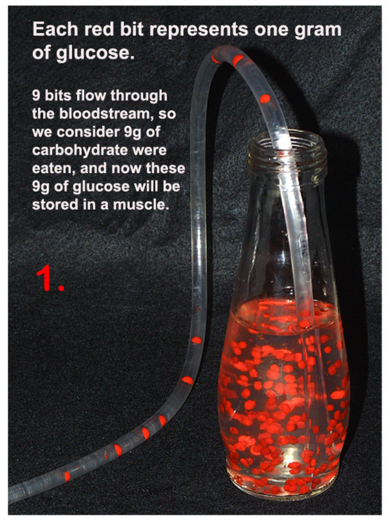
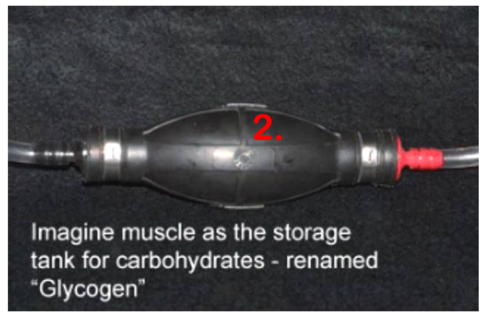
Glycogen Depletion Illustrated - Relative to RER & Physical Activity

Part I: Delivery of Glucose and How it gets Stored as Glycogen



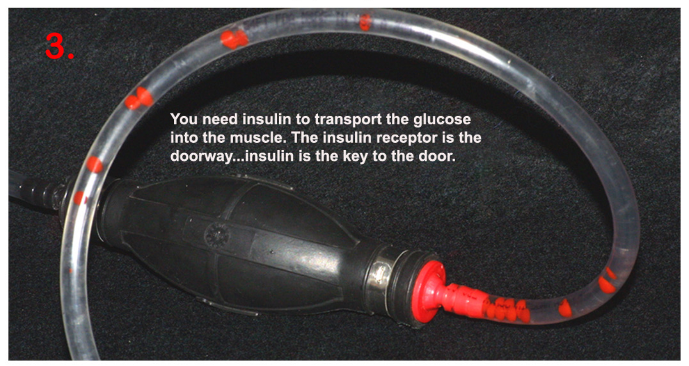
1. Orbitz: a discontinued soft drink was made with neutral density particles. Each bit represents blood sugar, specifically either a glucose molecule or 1 gram of glucose - depending on the lesson.



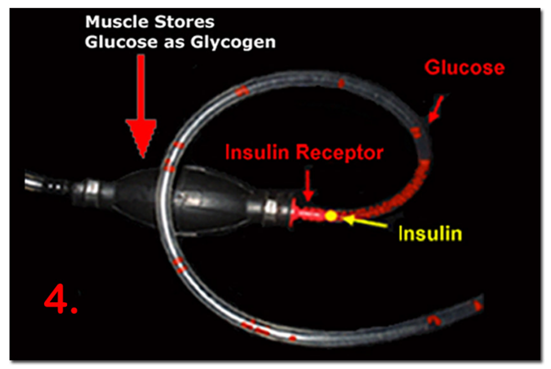
2. The siphon bulb represents a muscle, where glucose is stored as glycogen.

Glyocgen is your body's storage form of carbohydrate; storage capacity is limited by the amount of muscle mass. Hence, we can view muscles as the 'gas tank' for carbohydrates.

3. Muscle 'uptake glucose' where each unit is chained together as glycogen.



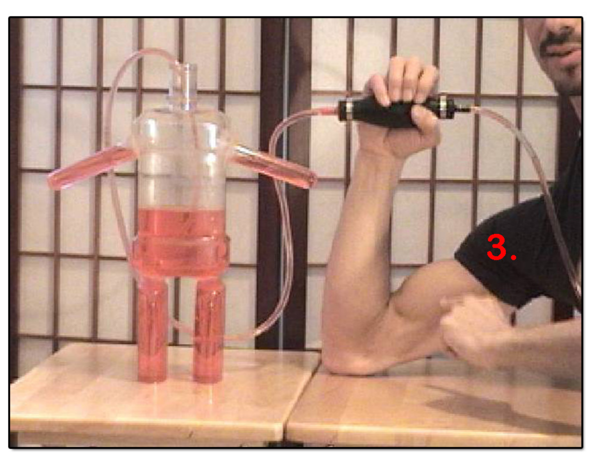
4. The total picture. The bloodstream delivers glucose to muscles.

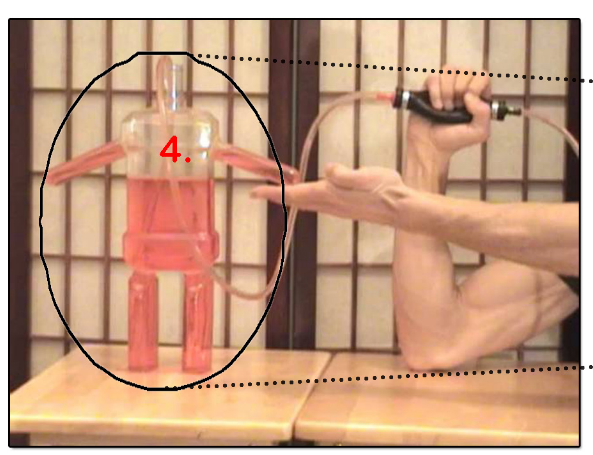


Part II: Breakdown of Glycogen and How it gets Utilized by Your Body

1. Imagine the volume of red liquid in figurines to be equal to the amount of glycogen (carbohydrates) collectively stored in all the muscles.
2. Glycogen breaks down back to glucose 'on demand' as fuel to power your cells.

3. As you repetitively contract muscles, you deplete glycogen in a quantity proportional to the speed of repetition and the resistance level your muscles work to overcome.



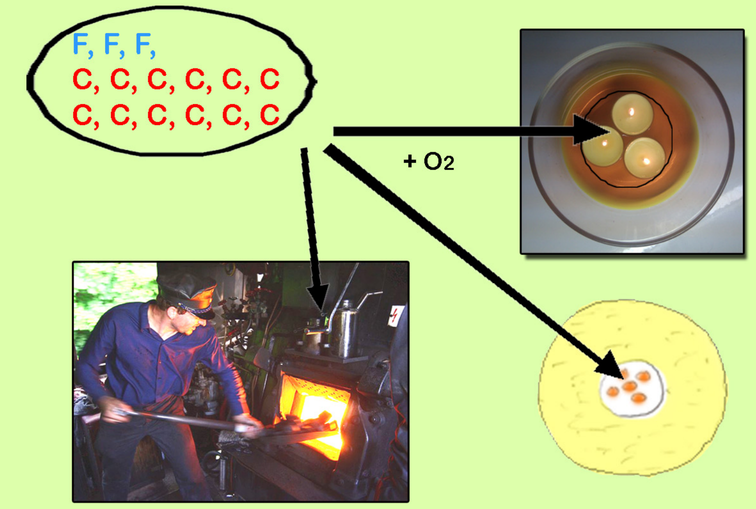


4. Both the quantity and rate of glycogen depleted is determined by the intensity and duration of working your muscles.

Glycogen Depletion Relative to RER & Physical Activity

BELOW: Shows how delivering fat (F) and glucose/carbohydrate (C) appears like to a cell - in terms of fuel substrate utilization at a fairly high intensity level.

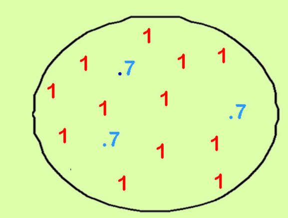
Each 'F' = 1 Fat molecule
Each 'C' = 1 Carb (glucose) molecule



We know each F produces a ratio of 16/23 = .7
3 F's combusted so we have three ".7's"

We know each C results in ratio of 6/6 = 1
12 C's combusted , so we have twelve 1's

Calculate the average for this set of numbers:



Note: There are 15 molecules burned, so we divide by 15

.7 + .7 + .7 + **twelve 1's** = 14.1

14.1/15 = .94

As you increase intensity level, you combust more glucose within the mitochondria (firebox), as explained in Lesson 9... thus your RER approaches 1. This corresponds to physical exertion beyond the 'Critical Point' in the red zone, pictured below.

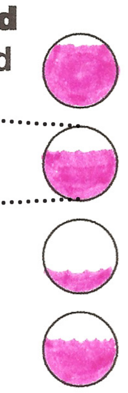
Intensity level and duration of exercise determine both the rate and quantity of glycogen. 'Proper' intake of carbohydrate is relative to your body's depletion of glycogen stores.

DEPLETING MUSCLE GLYCOGEN IS ANALOGOUS TO DRAINING A GAS TANK: as shown below

Notice below, how only a 15% increase in intensity level (increasing from 60% to 75% maximum) results in more than doubling the amount of glycogen depleted. This is analogous to moving past the critical point, above. These 'depletions' relate to 2 different groups of people beginning with 'loaded glycogen' stores.

The sudden and sharp increase of glycogen depletion happens because 'way more' glucose is 'wasted' due to increased glycolysis in the cytosol, as illustrated in lesson 6. I call this, 'Crazy Glycoysis' - the point you enter the RED ZONE in the Carbohydrate Continuum. Crazy glycolysis is essentially ***super fast depletion of glycogen***, which happens when 'running or working' at too fast a pace. This pace corresponds to surpassing your 'lactate threshold' - illustrated in the next lesson! Get ready to not just feel, but SEE the burn.

Intensity	Duration	Tradeoff fat/carbs	Glycogen Used Total Depleted
30% max	60 min	60/40	10% Gone
60%	60 min	30/70	30% Gone
75%	60 min	25/75	70% Gone
90%	30 min**	5/95	35% Gone



Less than 1/3 of the body's glycogen was depleted at 60% max, but a 15% increase caused a depletion of more than 2/3 of the total.

Each situation began with a 'full tank' of glycogen.

** subjects quit due to fatigue from working at too high of an intensity level.
Adapted from Costill & Miller, JM. Int J Sports Med. 1980. p.2-14