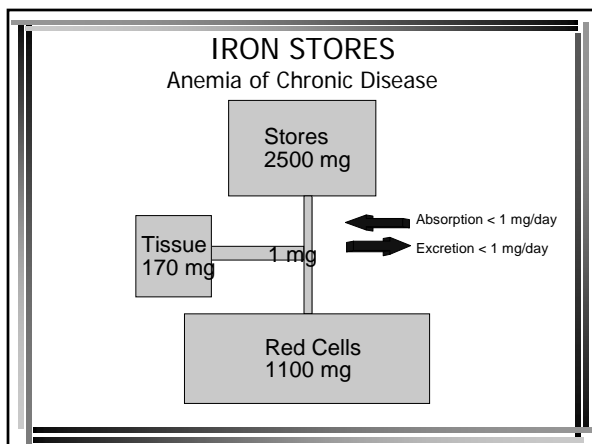
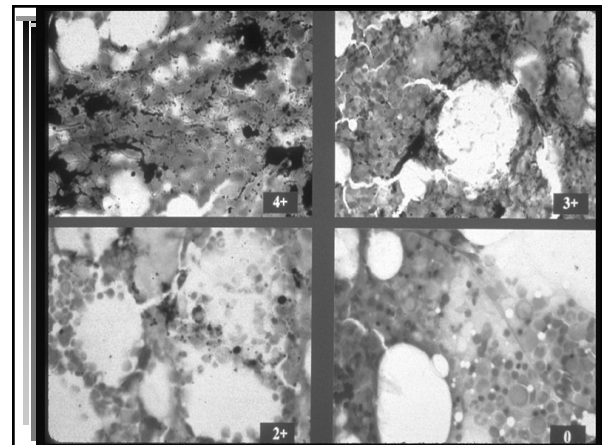
**ANEMIA OF CHRONIC DISEASE**  
*Findings*

- Mild, non-progressive anemia (Hgb c. 10, Hct c. 30%)
- Other counts normal
- Normochromic/normocytic (30% hypochromic/microcytic)
- Mild aniso- & poikilocytosis
- Somewhat shortened RBC survival
- Normal reticulocyte count (Inappropriately low for degree of anemia)
- Normal bilirubin
- EPO levels increased but blunted for degree of anemia



**ANEMIA OF CHRONIC DISEASE**  
*Causes*

- Thyroid disease
- Collagen Vascular Disease
  - Rheumatoid Arthritis
  - Systemic Lupus Erythematosus
  - Polymyositis
  - Polyarteritis Nodosa
- Inflammatory Bowel Disease
  - Ulcerative Colitis
  - Crohn's Disease
- Malignancy
- Chronic Infectious Diseases
  - Osteomyelitis
  - Tuberculosis
- Familial Mediterranean Fever



**IRON DEFICIENCY *versus* ACD**

	Serum Iron	Transferrin	Ferritin
Iron Deficiency	↓	↑	↓
ACD	↓	↓	↑

**SUMMARY**

*Iron-Related Anemias*

- Most common anemia
- Symptom of pathologic process
- Primary manifestation is hematologic
- Treatment requires:
  - Replacement therapy
  - Correction of underlying cause (if possible)