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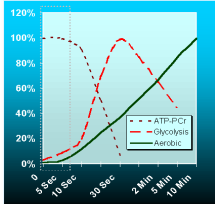


Chemical Energy

- Food we eat contains chemical energy
- Is **stored** in our body as glycogen, fat, and protein
- Can be released to provide the energy needed to produce adenosine triphosphate (ATP)

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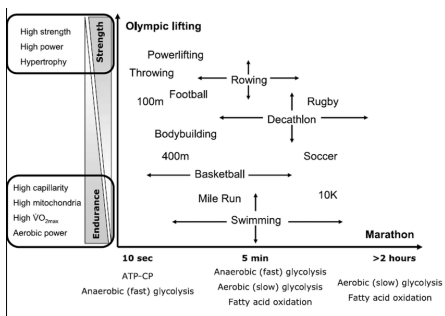
Biological Energy Systems



Three basic energy systems exist in mammalian muscle cells to replenish ATP:

- The phosphagen system
- Glycolysis
- The oxidative system

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Strength
High strength
High power
Hypertrophy

Endurance
High capillarity
High mitochondria
High $\dot{V}O_{2max}$
Aerobic power

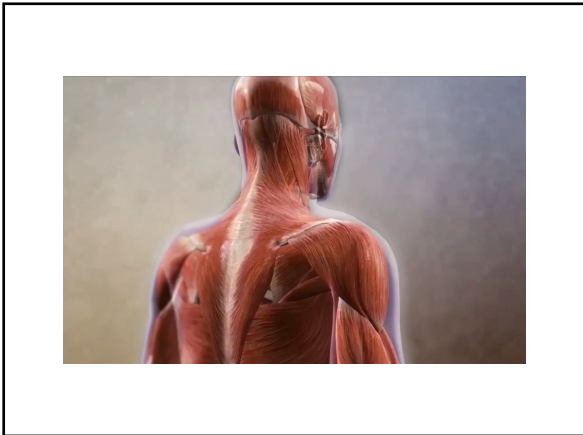
10 sec
ATP-CP
Anaerobic (fast) glycolysis

5 min
Anaerobic (fast) glycolysis
Aerobic (slow) glycolysis
Fatty acid oxidation

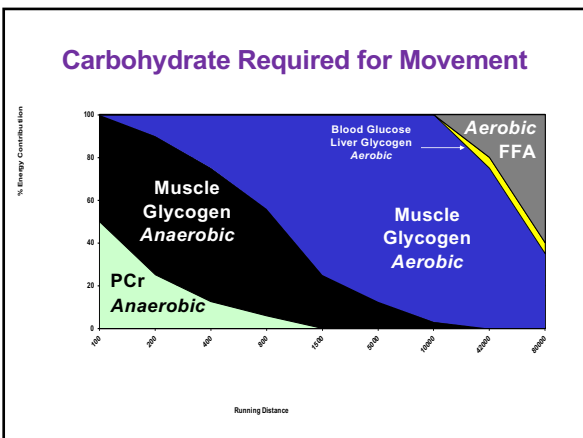
>2 hours
Aerobic (slow) glycolysis
Fatty acid oxidation

Sports: Olympic lifting, Powerlifting, Throwing, Football, 100m, Bodybuilding, 400m, Basketball, Mile Run, Swimming, 10K, Marathon, Rugby, Soccer, Decathlon, Rowing.

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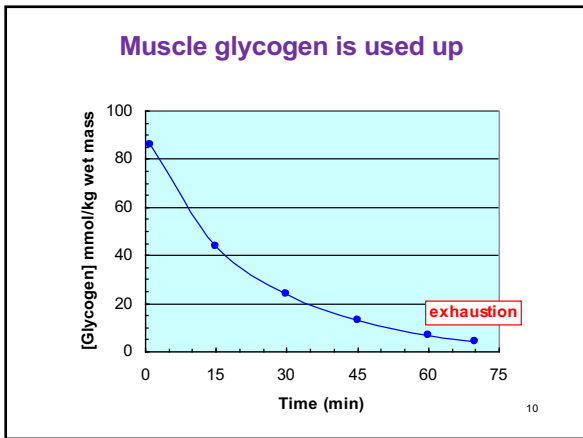


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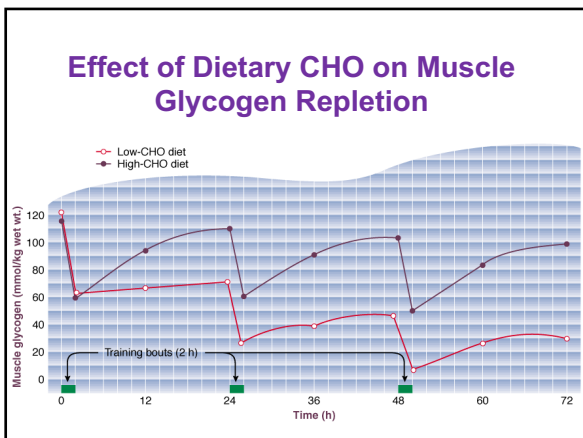
Finite Fuel stores in 65 kg man

Store (Tissue)	Weight (g)	Energy (MJ)	Starvation (days)	Running (min)
Glucose (Extracellular)	20	0.3	0.03	4
Glycogen (Liver)	90	1.5	0.15	18
Glycogen (Muscle)	350	6	0.6	70
Protein (Body)	8800	150	15	1800
TAG (Adipose)	9000	340	34	4000

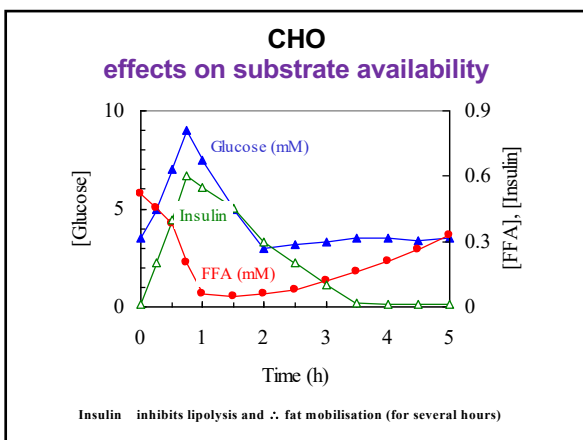
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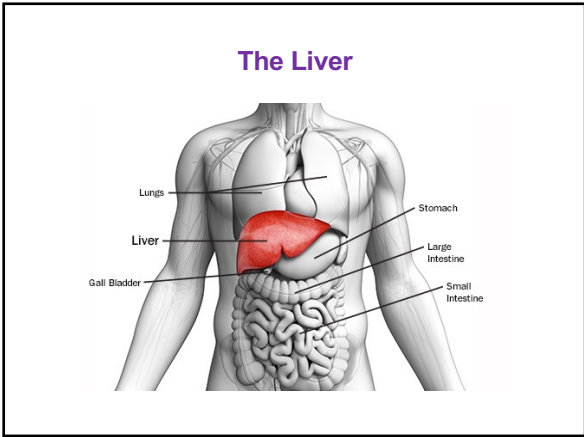
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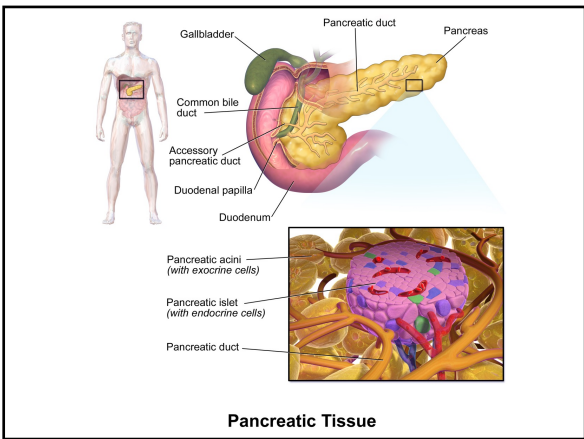
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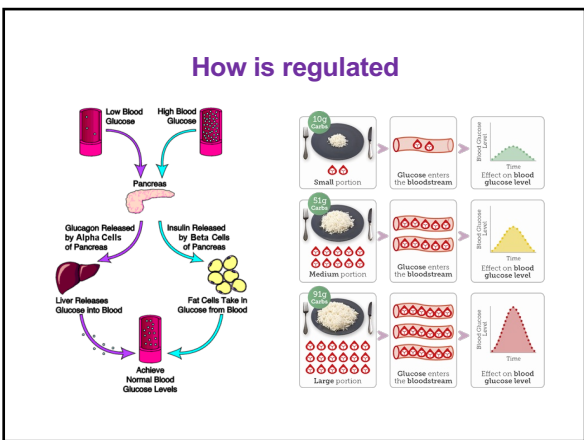
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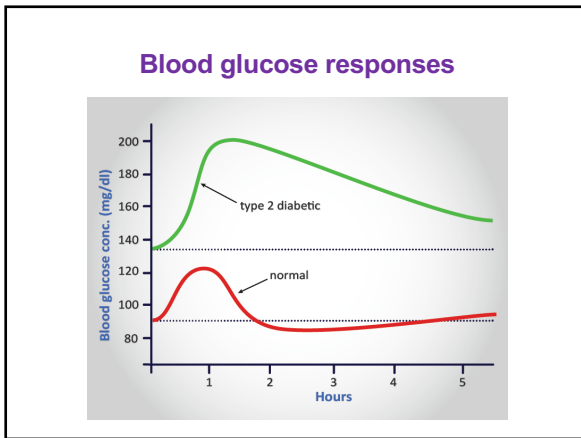
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Diabetes mellitus

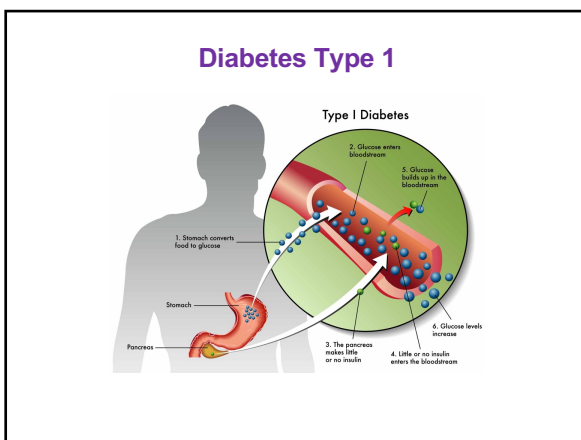
- Diabetes mellitus (DM) is a long-term metabolic disorder;
- 3.7 million people in UK with DM (2018):
 - 10% type 1;
 - 90% type 2.
- Acute effects and chronic complications;
- Increased risk of premature death.

Healthy: Pancreas produces insulin, which binds to receptors on cells to allow glucose entry.

Type 1: Pancreas failure to produce insulin. No insulin is available to bind to receptors.

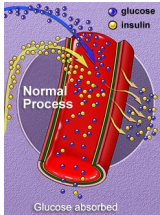
Type 2: Cells fail to respond to insulin properly. Insulin is present but ineffective.

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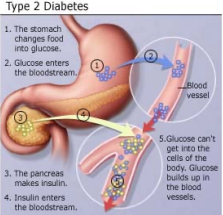
Diabetes Type 2



Normal Process
Glucose absorbed



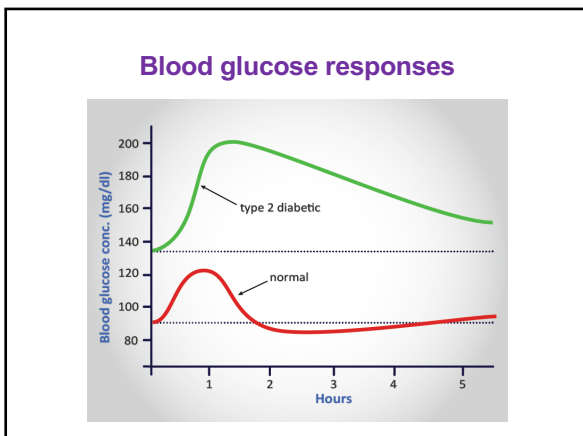
Insulin Resistance
Glucose stays in blood



Type 2 Diabetes

1. The stomach changes food into glucose.
2. Glucose enters the bloodstream.
3. The pancreas makes insulin.
4. Insulin enters the bloodstream.
5. Glucose can't get into the cells of the body. Glucose builds up in the blood vessels.

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Diabetes mellitus: characteristics

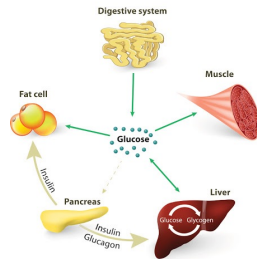
Factor	Type 1	Type 2
Age of onset	< 20 (normally)	> 40 (normally)
Family history	Infrequent	Frequent
Appearance of symptoms	Rapid	Slowly (insidious)
Use of insulin medication	Always	Possibly
Body fatness	Lean (typically)	Obese (associated)

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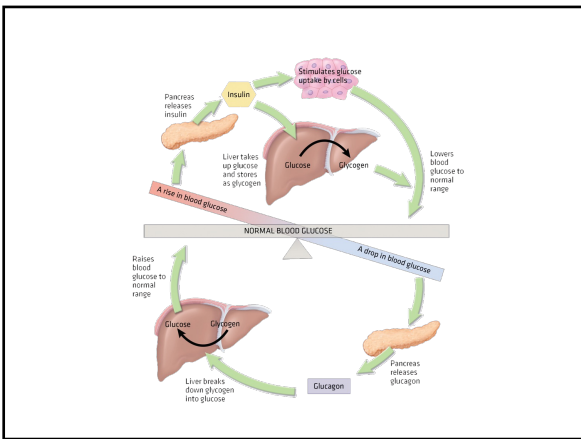
Carbohydrate metabolism and blood glucose control

- Glucose (carbohydrate) is the body's preferred source of fuel for energy transformation

- **Insulin and glucagon**

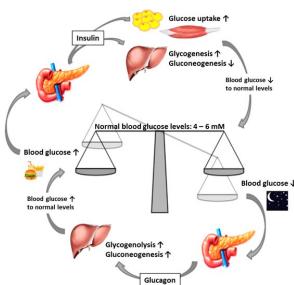


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Glycogenolysis



Glycogenolysis in muscle makes glucose available for immediate energy transformation.

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Gluconeogenesis

Gluconeogenesis is the metabolic process by which organisms produce sugars for catabolic reactions from non-carbohydrate precursors.

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Diet and Nutrition?

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