



Basic biochemical examination in endocrinology

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Diabetes mellitus

Endocrinology of reproduction

Endocrinology



Hormones - definition

Hormones are endogenous substances produced by specialized cells

Secretion: continuous (thyroid hormones)
 with diurnal rhythm (cortisol)
 with monathal rhythm (menstrual cycle hormones)
 seasonal rhythm (parathormon)

Hormones - types

Proteohormones and peptides

Steroid hormones

Low molecular weight hormones derived from modified amino acids

Prostanoids



Action of hormones

Autocrine

Paracrine

Endocrine

Diabetes mellitus

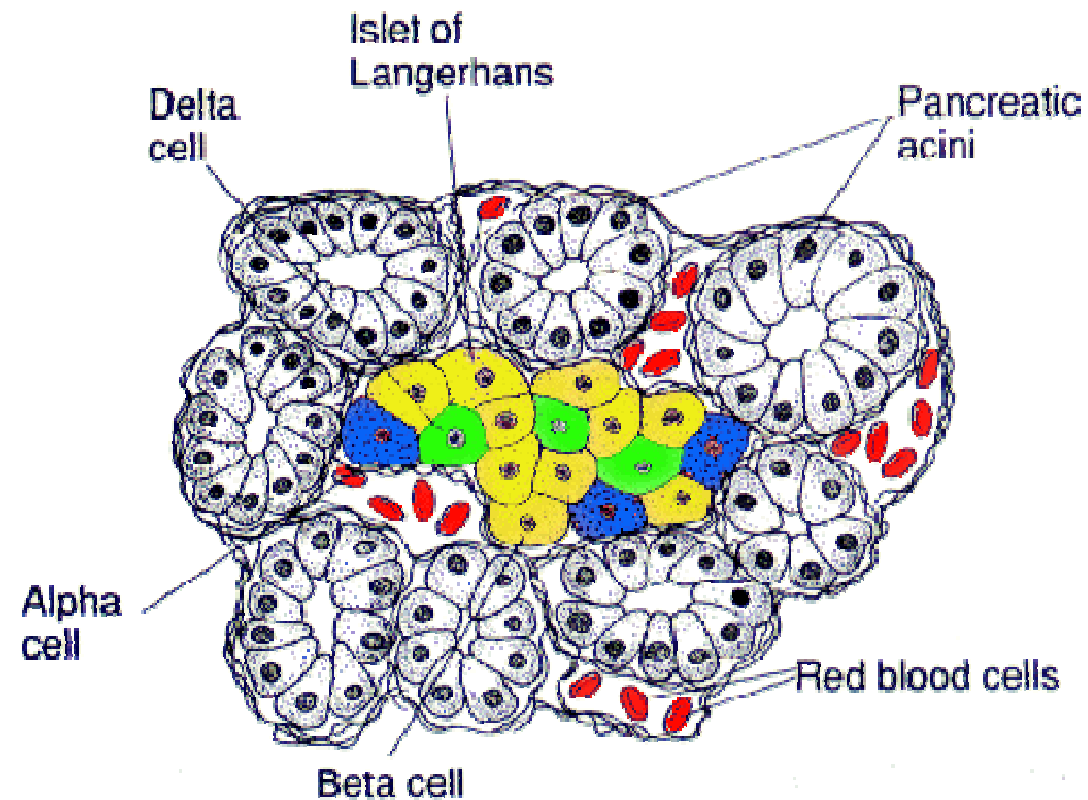


DM definition

WHO 1985

Status characterized by chronic elevation of blood glucose, that could be connected with clinical syndromes and could lead to death without proper care.

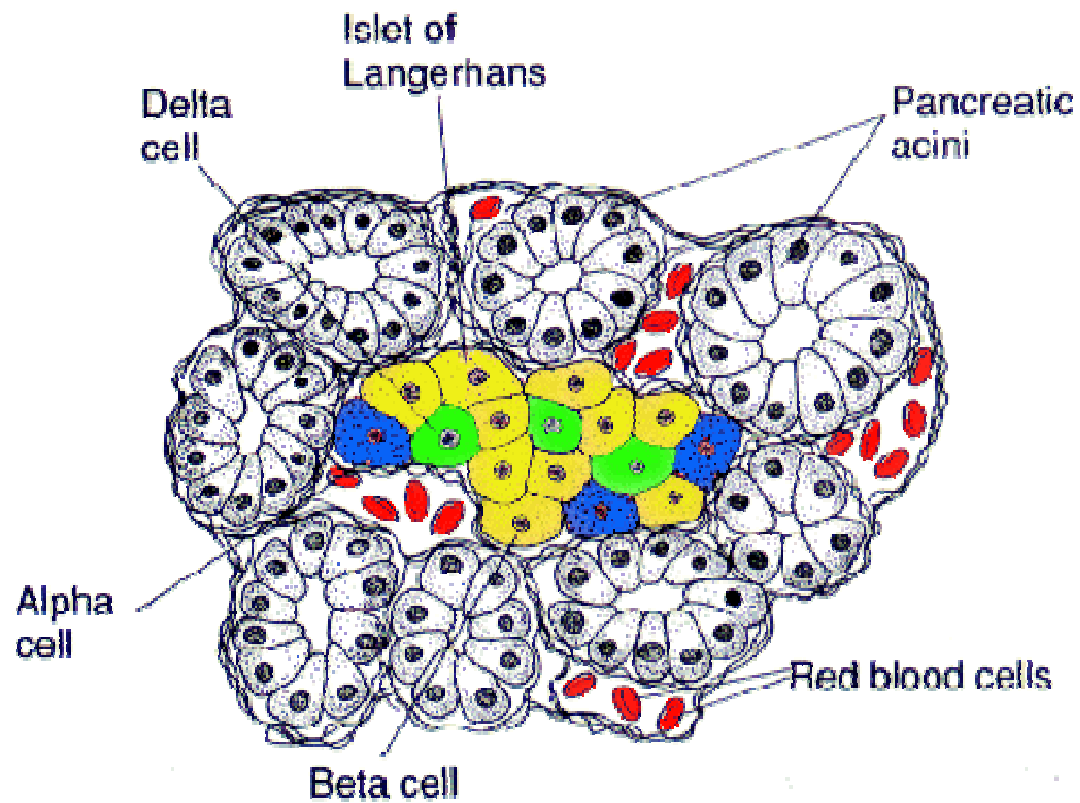
Langerhans islets



B (beta) cells

70%

Produce insulin

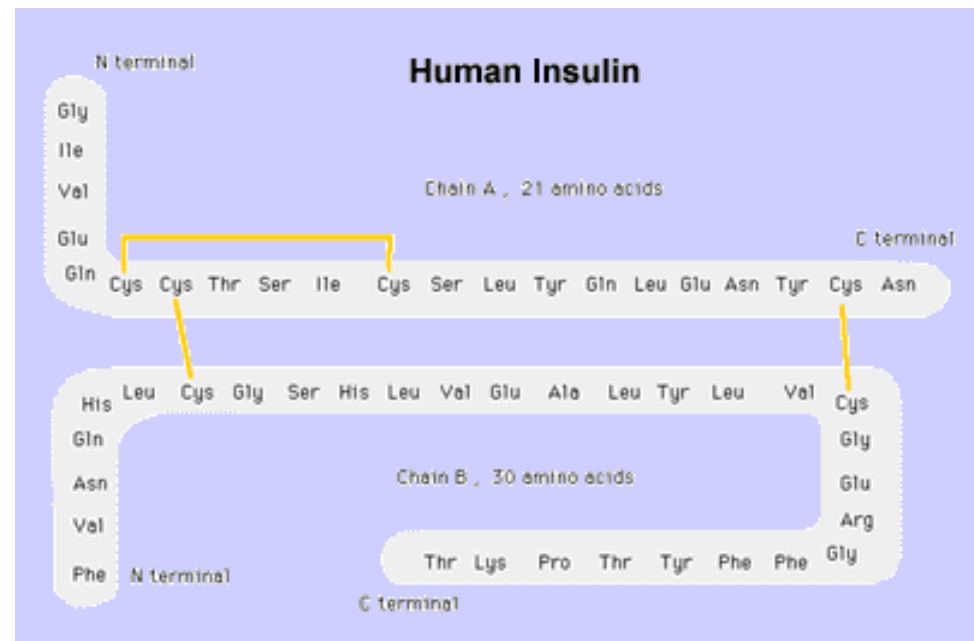


Insulin

Men and other mammals
1 gen on chromosome 11

(rodents, 2 genes)

51 AA, 2 strands



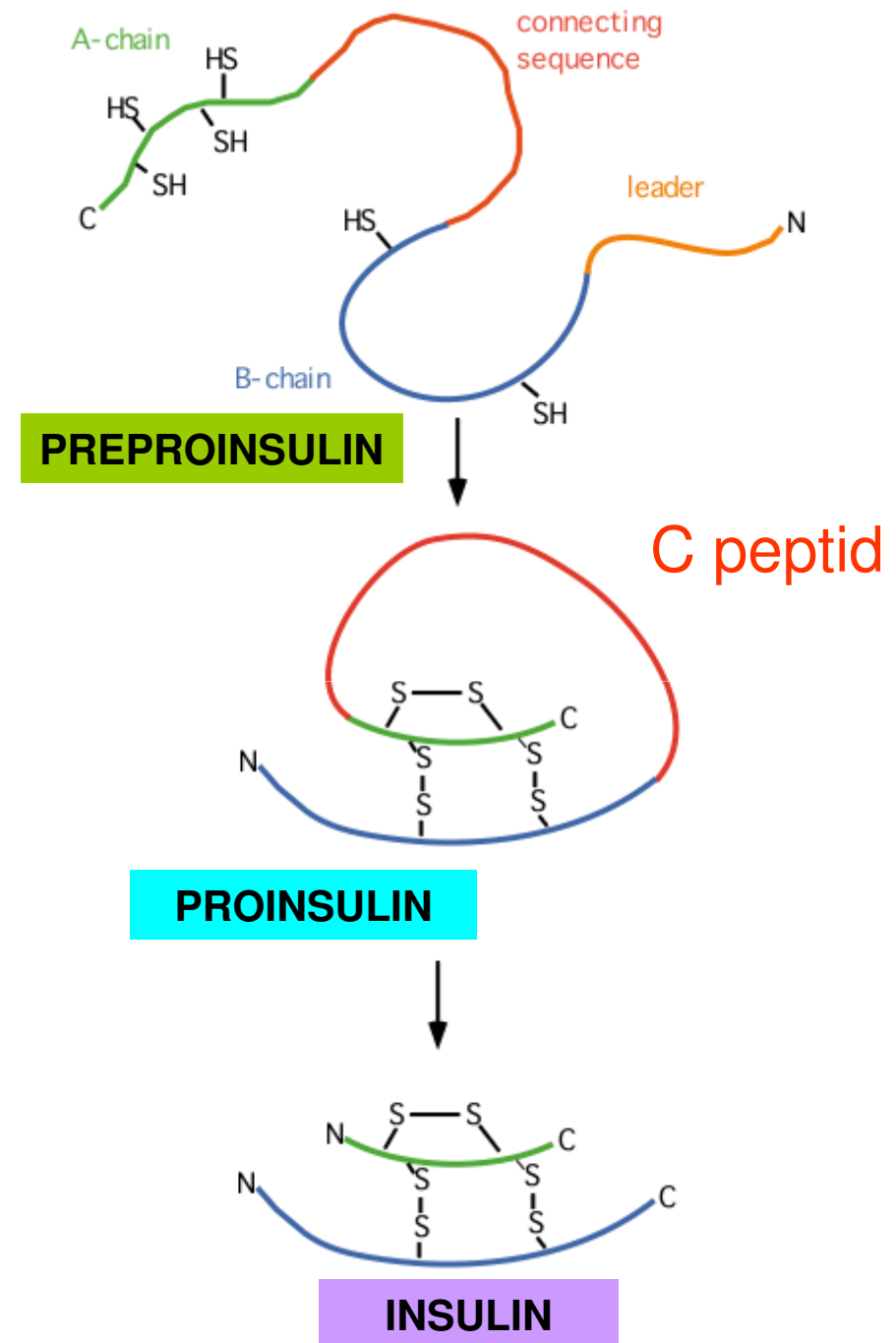
Homology between species high:

pig, dog, hare 1 AA; cow 3 AA; sheep, horse 4 AA.

Secretion increased: elevation of blood sugar, aminoacids, parasympaticus system action, glukagon, glucocorticoides, growth hormone, placental lactogen,estrogenes, gestagenes (during pregnancy)

Secretion decreased: fats, sympaticus action, somatostatin, adrenalin

Insulin



Insulin

Daily production:

40-50 units

(15-20% of pancreatic depot)

50% basal secretion

50% postprandial secretion

Plasmatic halftime:

3-5 minutes, no transport protein

First-pass effect:

50% used during first passage through liver



C peptid

Function unknown

Variable length

Used as marker of endogenous insulin production
(produced in equimolar proportion, can be used in patients
on insulin therapy as well)

No first-pass effect

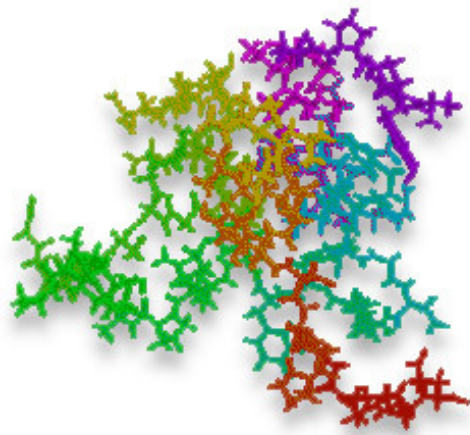
Insulin like growth factors

IGF-I
70 AMK

62 % homology (IGF-I and IGF-II)
50 % homology with insulin

IGF-II
67 AMK

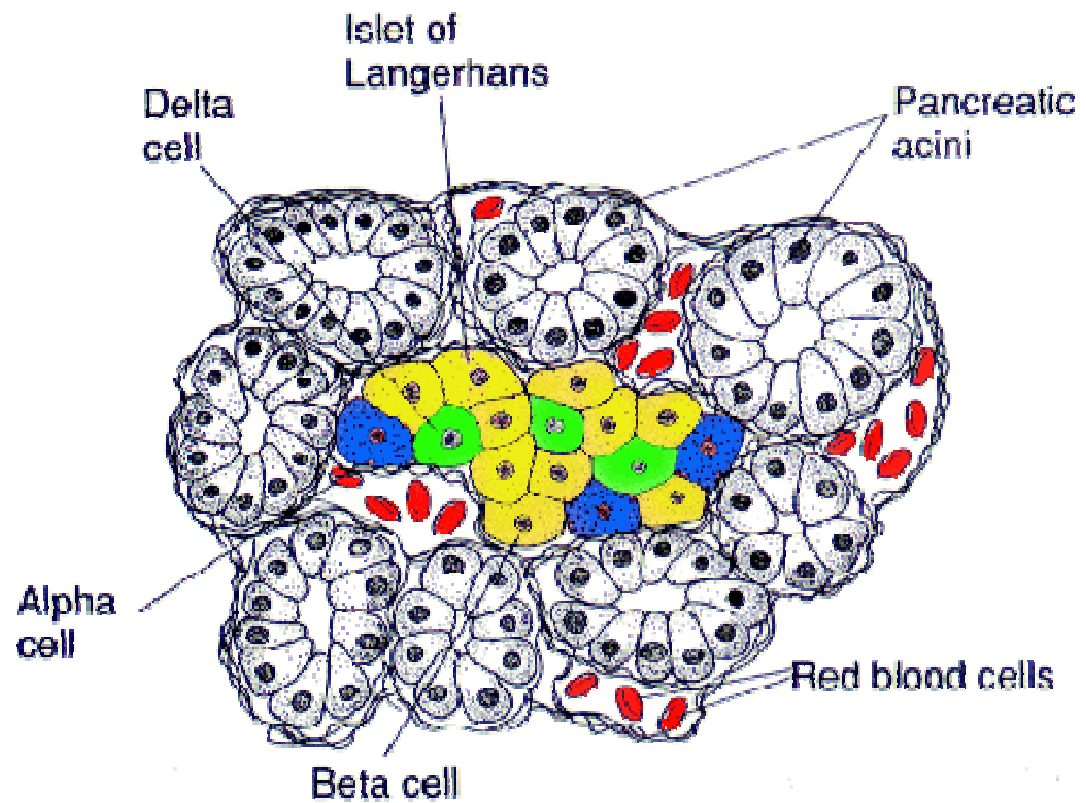
More stimulate growth than insulin
Have less metabolic effect than insulin



A (alpha) cells

25%

Produce glucagon



Glucagon

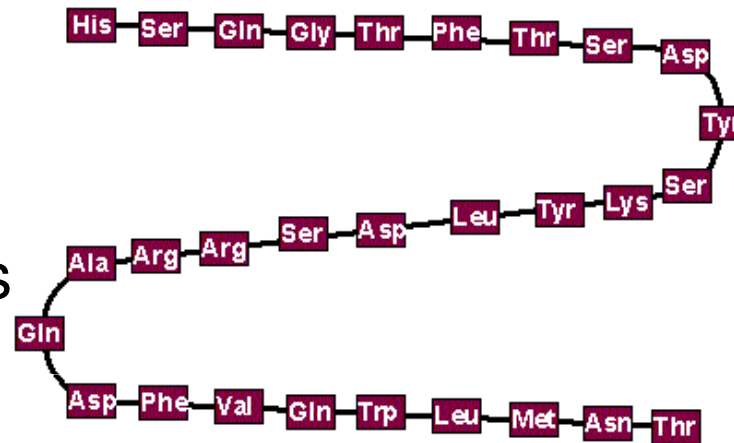
29 amino acids

Synthesized as proglukagon

Plasmatic halftime 5 minutes

No transport protein

Inactivation in liver

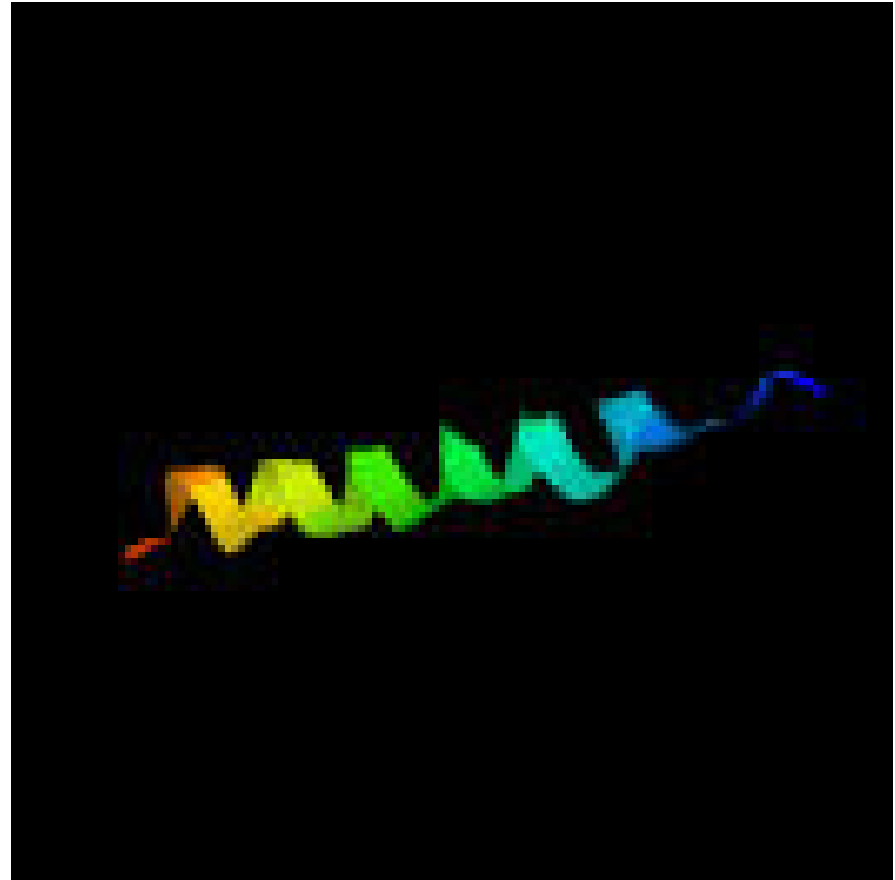


Glucagon

Enhances

- glycogenolysis
- lipolysis
- gluconeogenesis
- ketogenesis

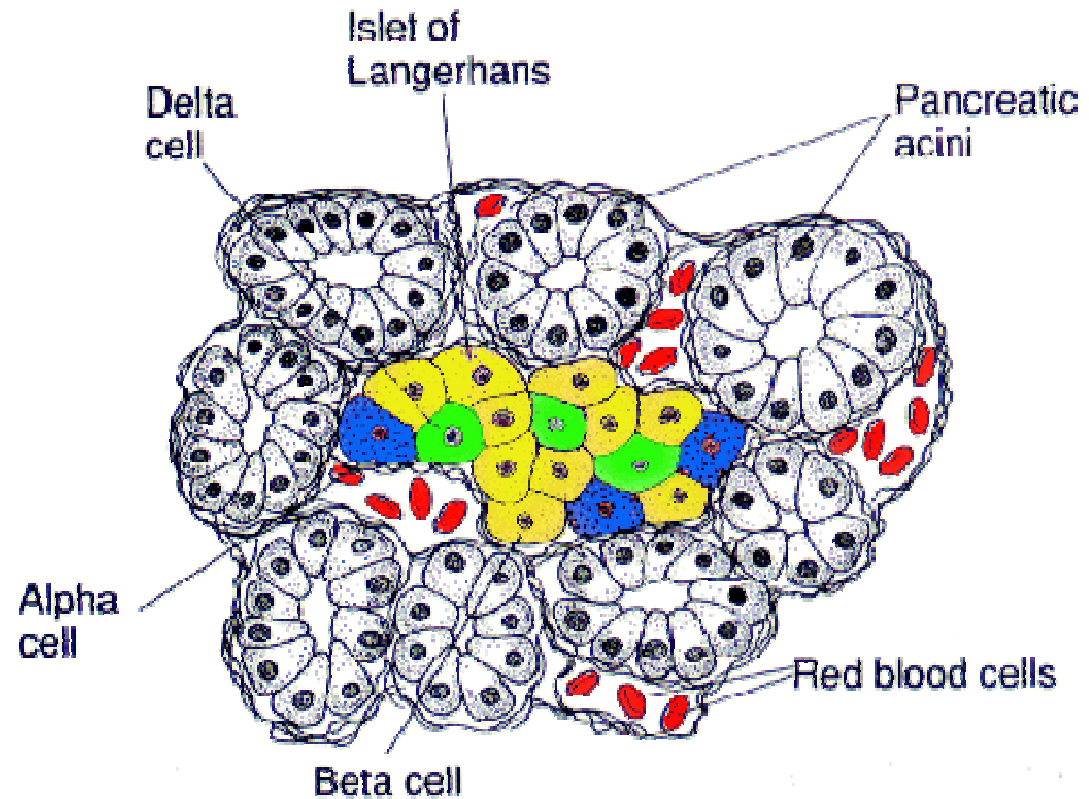
Receptors mainly in liver



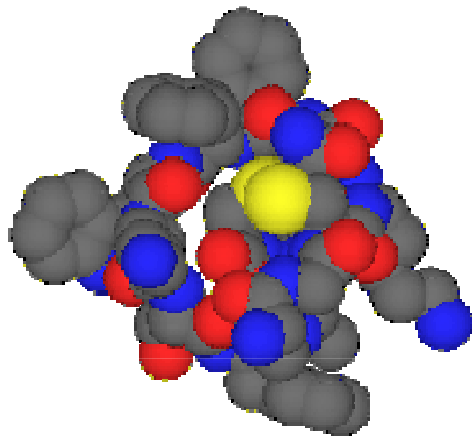
D (delta) cells

5%

Produce somatostatin



Somatostatin



cyclic peptide, 14 amino acids

in CNS – neurotransmitter function

synthesized also in other places in GIT

Inhibition of insulin and glucagon secretion

Slows gastric emptying, lowers gastrin secretion,
pancreatic exocrine secretion, ...

Blood glucose regulation



FOOD INTAKE

-

INSULIN

glucagon like peptid
utilization in CNS
muscle work

+

GLUCAGON

catecholamins
glucocorticoides
growth hormone

Blood glucose regulation



-

INSULIN

glucagon like peptid
utilization in CNS
Muscle work

+

GLUCAGON

catecholamins
glucocorticoides
growth hormone

DM diagnosis

Fasting glycemia (venous and capillary blood)

<5,6 mmol/l	no DM
5,7-7,0 mmol/l	impaired fasting glycemia
>7 mmol/l	DM present

Glycemia in random sample

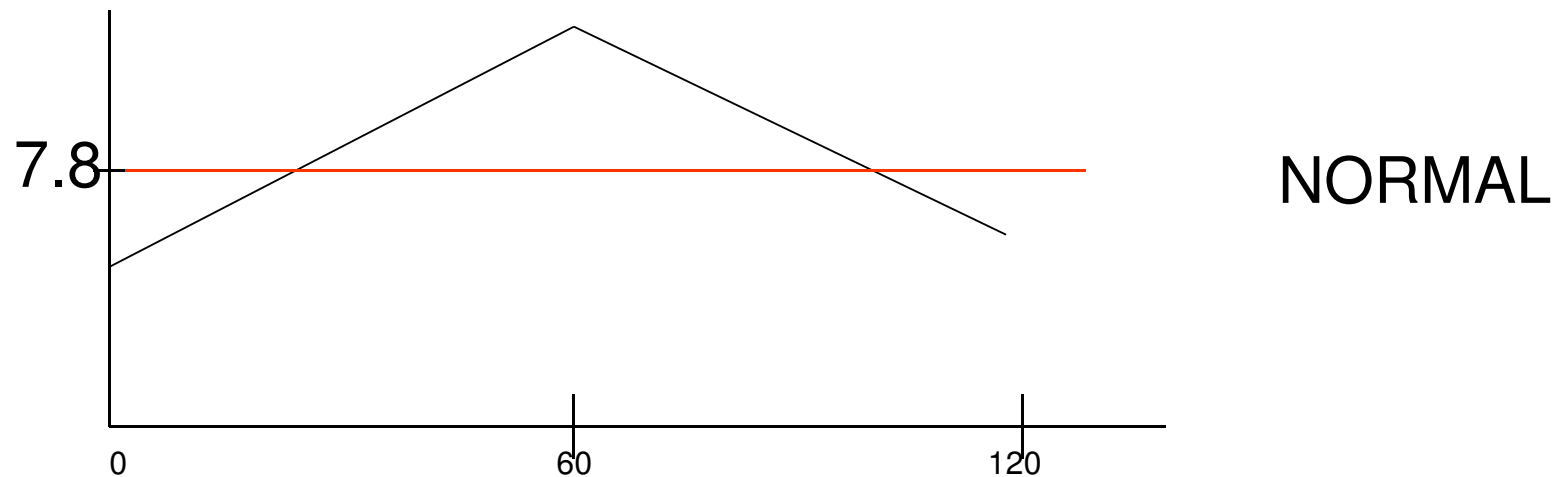
Several times >10mmol/l DM present

DM diagnosis

OGTT (oral glucose tolerance test)

75 g of glucose in 400 ml water (tea)

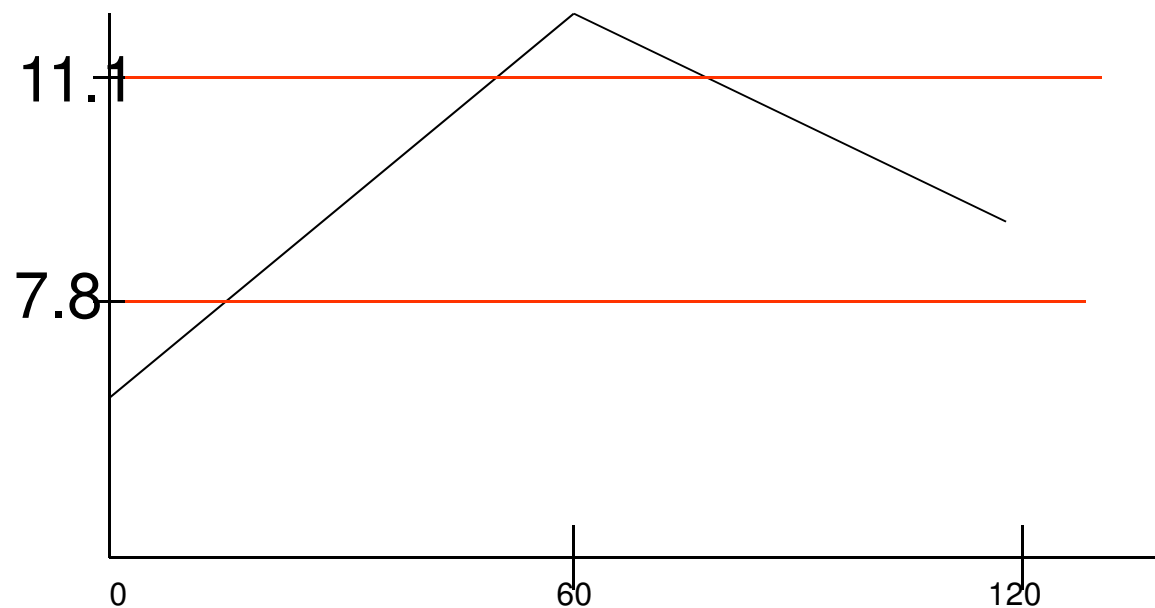
Measurement at time 0 and 120 min (60 min and 180 min sometimes added)



DM diagnosis

OGTT

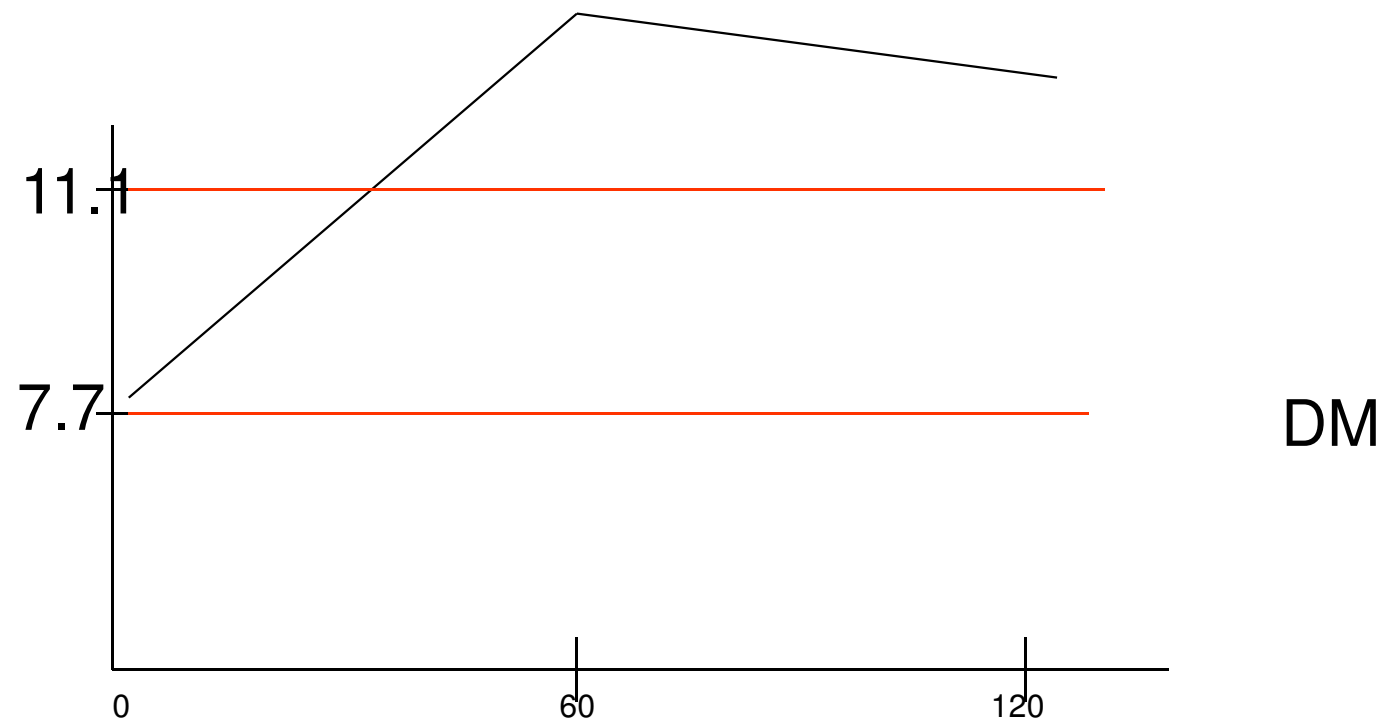
Impaired glucose tolerance



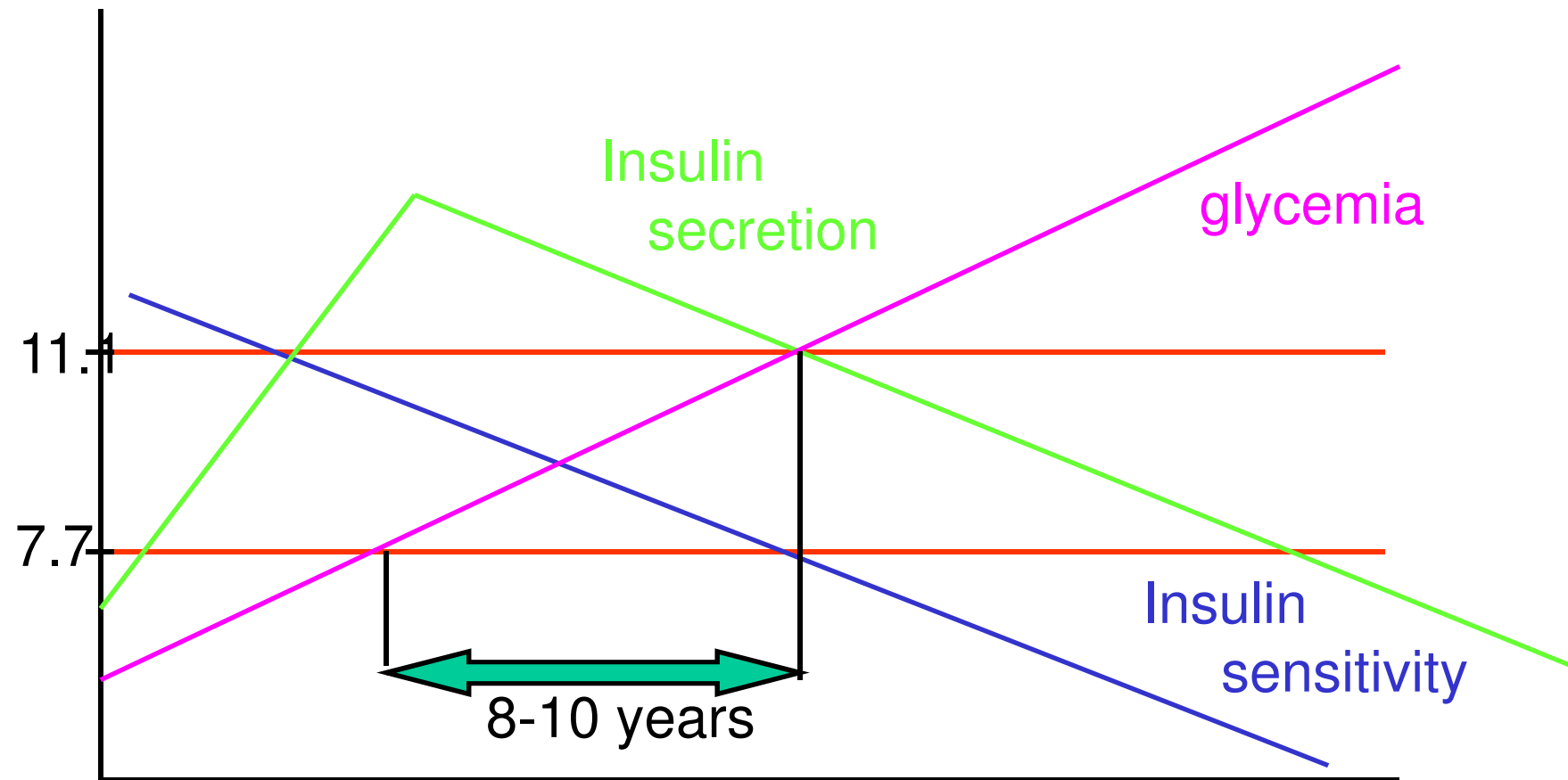
repeat OGTT
every 2-3 years

DM diagnosis

OGTT



DM



Lab tests in DM

BLOOD GLUCOSE

- fasting

- random

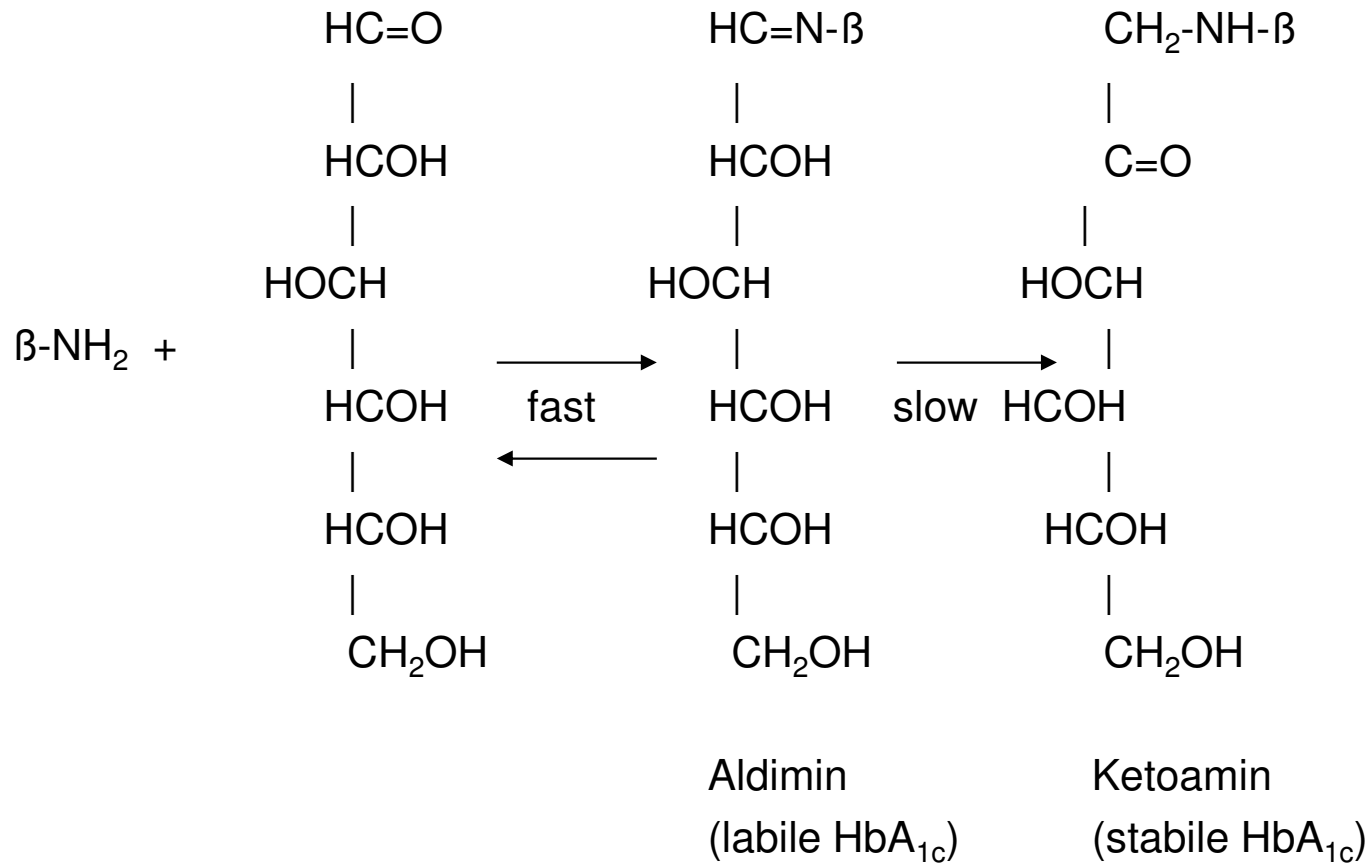
- oral glucose tolerance test (OGTT)

- glycemic profile

GLYCATED HAEMOGLOBIN, PEPTIDES, AGEs

INSULIN, C PEPTID, anti-GAD antibodies, antibodies against insulin, antibodies against B cells (ICA, IA2)

haemoglobin glycation



Haemoglobin - types

Haemoglobin and derivates	Subunits present	sugar	content
HbA ₀	$\alpha_2\beta_2$	-	> 90%
HbA ₂	$\alpha_2\delta_2$	-	2%
HbF	$\alpha_2\gamma_2$	-	0.5%
HbA _{1a1}	$\alpha_2(\beta\text{-F-D-P})_2$	Fructose-1,6-diphosphate	<1%
HbA _{1a2}	$\alpha_2(\beta\text{-G-6-P})_2$	Glucose-6-phosphate	<1%
HbA _{1b}	?	?	<1%
HbA _{1c}	$\alpha_2(\beta\text{-G})_2$	Glucose	<4%
HbA _{1d}	?	?	traces
HbA _{1e}	?	?	traces



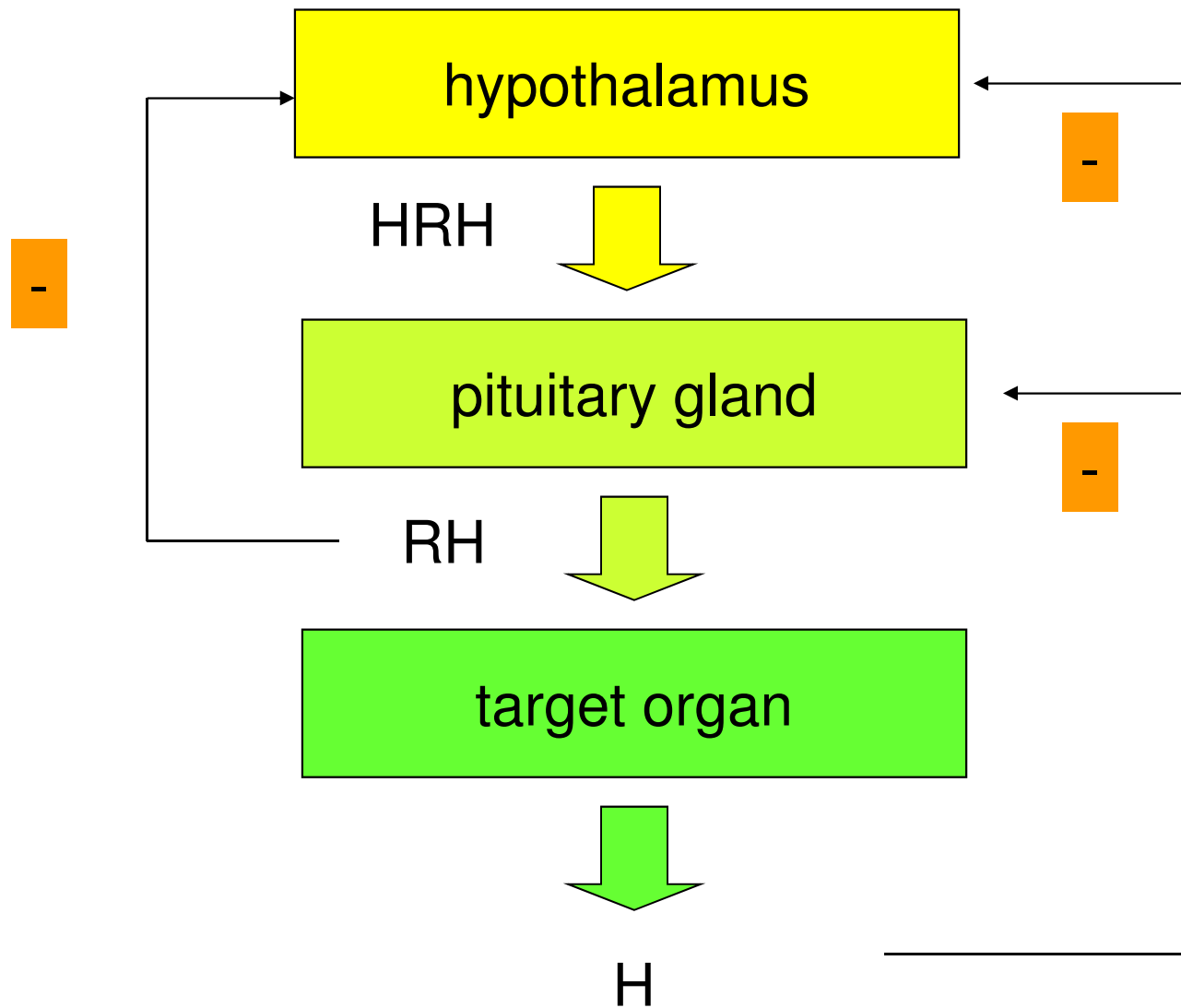
Haemoglobin A_{1c}

Reference values 28 – 40 (95 % interval)

<i>DM compensation</i>	<i>Values given by IFCC applicable from 1. 1. 2004</i>
<i>excellent</i>	<i>< 45</i>
<i>good</i>	<i>45 – 60</i>
<i>bad</i>	<i>> 60</i>



Endocrinology of reproduction



Female hormonal system

Gonadotropic hormones

FSH

LH

prolactin



Female hormonal system

Gonadotropic hormones

FSH



function: follicles growth, stimulation of estrogens secretion

structure: proteohormon, 207 amino acids,
 subunits alpha and beta

Lab assessment: immunoanalysis

Female hormonal system

Gonadotropic hormones

LH



function: peak precedes ovulation, afterwards stimulation of both estrogen and gestagen secretion

structure: proteohormon, 205 amino acids, alpha and beta subunits

lab: immunoanalysis

Female hormonal system

Gonadotropic hormones

prolaktin



function: mainly milk production, acts also on ovaries

structure: proteohormon, 198 amino acids, 1band

lab: immunoanalysis

Female hormonal system

Native estrogens

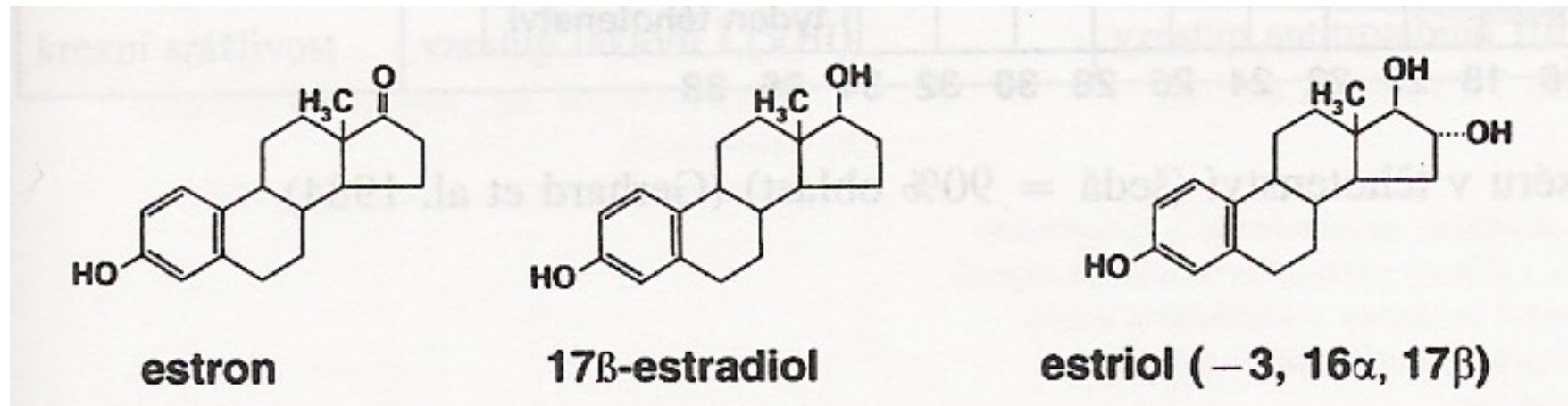
structure: 18C steroids
 aromatic A circle

lab: immunochemistry



Female hormonal system

Native estrogens



Female hormonal system

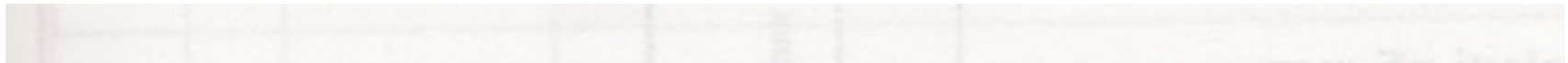
Native gestagens

structure: 21C steroids

Lab: immunochemistry



Native gestagens



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