

The Absorption of Vitamin B12 and its Interruption Revisited
Grand Pavillion
Portcawl,
South Wales

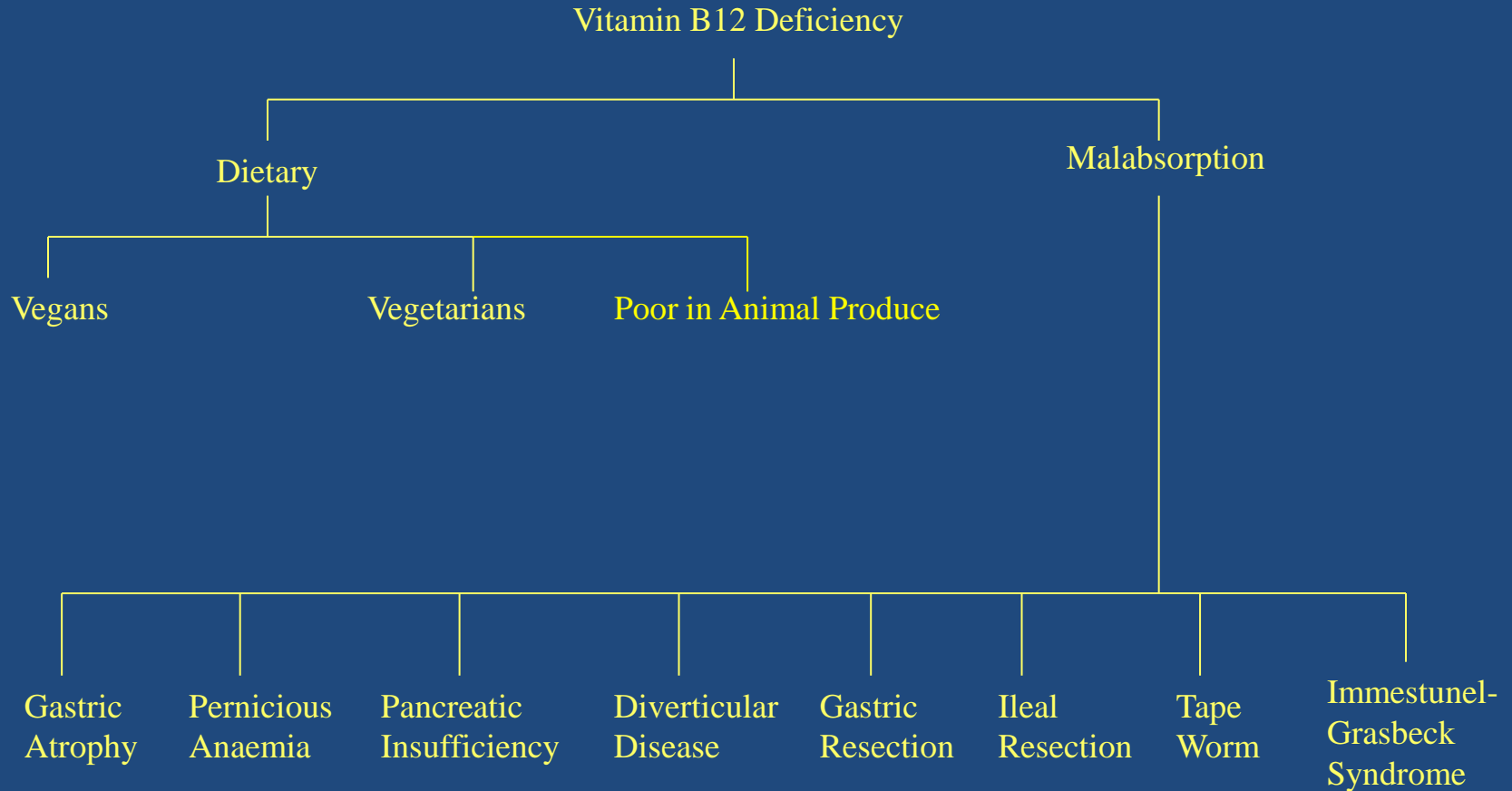
Thursday 9th June 2011

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Vitamin B12 Deficiency



STOMACH

- Vitamin B₁₂ released from food
- Vitamin B₁₂ present in free form from supplements
- Both bound to R-Binders

R-Binders

- Glycoprotein from saliva or gastric juice
- Have high affinity for vitamin B₁₂
- Will also bind vitamin B₁₂ analogues
- Role to protect vitamin B₁₂ from degradation

STOMACH

- Intrinsic Factor
 - Glycoprotein
 - Secreted by parietal cells
 - Does not bind B₁₂ at acid pH
 - **Problems:**
 - Pernicious Anaemia is an autoimmune disease
 - Autoantibodies produced which attack the parietal cell
 - Reduced Intrinsic Factor secretion
 - Reduced Acid secretion
 - Gastric Atrophy
 - Reduction in acid
 - Reduction in Intrinsic Factor
- Acid
Secreted by
parietal cell

DUODENUM

R-Binders

- Partly degraded by pancreatic proteinases
- Lose their high affinity for vitamin B₁₂

Problems:

Pancreatic insufficiency causes B12 malabsorption

DUODENUM

Intrinsic Factor

- Great affinity for vitamin B12 at neural pH
- Excess (90%) of intrinsic factor over amount of dietary B12 (1-3ug per meal)
- High level of specificity
- Will not bind inactive vitamin B12 analogues

Problems:

Lack of Intrinsic factor in Pernicious Anaemia (PA)

Prolonged Gastric Atrophy, lack of IF and Acid

Result malabsorption of Food and Biliary B12

DUODENUM

- Bile enters duodenum
- Bile contains about 1 to 6 ug per day vitamin B₁₂
- Vitamin B₁₂ in bile also binds to Intrinsic Factor

Problems:

- Intrinsic Factor level in PA is reduced
- Prolonged gastric atrophy. IF reduced
- Interruption of enterohepatic circulation of biliary B₁₂ causes negative B₁₂ balance
- Negative balance means continuous loss
- Such loss with time depletes B₁₂ stores
- This may take 2 to 3 years for stores to run out
- When stores run out death follows in months,
- Hence the name pernicious anaemia

ILEUM

Number of ileal receptors limits absorption

- Most Intrinsic Factor – B₁₂ (90%) not bound to receptor
- Intrinsic Factor – B₁₂ (10%) binds to ileal receptors
- Internalised by endocytosis
- Released in ileal mucosal cells
- Bound by Transcobalamin II (TCII) in Plasma

Vitamin B12 Absorption

Active Absorption

- Limited by number of ileal receptors
- Large excess of Intrinsic Factor
- Large excess of IF – B12 complex (90%)
- Only 10% of IF – B12 absorbed
- Translate into < 2.5 ug per meal

Passive Absorption

- Passive absorption up to 3% of any dose of free B₁₂

Diet say 1 to 5 ug per day

- Passive absorption small contribution up to 0.15 ug/day

Supplement of say 100 ug

- Passive absorption could be 3.0 ug/day

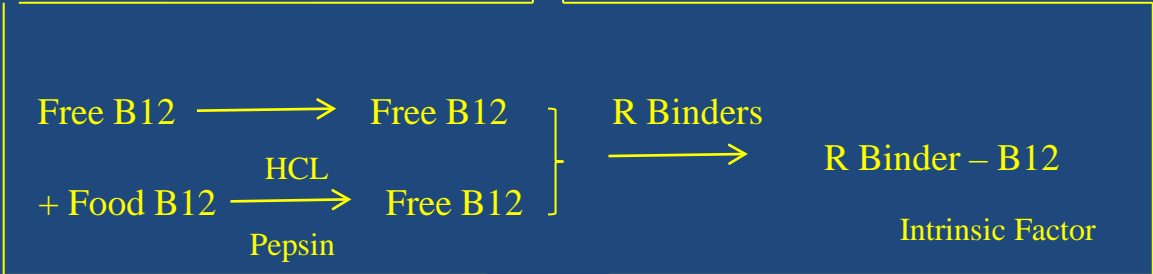
Organ

Mouth

Saliva

Stomach

HCL
PEPSIN
INTRINSIC
FACTOR

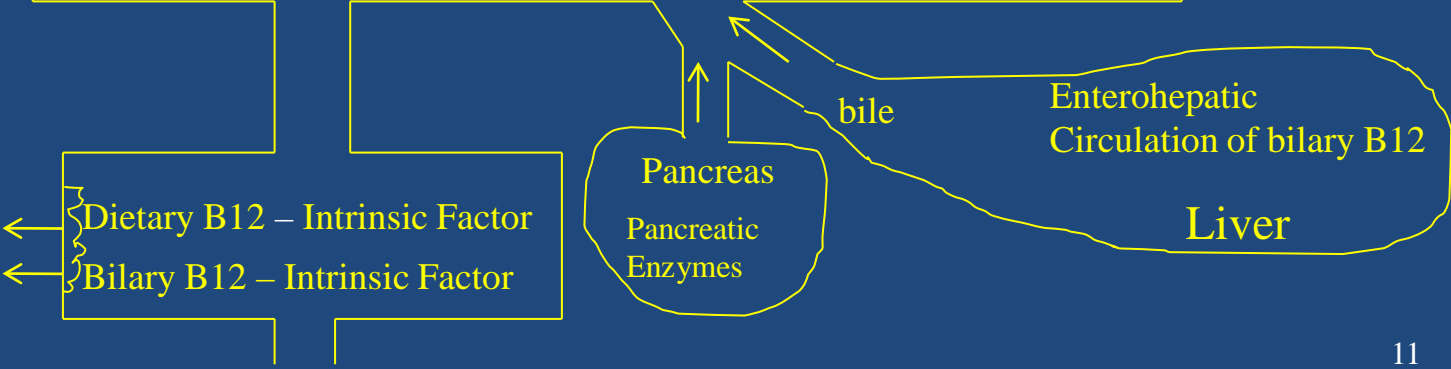


Gastric Atrophy
Pernicious Anaemia

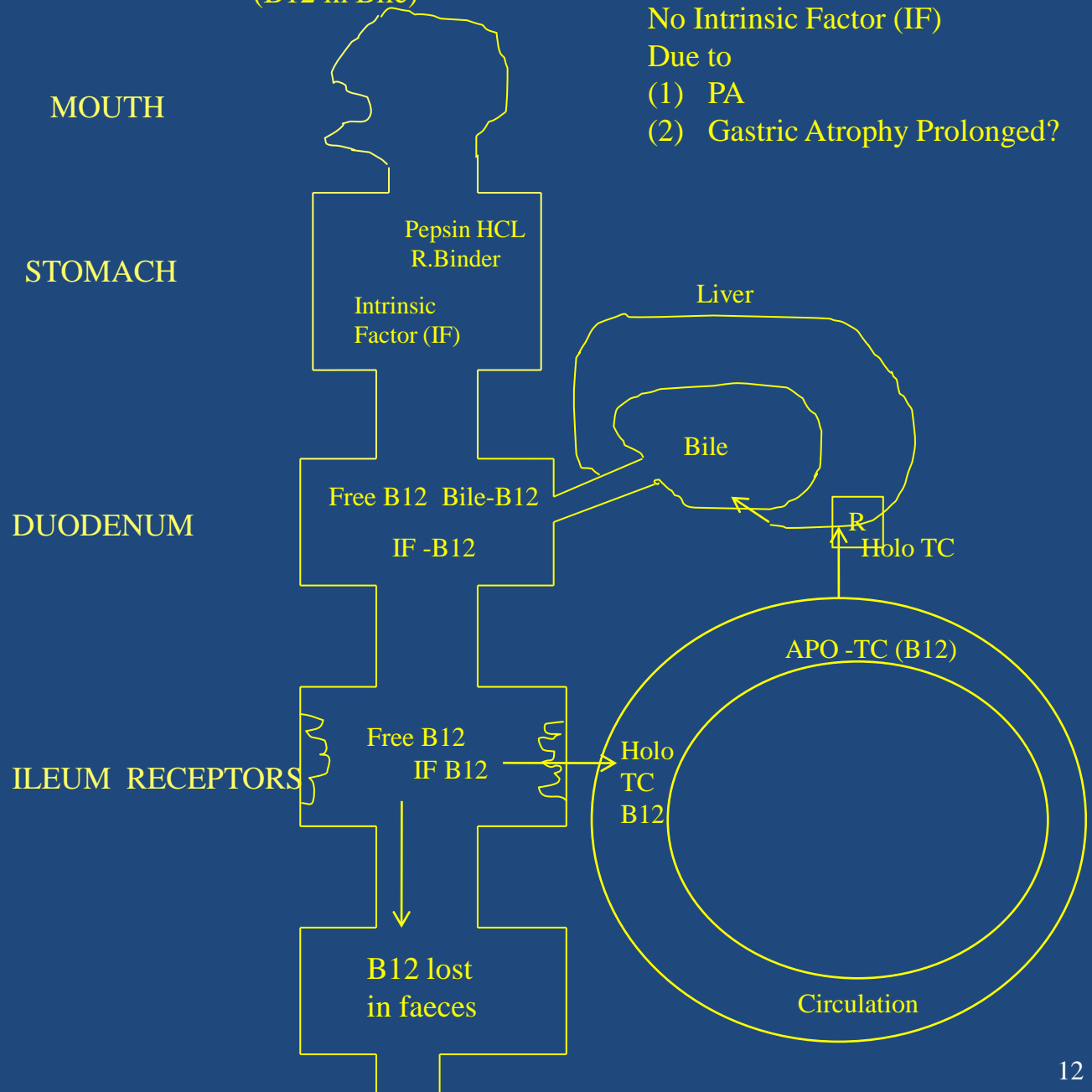
Duodenum

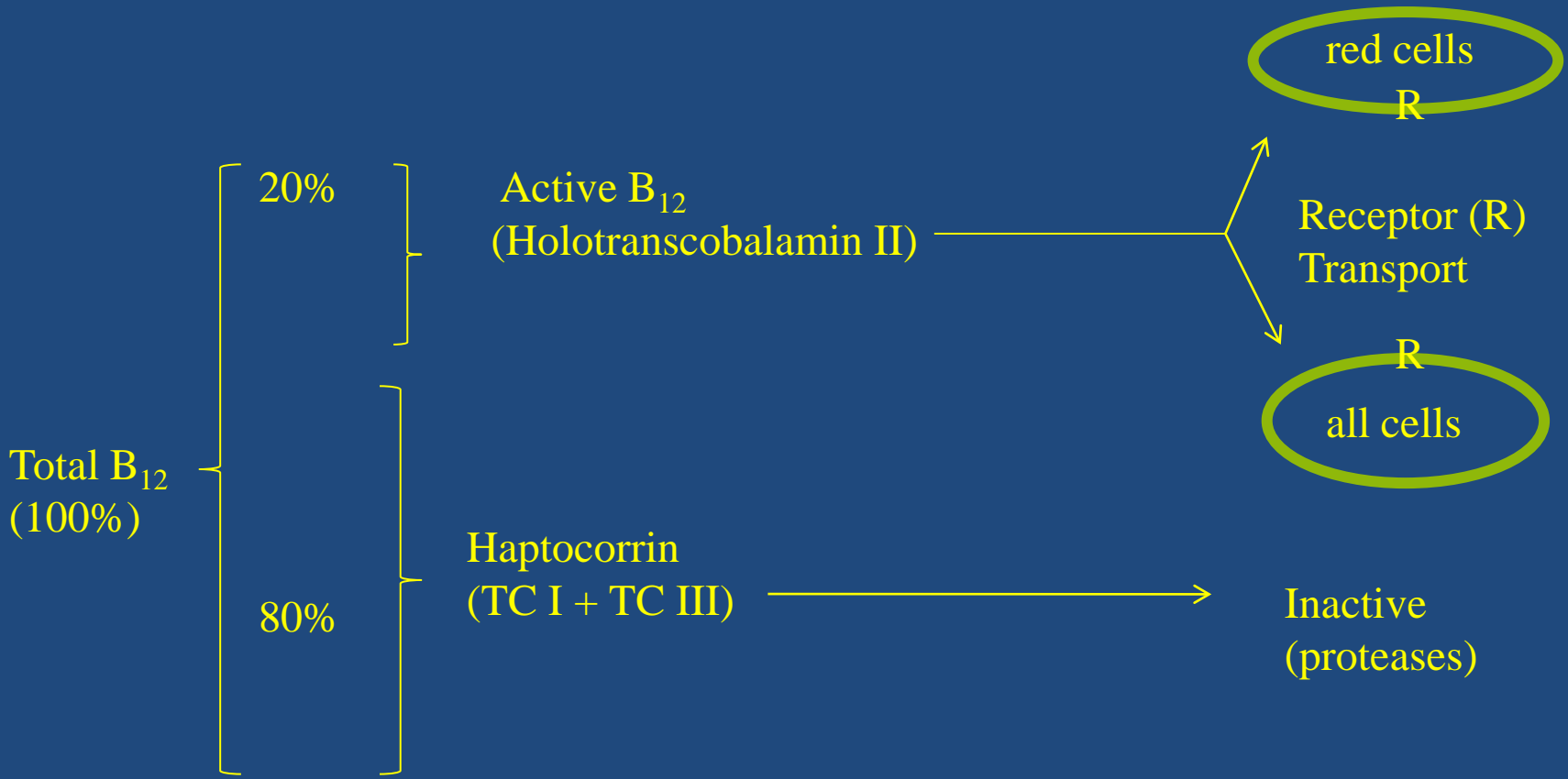


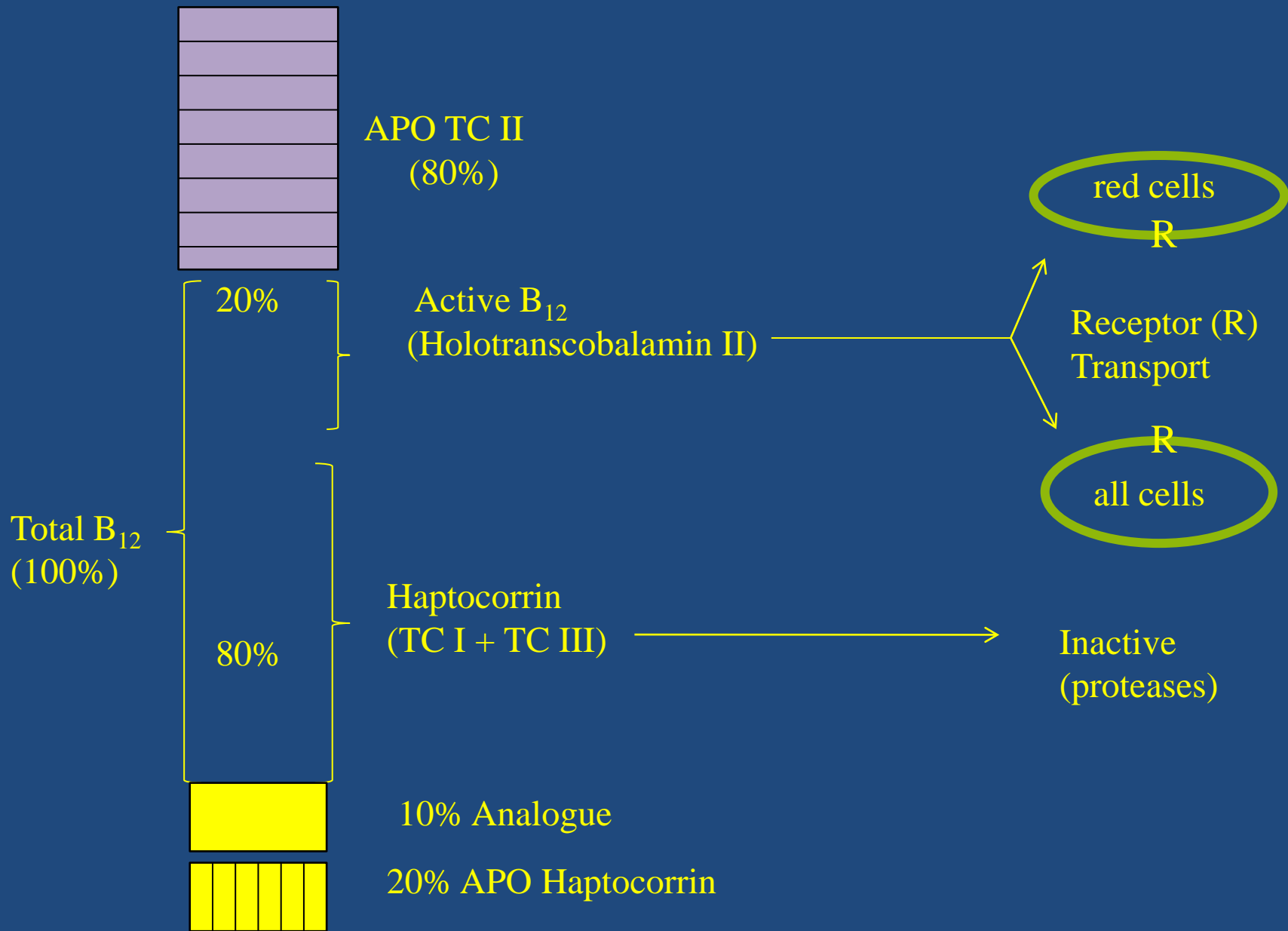
Ileal Receptors



Enterohepatic Circulation of B12 (B12 in Bile)







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