

# OSTEOPOROSIS

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# Definition of Osteoporosis

- A systemic skeletal disease
- characterized by **low bone mass**
- microarchitectural deterioration of bone tissue
- with a consequent increase in bone fragility and susceptibility to **fracture**



# **OSTEOPOROSIS**

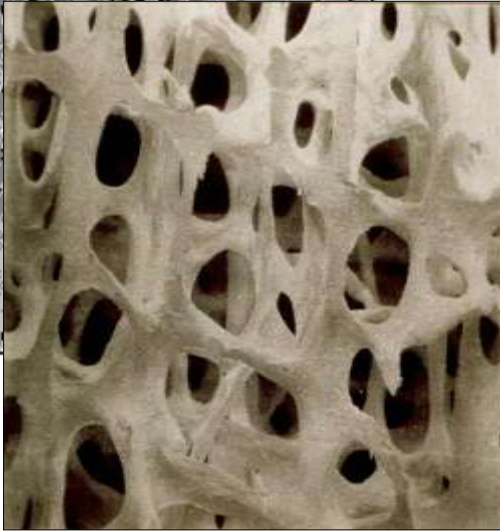
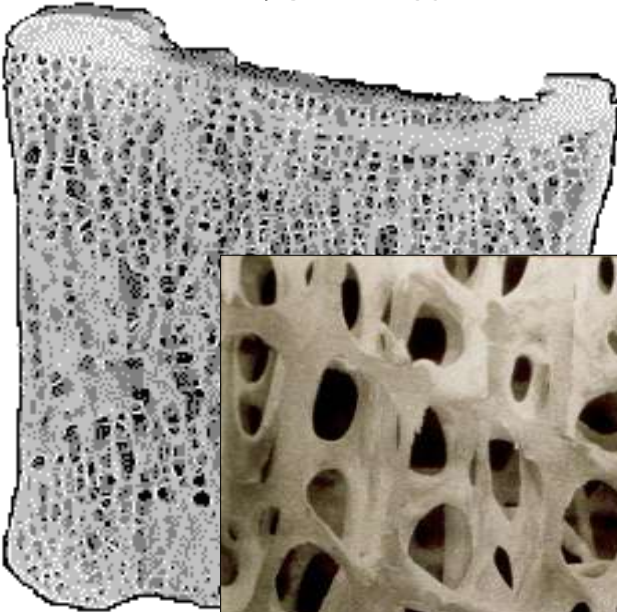
**“Osteo” is Latin word for  
“bone”**

**“Porosis” means “porous or full  
of holes”**

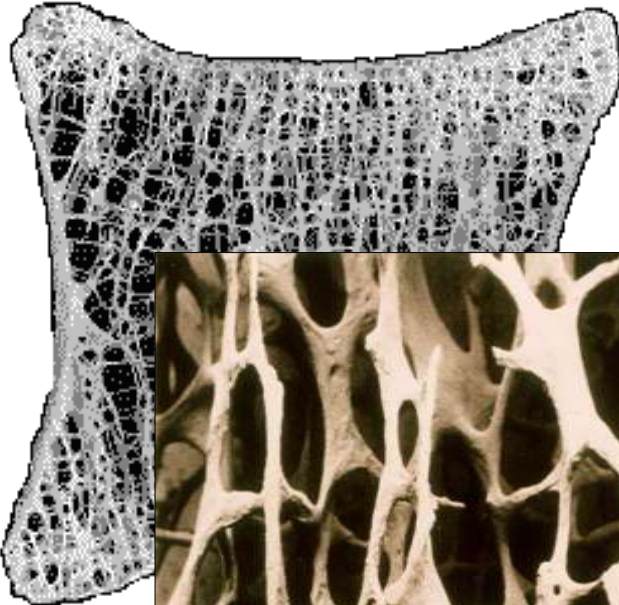
**“Osteoporosis” means “bones  
that are full of holes”**

# Vertebral Body

**Normal**



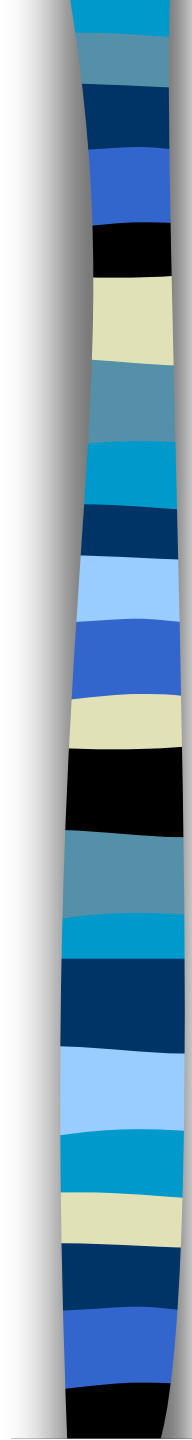
**Osteoporotic**





# Why Does it Matter?

- 44 million people in U.S. with low bone mass
- 80% are women
- 1 in 2 women & 1 in 8 men over 50 years old suffer from osteoporosis
- 2 million osteoporotic fractures per year
- \$17 billion spent per year on osteoporotic fractures and their complications
- 20% increased mortality over 5 years following a vertebral fracture
- 10-30% increased mortality over one year following a hip fracture

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- 50% require nursing home care after hip fracture
  - 30% need assistance with daily activities
  - Only 20% return to previous level of functioning



# Types of bone :

- 1) **Cortical** : is hard, compact, dense bone (example: mid-section of larger, long-bones of arms and legs)
- 2) **Trabecular** : is spongy, porous and flexible bone (example: end of the wrist, hip and the spine)



# Bone Metabolism

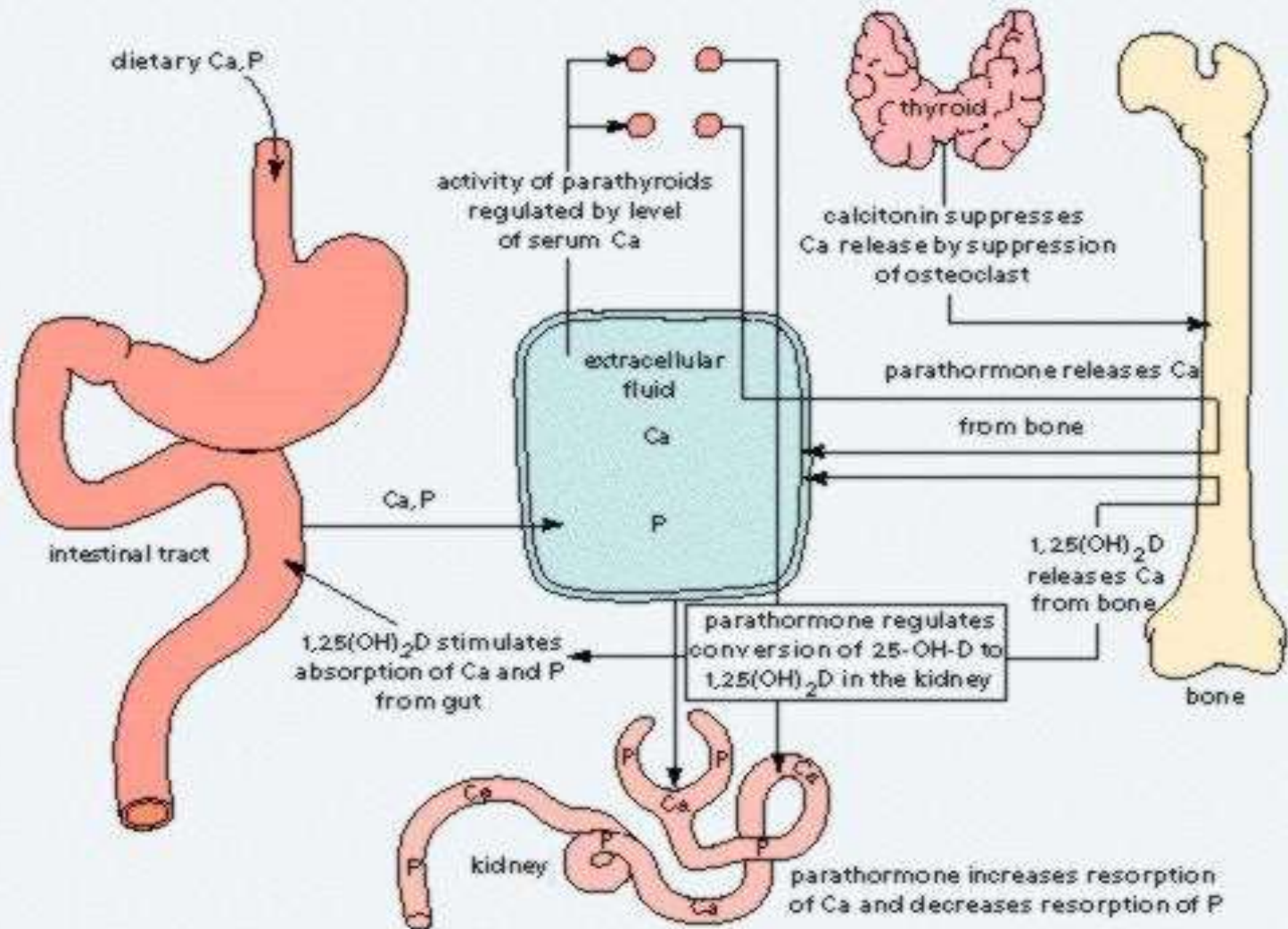
Local factors : Growth factors

**3 Systemic hormones:** - Parathormone  
- Vitamin D  
- Calcitonin

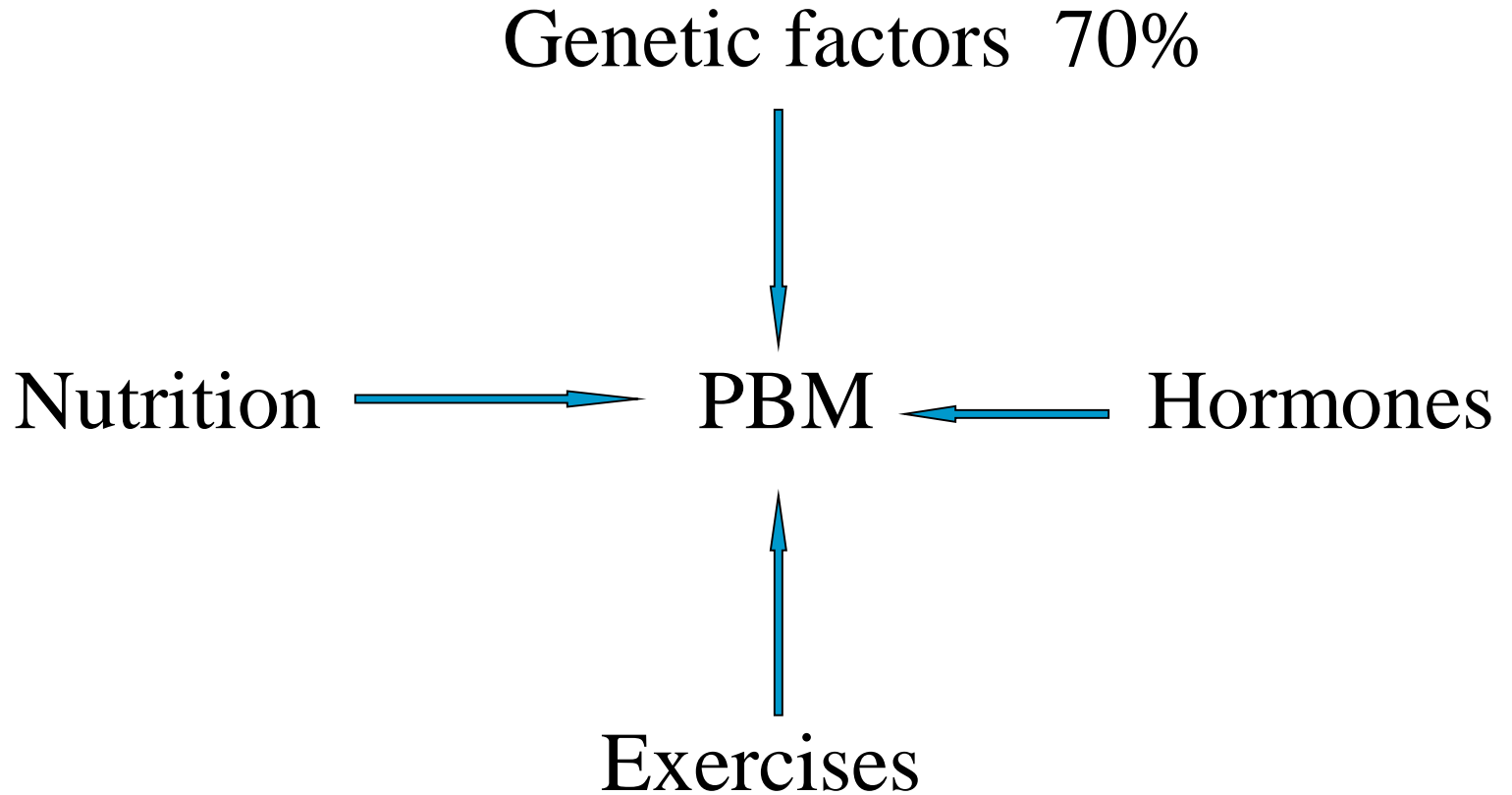
**3 Involved systems:** - Bone  
- Intestines  
- Renal

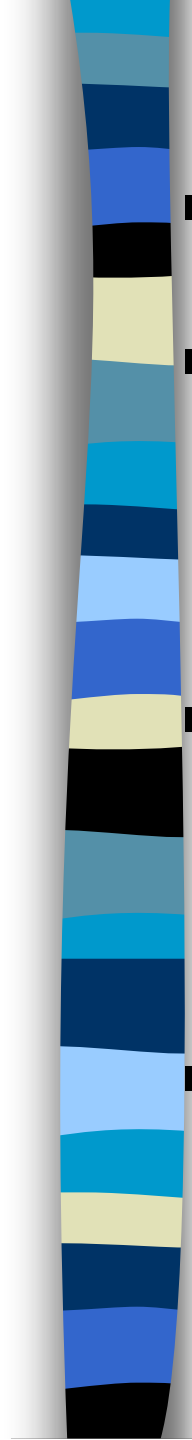


# Bone Metabolism

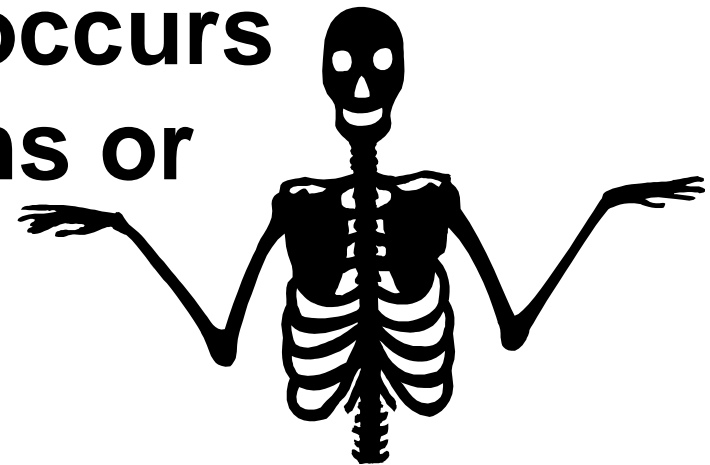


# Peak Bone Mass



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- **we build bone until about age 30**
  - **From birth through adolescence, new bone is built faster than old bone is removed**
  - **In mid-life, depending on lifestyle and other factors, bone removal can achieve a balance with bone formation**
  - **After menopause, bone removal may accelerate**

- **During The first 5-15 years after menopause a woman can lose approximately 25 - 30 % of trabecular bone & approximately 10 – 15 % of cortical bone**
- **Bone loss often occurs without symptoms or warning signs**



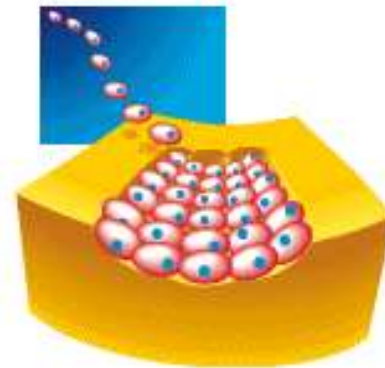
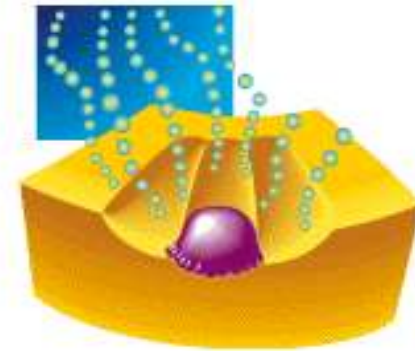
# Healthy bone



- **Bone is living tissue, which is constantly being broken down and rebuilt, a process called remodeling**
- **Bone is renewed like skin, hair and nails**

# BONE “REMODELING”

- **Resorption-**  
removes old  
bone
- **Formation-**  
replaces old  
bone with new  
bone



# OSTEOCLASTS-PHASE 1



- **Cells called osteoclasts seek out old bone or damaged bone tissue and destroy it, leaving small spaces (resorption)**

# OSTEOBLASTS – PHASE 2



- Cells called osteoblasts use minerals like calcium, phosphorus, and vitamin D to fill in the spaces with new bone (formation)





## **::WHAT CAUSES OSTEOPOROSIS ?**

- Osteoclasts and osteoblasts are activated by parathyroid hormone (PTH) which signals osteoclasts to pull calcium *from* the bones.
- Calcitonin is the hormone that stimulates osteoblasts to deposit calcium *into* the bones.
- The problem begins when the delicate balance between PTH and Calcitonin is disrupted.



# ::WHO IS AT RISK ??::

Risk factors you cannot change include :

- Gender. Women get osteoporosis more often than men.
- Age. The older you are, the greater your risk of osteoporosis.
- Body size. Small, thin women are at greater risk.
- Ethnicity. White and Asian women are at highest risk. Black women have a lower risk.
- Family history. Osteoporosis tends to run in families. If a family member has osteoporosis or osteoporotic fracture, there is a greater chance that you will too.



Other risk factors are:

- Sex hormones. Low estrogen levels due to missing menstrual periods or to menopause can cause osteoporosis in women. Low testosterone levels can bring on osteoporosis in men.
- Calcium and vitamin D intake. A diet low in calcium and vitamin D makes you more prone to bone loss.
- Medication use. Some medicines increase the risk of osteoporosis.
- Too Much acidity in Food. As the blood must be a neutral pH, your body pulls calcium from the bones to neutralize the acidity. This is often the major factor in the development of osteoporosis

# Classification

## I. Primary OP

- 1- Postmenopausal
- 2- Senile

## II. Secondary OP

Type I  
Postmenopausal  
osteoporosis

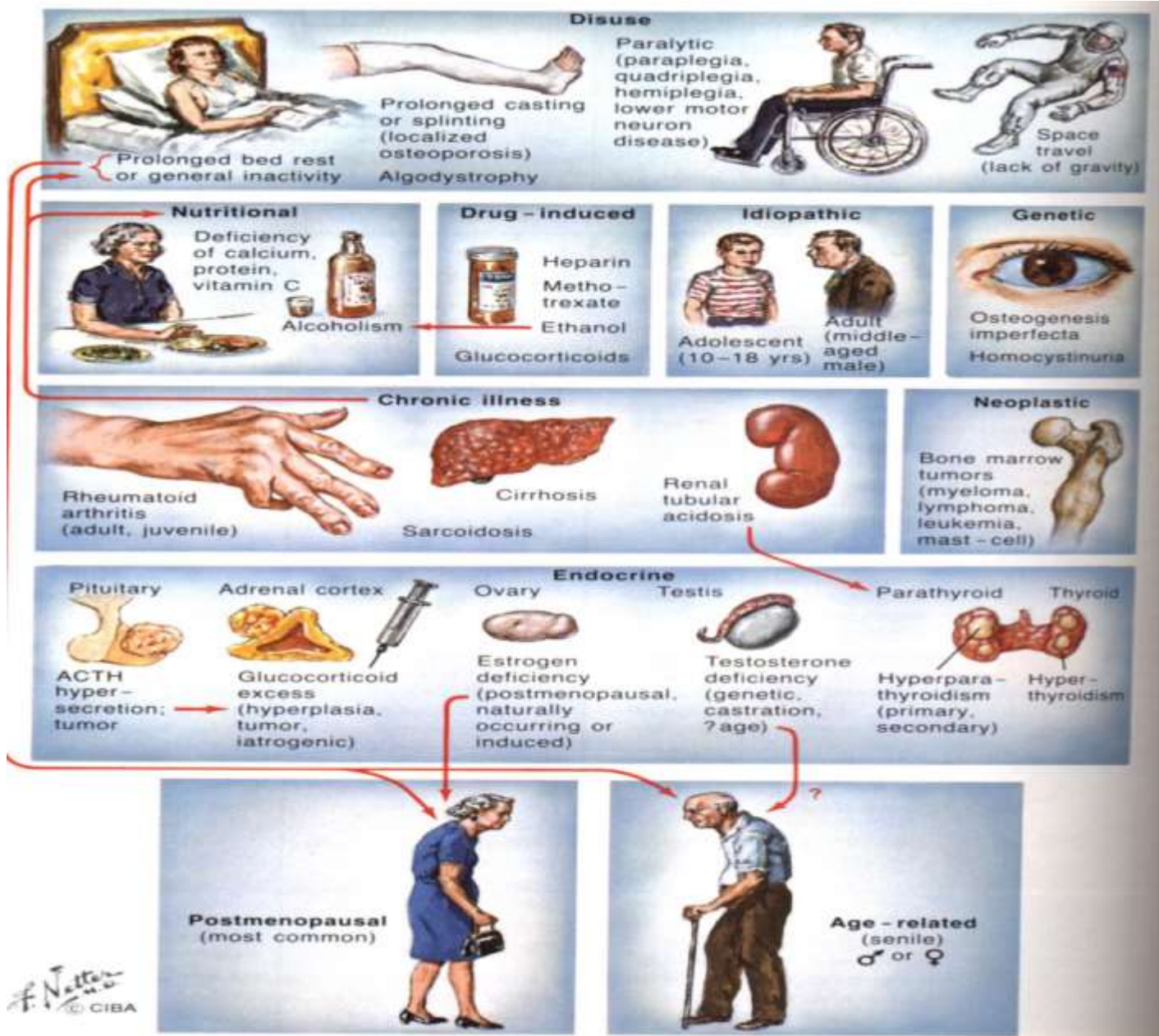


Age-related (type II)  
osteoporosis  
♂ or ♀



*F. Netter M.D.*  
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# Sec. OP





## ::SYMPTOMS::

Osteoporosis is called the  
"silent disease"

Because bone is lost with no signs. You may not know that you have osteoporosis until a strain, bump, or fall causes a fracture.



# Major Osteoporotic Fractures

Type	Colles	Vertebral	Hip
Typical age	55	65	75
Female : male ratio	4:1	3:1	2:1

# Clinical Results of Osteoporotic Fractures

- Pain
- Reduction in physical activity
- Deformity
- Muscle weakness
- Social isolation
- Loss of independence
- Increased mortality





# Evaluation of Osteoporosis

- Identify risk factors for OP
- Identify contributing factors  
Medical history: Secondary OP
- Physical examination
- DXA
- X-ray
- Laboratory Evaluation





# Diagnosis of Osteoporosis

- Osteodensitometry **DXA**

DXA = Dual X- ray Absorptiometry

Bone Mineral Density BMD

# Osteodensitometry is the most important method for diagnosis

- Fracture risk may be assessed
- Low BMD is associated with increased fracture risk



Şekil 5.9 Dual-enerji X-ışın absorpsiyometri cihazı (DEXA; Lunar DPX-IQ). Lunar, Madison, WI'nin izniyle.



# Indications for Bone Densitometry

- Female patients > **65** years
- Male patients > 70 years
- Young adults with osteoporosis risk factors
- Vertebral abnormalities and/or osteopenia on x-rays
- Long – term glucocorticoid therapy
- Primary hyperparathyroidism or other diseases with high risk of OP
- Patients being treated for OP, to monitor changes in bone mass



# Diagnosis Based on BMD (WHO)

**BMD**

**T-score**

Normal

0 - (-1)SD

Osteopenia

(-1) - (-2.5)SD

Osteoporosis

<(-2.5)SD

Established OP

“

+ fracture



# Recommendations Based on BMD

<b>BMD</b>	<b>Risk of Fx</b>	<b>Action</b>
Normal	Very low	Prevention
Osteopenia	Low	Prevention
OP	High < $(-2.5)SD$	Treatment
Establ OP	Very high	Treatment



# less commonly used

- Quantitative CT
- Quantitative US

# Laboratory Tests

## - Routine Biochemistry

Serum calcium

Phosphorus

Alkaline phosphatase

Creatinine

Total protein, albumin, and globulin

## 25(OH)Vitamin D

- Complete blood count

- Sedimentation rate







## ■ **markers of bone resorption**

- Hydroxyproline
- Free and total pyridinoline
- Free and total deoxypyridinoline

## ■ **Markers of bone formation**

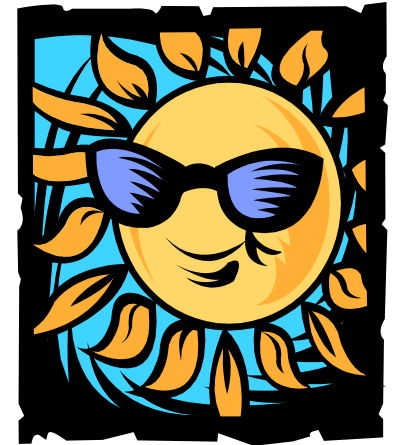
- Bone specific alkaline phosphatase
- osteocalcin

# Prevention and management

Osteoporosis is a...  
Preventable disease

## ■ Recommendations

1. Nutrition
2. Activity
3. Vitamin D



# PREVENTION



1. Enough **calcium intake** daily; 800-1000 mg, also other important nutrients; proteins, zinc, vitamin D for healthy and strong bone

**Vitamin D** is important in absorption of Ca from food and incorporate it into bones

2. **Bone examination** assess risk of loss of bone mass

3. **Exercises** but not excessive!!! (3-4 times a week)

Exercise alters hormonal balances, favoring the hormones that protects bone

So, **walk rather than ride,**

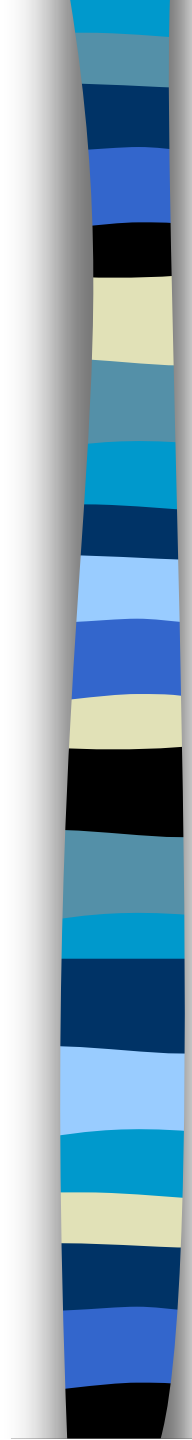
**climb the stairs rather than using lift,**

**stand rather than sit when appropriate**

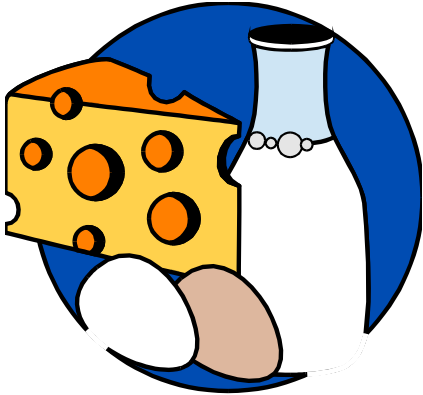


## 4. Importance of good posture

- **Proper way to sit** - Support your lower back with a pillow or by a straight high-backed chair. When driving or reading, **avoid bending the neck forward**. When rising from a chair, do it slowly.
- **Proper way to walk and stand** - Keep your head high, look forward with the chin in. Pull your shoulders back, pull your stomach in to maintain the natural arch of the lower back, Wear **low-heeled shoes with rubber soles**
- **Proper way to lift** - You must **bend your knees** when lifting heavy objects to avoid backstrain and further compression fractures. **Use your Leg muscles rather than your back!**

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5. Avoid taking too much coffee, tea or chocolate, because they help in loss of Ca.
  6. Alcohol destroys cells forming bone.
  7. Smoking reduces estrogen
    - It is important to remember that we cannot avoid hormonal and genetic factor thus, we control the environment and diet factor, so that we can overcome the osteoporosis problem.

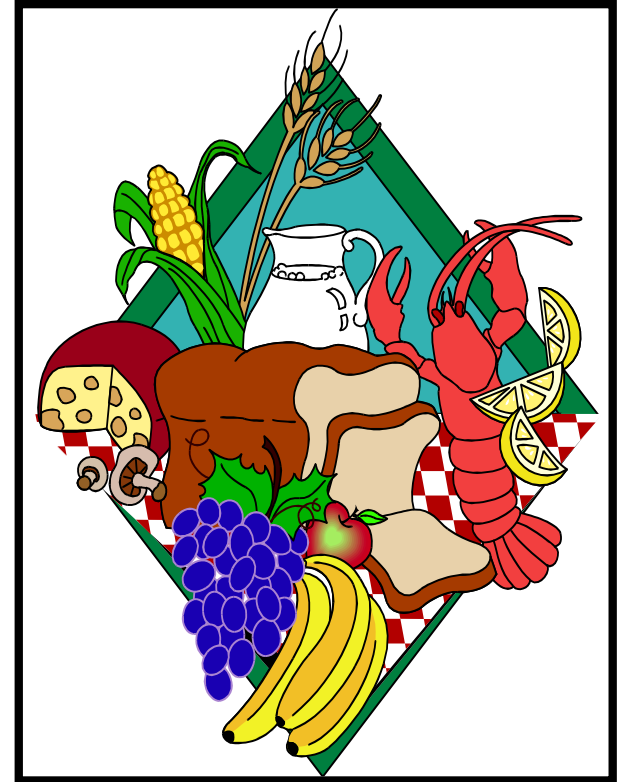
# DAILY CALCIUM REQUIREMENTS

<u>Age</u>		<u>Milligrams (mg)</u>
1-3 years		500
4-8 years		800
9-18 years		1,300
19-50 years		1,000
over 50 years		1,200- 1,500

National Academy of Science

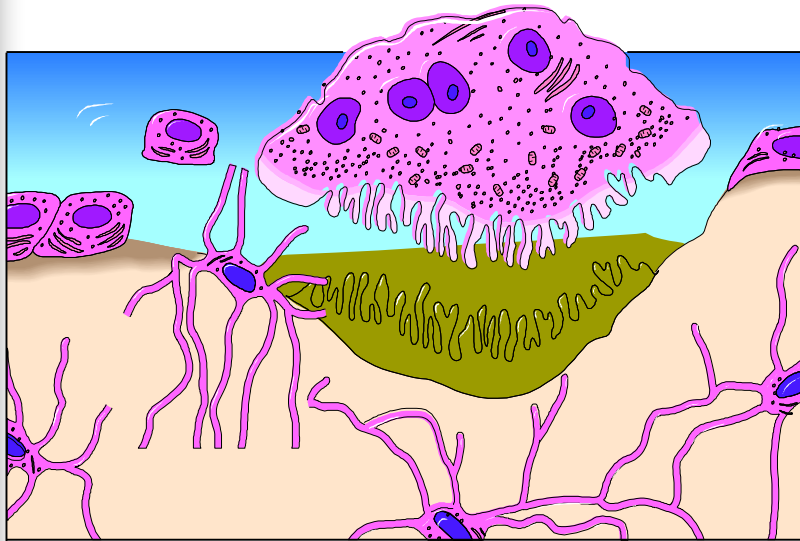
# CALCIUM IN FOODS

<b>1 oz cream cheese:</b>	<b>20 mg</b>
<b>1 hard boiled egg:</b>	<b>30 mg</b>
<b>½ cup cooked broccoli:</b>	<b>40 mg</b>
<b>½ cup cottage cheese:</b>	<b>80 mg</b>
<b>1 oz cheddar cheese:</b>	<b>205 mg</b>
<b>6 oz calcium-fortified OJ:</b>	<b>250 mg</b>
<b>1 cup milk:</b>	<b>300 mg</b>
<b>1 cup fruit yogurt:</b>	<b>345 mg</b>
<b>3 oz sardines with bones:</b>	<b>370 mg</b>
<b>8 oz vegetable lasagna:</b>	<b>450 mg</b>



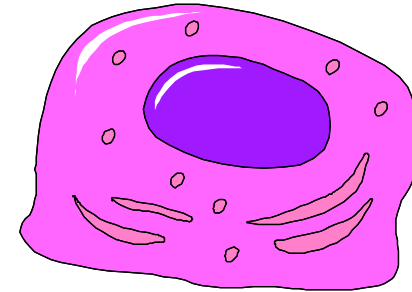
# Therapeutic Agents Used in Osteoporosis

**Osteoclast**



**Inhibition of Resorption**

**Osteoblast**



**Stimulation of Formation**





# Inhibitors of Bone Resorption

- Calcium
- SERMs
- Bisphosphonates
  - Alendronate
  - Zoledronate
  - Risedronate
  - Ibandronate
- Calcitonin



# Stimulators of Bone Formation

- **Parathyroid hormone injections**



# Dual Action

- Strontium ranelate
- Vitamin D and active derivatives
- Anabolic steroids

# Strategies for Reducing Falls and Fractures

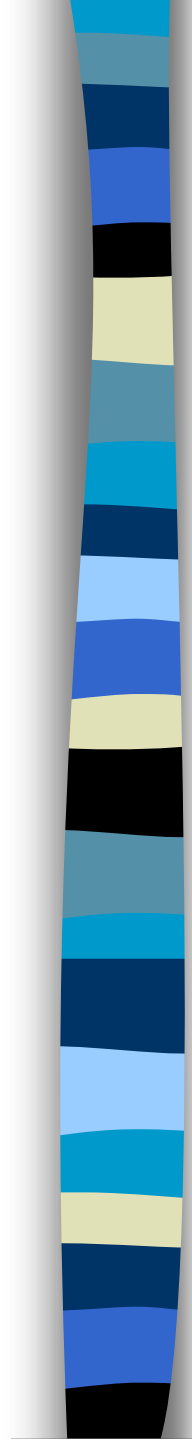
- Maintain physical activity
- Provide a safe home environment
- Balance training
- Ambulatory support when appropriate
- Avoid sedative medications
- Minimize other contributing medical problems
- Hip pads in the frail elderly





# Conclusion

- Osteoporosis is a common but underestimated disease
- It is a silent disease
- Fracture may be the first presentation
- We should suspect osteoporosis if the patient has fragility fracture e.g spine, hip, and wrist

- 
- DXA is the most reliable method of diagnosis
  - Prevention is the most important line of management through
    - Good nutrition
    - Exercises
    - Vitamin D

# Thank you

