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## Musculoskeletal: Bone & Growth

**Printable Flashcards — Pre-Med Biology**

Bone structure, osteoblasts, osteoclasts, growth plates, bone marrow, and calcium homeostasis.

146 cards — Print double-sided, flip on long edge, then cut along dashed lines.

146 cards — Printable Flashcards

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1

Bone isn't just 'dead hard stuff'. Name 2 big jobs it does.

2

Compact bone vs spongy bone: which is dense outer layer?

3

Compact vs spongy: which one has trabeculae (a lattice)?

4

Where do you usually find spongy bone in a long bone?

5

Where do you usually find compact bone in a long bone?

6

Epiphysis vs diaphysis: which is the shaft?

7

Epiphysis vs diaphysis: which are the ends?

8

Periosteum is...



2

Compact bone.

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1

Support/movement and mineral storage  
(plus making blood cells in marrow).

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4

Mostly at the ends (epiphyses).

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3

Spongy bone (cancellous bone).

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6

Diaphysis.

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5

Mostly in the shaft (diaphysis)  
and the outer shell everywhere.

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8

A tough membrane covering the  
outside of bone (except at joints).

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7

Epiphyses.

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9

Articular cartilage covers...

10

Bone matrix is made of... (big 2 ingredients)

11

If bone has weak mineralization (too little calcium/phosphate), it becomes...

12

If bone has weak collagen (scaffold problem), it becomes...

13

Bone marrow is found in...

14

Red marrow vs yellow marrow:  
which one makes blood cells?

15

Yellow marrow is mainly...

16

Kids vs adults: who has more red marrow overall?



10

Collagen fibers + mineral (calcium phosphate).

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9

The ends of bones in joints (to reduce friction).

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12

More fragile/brittle (breaks more easily).

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11

Softer and bends more easily  
(osteomalacia/rickets idea).

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14

Red marrow.

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13

The spaces inside bones (especially  
spongy bone and the marrow cavity).

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16

Kids.

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15

Fat storage (and can convert  
back to red in emergencies).

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17

In adults, red marrow is mainly found in... (name a few areas)

18

Hematopoiesis means...

19

Bone marrow makes platelets via... (simple)

20

Trap check: bone marrow makes blood cells. The spinal cord makes...

21

Why does bone marrow matter for immunity?

22

Osteoblasts do what?

23

Osteoclasts do what?

24

Osteocytes are basically...



18

Making blood cells (RBCs, WBCs, platelets).

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17

Flat bones like pelvis, sternum, ribs, vertebrae  
(and proximal ends of some long bones).

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20

Nerve signals (not blood cells).

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19

Large marrow cells called  
megakaryocytes that shed platelets.

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22

Build bone.

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21

Because many immune cells  
(white blood cells) are made there.

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24

Mature bone cells that maintain bone tissue.

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23

Break down bone (resorb).

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25

If you see 'bone resorption', think...

26

If you see 'bone deposition/formation', think...

27

Trap: osteoblasts and osteoclasts are the same job at different times. True or false?

28

Bone remodeling is basically...

29

Why remodel bone if you're not growing? Name 2 reasons.

30

Wolff's law (simple):

31

If someone is immobilized for a long time, bone density tends to...

32

Weight-bearing exercise tends to...



26

Osteoblast activity.

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25

Osteoclast activity.

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28

Constant breaking and rebuilding of bone to keep it strong and control minerals.

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27

False.

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30

Bone adapts to the loads placed on it.

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29

Repair microcracks and keep blood calcium stable.

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32

Increase bone strength/density over time.

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31

Decrease.

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33

Bone grows in length mainly at the...

34

Epiphyseal plate is made of... bone or cartilage?

35

Bone grows in thickness (width) mainly by...

36

When do you stop getting taller?

37

What hormone group is famous for triggering growth plate closure at puberty?

38

Gigantism vs acromegaly: what's the key difference?

39

Gigantism happens when growth hormone is too high...

40

Acromegaly happens when growth hormone is too high...



34

Cartilage (before it ossifies).

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33

Epiphyseal (growth) plates.

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36

When growth plates close (epiphyseal fusion).

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35

Appositional growth (new bone added on the outside).

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38

Timing: before vs after growth plate closure.

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37

Sex hormones (especially estrogen).

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40

After epiphyseal plates close (in adults).

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39

Before epiphyseal plates close (in childhood).

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41

Bone development in embryos: long bones mostly form by... (high-level)

42

Flat bones (like skull) mostly form by... (high-level)

43

Growth hormone (GH) is made by the...

44

GH mainly increases growth by telling the liver/body to make...

45

GH helps you grow taller mainly by acting on...

46

In childhood, too little GH can cause...

47

Trap: GH is the only hormone that affects growth. True or false?

48

Why does malnutrition stunt growth even if GH is normal?



42

Intramembranous ossification (bone forms directly).

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41

Endochondral ossification  
(cartilage model replaced by bone).

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44

IGF-1 (insulin-like growth factor 1).

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43

Anterior pituitary gland.

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46

Short stature (pituitary dwarfism concept).

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45

Cartilage at growth plates.

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48

Because growth needs building materials  
(protein/energy) and other hormones too.

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47

False.

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49

Most calcium in the body is stored in...

50

Parathyroid hormone (PTH)  
raises or lowers blood calcium?

51

Calcitonin (basic idea) tends to...

52

Vitamin D helps raise blood calcium mainly by...

53

If vitamin D is low in a growing  
child, you worry about...

54

Osteoporosis (simple): what's the core problem?

55

Osteomalacia/rickets vs osteoporosis:  
what's the key difference?

56

Why does bone remodeling  
matter for calcium levels?



50

Raises blood calcium.

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49

Bones.

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52

Increasing calcium absorption from the gut.

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51

Lower blood calcium (by reducing bone resorption).

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54

Low bone mass -> fragile bones.

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53

Rickets (soft/poorly mineralized bones).

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56

Breaking bone releases calcium;  
building bone stores calcium.

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55

Osteomalacia/rickets = poor mineralization.  
Osteoporosis = low bone mass.

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57

Menopause/low estrogen tends to increase osteoporosis risk because... (simple idea)

58

Bone healing is possible because bone is...

59

Fracture healing step 1 is usually...

60

Fracture healing (basic): soft callus is mainly...

61

Fracture healing ends with...

62

If you see 'build bone', pick...  
osteoblast or osteoclast?

63

If you see 'resorb bone', pick...  
osteoblast or osteoclast?

64

If you see 'red marrow', think...



58

Living tissue with blood supply and remodeling cells.

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57

Less estrogen -> more bone resorption over time.

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60

Cartilage/fibrous tissue bridging the break.

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59

A blood clot (hematoma) forms.

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62

Osteoblast.

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61

Remodeling (bone reshaped back toward normal).

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64

Blood cell production.

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63

Osteoclast.

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65

If you see 'yellow marrow', think...

66

If a question says 'child is too tall due to a hormone problem', your first suspect is...

67

If a question says 'adult has enlarged hands/jaw due to hormone problem', suspect...

68

Cell that builds bone:

69

Cell that breaks down bone:

70

Blood cell production in bone happens in \_\_\_\_\_ marrow.

71

Long bone grows in length at the:

72

Bone basics: osteo{{c1::blast}} builds and osteo{{c2::clast}} breaks.



66

Too much growth hormone before growth plates close (gigantism idea).

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65

Fat storage (can revert to red).

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68

Osteoblast

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67

Too much growth hormone after growth plates close (acromegaly idea).

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70

Red

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69

Osteoclast

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72

Bone basics: osteoblast builds and osteoclast breaks.

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71

Epiphyseal (growth) plate

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73

Red marrow = hematopoiesis;  
yellow marrow = mostly fat.

74

Bone length growth happens at growth plates (cartilage) until they close.

75

Growth hormone timing: too much GH  
before closure -> gigantism;  
after closure -> acromegaly.

76

4 basic bone shape categories (high school list):

77

Flat bones are especially  
important for... (one big thing)

78

In a long bone, the medullary cavity is...

79

Metaphysis is basically...

80

Endosteum is...



74

Bone length growth happens at growth plates (cartilage) until they close.

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73

Red marrow = hematopoiesis; yellow marrow = mostly fat.

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76

Long, short, flat, irregular.

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75

Growth hormone timing: too much GH before closure -> gigantism; after closure -> acromegaly.

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78

The hollow space in the shaft that contains marrow.

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77

Protecting organs and housing red marrow (blood cell production).

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80

The lining on the inside surface of bone (around marrow cavity).

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79

The region between epiphysis and diaphysis (near the growth plate).

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81

Periosteum vs endosteum: which is outside?

82

Periosteum vs endosteum: which is inside?

83

Epiphyseal line is...

84

Cartilage has poor healing partly because...

85

What gives bone its flexibility/toughness?

86

What gives bone its hardness?

87

Osteoid is basically...

88

Mineralization needs enough...



82

Endosteum.

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81

Periosteum.

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84

It has little/no blood supply.

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83

The bony 'scar' left after a growth plate closes.

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86

Mineral (calcium phosphate crystals).

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85

Collagen.

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88

Calcium and phosphate (and vitamin D helps).

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87

The unmineralized bone matrix laid down by osteoblasts (mostly collagen).

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89

Three main blood components made in marrow:

90

RBC main job (one line):

91

WBC main job:

92

Platelets main job:

93

If bone marrow fails, one big consequence is...

94

B cells mature in...

95

T cells mature in... (not marrow)

96

Bone marrow transplant (very basic idea):



90

Carry oxygen (via hemoglobin).

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89

Red blood cells, white blood cells, platelets.

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92

Help blood clot.

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91

Defense (immune system).

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94

Bone marrow.

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93

Low blood cells (anemia, infections, bleeding).

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96

Replacing damaged blood-forming stem cells with healthy ones.

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95

Thymus.

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97

Name 3 hormones that matter for bone (high level):

98

Thyroid hormones (basic) help growth by...

99

Cortisol/stress hormones long-term tend to... bone density

100

Why puberty causes a growth spurt AND then stops height growth:

101

If growth plates close early, expected effect on adult height?

102

If growth plates stay open longer than usual, expected effect on height?

103

Adult bones can still grow in thickness even if you can't grow taller. True or false?

104

If blood calcium is low, the body will tend to...



98

Supporting normal development/metabolism  
(growth needs energy).

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97

Growth hormone, sex hormones,  
PTH/vitamin D (calcium regulators).

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100

Sex hormones boost growth  
early, then close growth plates.

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99

Lower it (more breakdown, less building).

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102

Potentially taller height (more  
time for length growth).

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101

Shorter adult height.

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104

Increase bone resorption (via  
PTH) to raise blood calcium.

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103

True.

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105

If blood calcium is high, the body will tend to...

106

Why does low calcium in blood matter so much? (one big reason)

107

Why do smokers/poor nutrition slow fracture healing? (basic idea)

108

Why do fractures in children often heal faster than in adults? (basic)

109

If a fracture damages the blood supply badly, healing can be...

110

If you picked 'yellow marrow = blood cell production', what's the fix?

111

If you picked 'growth plate = articular cartilage', what's the fix?

112

If you picked 'acromegaly = tall adult height', what's the fix?



106

Nerves and muscles need calcium for normal function.

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105

Store more calcium in bone (and reduce resorption).

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108

Better blood supply and more active growth/remodeling.

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107

Less oxygen/nutrients -> slower tissue repair and bone building.

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110

Red marrow makes blood cells.  
Yellow marrow is mostly fat.

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109

Poor or delayed.

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112

Acromegaly is after plate closure:  
thickening/enlargement, not extra height.

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111

Growth plate is for length growth.  
Articular cartilage is for smooth joints.

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113

Compact bone is **dense outer** bone;  
spongy bone is **trabecular inner** bone.

114

Epiphysis = **ends**;  
diaphysis = **shaft**.

115

GH comes from the **pituitary**  
and works a lot through **IGF-1**.

116

Hormone that raises blood calcium (basic):

117

Hormone that helps absorb calcium from the gut:

118

Osteoporosis usually makes bones...

119

Osteoporosis is more about losing...  
mineralization quality or bone amount?

120

Name 3 simple osteoporosis  
risk factors (pre-med level).



114

Epiphysis = ends; diaphysis = shaft.

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113

Compact bone is dense outer bone; spongy bone is trabecular inner bone.

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116

Parathyroid hormone (PTH)

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115

GH comes from the pituitary and works a lot through IGF-1.

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118

More likely to fracture (especially hip, spine, wrist).

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117

Vitamin D

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120

Aging, low activity, low calcium/vitamin D, low estrogen, smoking (any 3).

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119

Bone amount (bone mass/density).

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121

Rickets vs osteomalacia: which is in children?

122

Rickets can cause... (classic sign)

123

Why is rickets often linked to low vitamin D?

124

In healthy bone, remodeling means osteoblast activity and osteoclast activity are...

125

Osteoclasts are 'bad'. True or false?

126

Bone remodeling helps repair...

127

If osteoclast activity is way higher than osteoblast activity over time, result is...

128

Growth hormone helps growth, but bone length only increases if...



122

Bone deformities like bowed legs.

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121

Rickets.

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124

Balanced overall.

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123

Low vitamin D -> less calcium absorption -> poor mineralization.

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126

Microcracks from everyday use.

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125

False.

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128

Growth plates are still open.

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127

Bone loss (osteoporosis direction).

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129

If someone claims 'stretching exercises made me taller at 25', your pre-med answer is...

130

Short stature isn't always GH deficiency. Name one other broad reason.

131

Kidneys help regulate RBC production by releasing...

132

At high altitude (less oxygen), the body tends to make...

133

If someone has low RBC count (anemia), one symptom is...

134

Compact bone is organized into... (basic term)

135

Spongy bone is organized into...

136

Why is spongy bone useful?



130

Genetics, nutrition, thyroid hormone problems, or growth plate disorders.

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129

Unlikely. Growth plates are usually closed in adults.

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132

More red blood cells (over time).

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131

Erythropoietin (EPO) when oxygen is low.

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134

Osteons (Haversian systems).

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133

Fatigue/shortness of breath (less oxygen delivery).

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136

Strong but lightweight and provides space for marrow.

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135

Trabeculae.

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137

Why are long bones good levers?

138

Bone growth and bone remodeling are...

139

An adult can increase bone density with exercise because of...

140

Why does strength training help bone?

141

Open fracture (bone through skin) is riskier mainly because...

142

Why do doctors sometimes immobilize fractures with a cast?

143

Hormone from kidneys that increases RBC production:

144

PTH  $\{\{c1::raises\}\}$  blood calcium; calcitonin  $\{\{c2::lowers\}\}$  it (basic).



138

Related but not the same. Growth increases size; remodeling replaces/reshapes bone.

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137

Muscles attach and pull, turning force into movement.

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140

Mechanical load signals osteoblast activity and improves bone density.

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139

Remodeling (Wolff's law).

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142

To keep bone ends aligned and stable so the callus can form.

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141

Higher infection risk.

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144

PTH raises blood calcium; calcitonin lowers it (basic).

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143

Erythropoietin (EPO)

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145

Bone length growth = {{c1::epiphyseal plates}}; bone thickness growth = {{c2::appositional growth}}.

146

Osteoporosis = low {{c1::bone mass}};  
rickets/osteomalacia = poor {{c2::mineralization}}.



146

Osteoporosis = low bone mass;  
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145

Bone length growth = epiphyseal plates; bone  
thickness growth = appositional growth.

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