* Cardiac muscle is the most highly oxidative cell ((based on oxidative phosphorylation for producing energy))

glycolysis

aerobic

- more energy produced, because glycolysis will not be the end point

pyruvate $\xrightarrow{\text{oxidative decarboxylation}}$

→ acetyl-CoA → Citric acid cycle.

anaerobic

produce only 2 molecule of ATP + lactic acid

* Cardiac muscle is in continous contraction, huge amount of ATP must be available.

* Fatty acid oxidation should be under arobic condition, because all the reaction of B-oxidation that producing energy take place in mitochondrea.

* oxidative doesn't mean only oxygen We should have oxygen + mitochondrea

example: RBC : anaerobic ⇒ mitochondrial ليس لها

skeletal muscle : aerobic + anarobic ⇒ The musle divided into 2 compartment central & peripheral, during contraction The central part performing anaerobic glycolysis ? because Blood vessels are compressed → O_2 supply to skeletal muscle will be insufficient, but in the periphry there's good blood supply

Cardiac muscle: 1) under physological condition → impossible to perform anaerobic glycolysis

2) in Ischemia (not all the part of the heart) → anaerobic

* Cardiac muscle should have a balance between what c.m is going to do & what amount of energy to be produce

* The 3 components of biochemical reaction:

[1] obtaning the primary supply «fuel»

[2] biochemical reaction to produce common Intermediate «Acety co A» To Join TCA cycle —ينتج→ NADH, FADH₂ → transfer the electron to electron transport chain.

NADH, FADH₂ = reducing equivalents

[3] مصدر آخر: Creatine phosphate

$$ATP + creatine \xrightarrow[kinase]{creatine} creatine\ phosphat + ADP$$

shortage of glucose supply أو shortage of F.A supply إذا حصل, (storage form of energy) *

← لازم يكون في مصدر تاني للطاقة لما c.m تجهز نفسها.

«important source of energy under high demand conditions»

* cardiomyocyte بتحتوي على عدد أكبر من ال mitochondria من ال hepatocyte

* oxidative state during contraction: 80-90 %

" " " rest: 15-25 %

* أعلى مكان فيه معدل hydrolysis of ATP to supply energy for contraction is the cardiac muscle, 95 % of ATP every second hydrolysis to produce energy

[1]
* First line of energy production is fatty acid 60 %

« main source » ← fatty acid → Triacylglycerol

Come from out side
« free fatty acid »
— chylomicron + VLDL

Triacylglycerol:
(10 - 30%) of fatty acid can be uptake by c.m will convent to ATP

* كلما زاد non-~~esterified~~ esterified fatty acid in the plasma ⇐ كلما زادت قدرة c.m to uptake fatty acid for B- oxidation

[2] 35 % Carbohydrates : glucose , glycogen
* pool of glycogen in C.m = $\frac{1}{5}$ glycogen in skeletal muscle

[3] 5 % amino acid

intermediate in gluconeogenesis	(Directly) intermediate in CAC	never produce glucose :
« α-Keto glutarate » → glutamate, glutamic, aspartate	« alanine » ↓ oxidative deamination → Pyruvate	« Lysine , leucine »
- oxaloacetate → aspartate, aspargine		

Lactate
→ directly : lactate —(dehydrogenase)→ pyruvate → Acetyl coA → CAC
→ indirectly : Cori cycle « pass by monocarboxylate - transport → liver → glucose

* ~~Transamination~~
Transamination
→ Pyruvate → alanine
→ glutamate → α-Keto glutrate

* carbohydrate metabolism

Glut-4, synthesise & located in cytosole of c.m, when need to uptake glucose, it migrate from cytosole to cell membrane (insuline dependent)

* In patient with uncontrolled DM ⇒ عدم transporting of glut-4 to cell membrane → ↑ dependence of fatty acid (F.a → consuming) → hypertrophy

* glucose-transporter 1 → playing accessory role

* Key steps in glycolytic pathway :- « Irreversible »

1 → Hexokinase

10 → Pyruvate kinase

3 → phosphofructokinase 1

6 → glyceraldhyde-3-phosphate dehydrogenase

ينتج منه 1) 1,3 biphosphateglycerate + NADH

* آخر تفاعل activate by lactate dehydrogenase enzyme ـه وفيه يوخذ الـ H من NADH+H⁺

إذاً حيصل تراكم للـ H^+ ← shifting of pH to more acidic from 6.9 → 6.8 مثلاً → stop the activity of most of enzymes & cardiomyocytes → Death

* هاد بحالات الـ (ischemia)

مشان ما يصير تراكم للـ H^+ : ١) عرفنا كيف نتخلص * من الـ (lactate)

(2) * Na^+-H^+ exchanger chennel: keep H^+ in suitable amount to not affect pH → (not to inhibite enzyme)

* بيدخل الـ Na^+ وبطلع الـ H^+ مشان يتحد الـ HCO_3^- ويتفاعل معه « عن طريق amine exchanger »

↳ $H_2CO_3 \xrightarrow{C.A} H_2O + CO_2$ زفير

= فازاد اشي على بالي [illegible] =