GLUT4 on PBMC in Conditioned vs. Sedentary College Students

Kendra Sticka, MS, RD
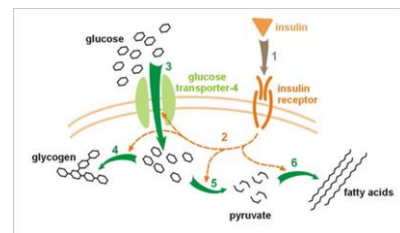### PhD Student

Terminology: Glucose Transporter-4 (GLUT4)
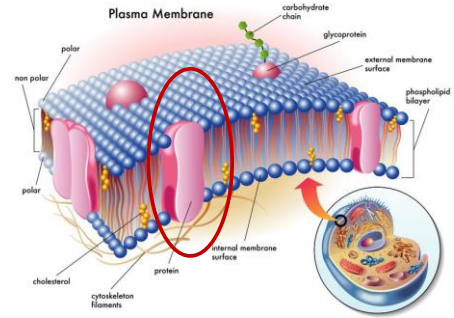
GLUT4 and Glucose Transport
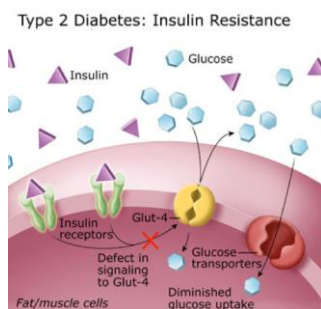
Retrieved from http://evolutionmedicine.com/2013/09/28/october-2-no-writing-assignment/ 3/22/15

Insulin-Stimulated GLUT4 Activity

Mossop, 2010, Nutrition Wonderland
http://nutritionwonderland.com/2010/01/glucose-brain-alzheimers-diabetes/
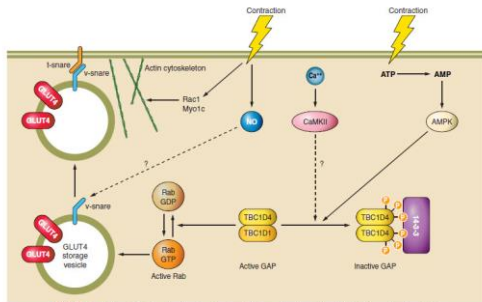
Exercise-Stimulated GLUT4 Activity

FIGURE 4. Schematic of molecular signaling involved in contraction-induced GLUT4 translocation to the surface membrane. See text for details. Dotted lines indicate probable but not proven pathways.
Richter & Hargreaves, Phys Rev, 2013

http://www.vtnews.vt.edu/articles/2013/03/032013-fralin-diabetesgrant.html
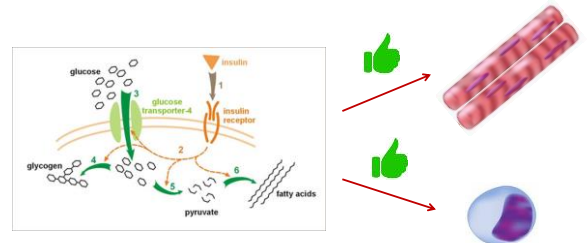
Terminology: Peripheral Blood Mononuclear Cells (PBMC)

Blood cells

Insulin-Stimulated GLUT4 Activity by Cell Type

Mossop, 2010, Nutrition Wonderland
http://nutritionwonderland.com/2010/01/glucose-brain-alzheimers-diabetes/

Exercise-Stimulated GLUT4 Activity by Cell Type
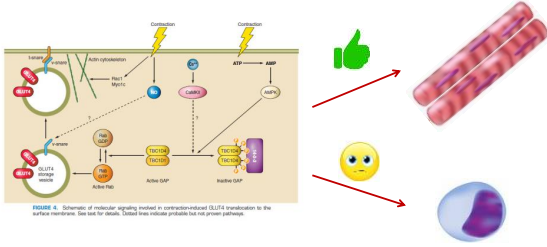
Study Design

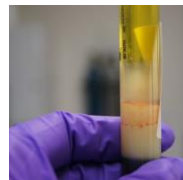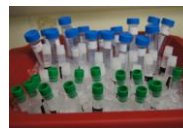UAF Students aged 18-25; male and female

16 competitive, endurance athletes

16 self-reported sedentary students

Sample and Data Collection

Lab Analysis

TABLE 1: Demographics

Parameter	Conditioned	Sedentary
n	16	15
Age (years)	20.1 ± 2.0	21.5 ± 2.1
Gender:		
Male	8	8
Female	8	7

Demographic data as reported on health history form.
Data are means ± standard deviations.
No significant differences between groups for age or gender.

TABLE 2: Anthropometrics

Parameter	Conditioned Mean	Sedentary Mean	p-value
Body Mass Index (kg/m^2)*	21.7 (1.8)	24.8 (5.3)	0.05
Body Fat (%)	17.2 (8.0)	22.4 (8.9)	0.10
Waist Circumference (cm)	72.9 (5.8)	80.7 (13.9)	0.06
Basal Metabolic Rate (kcal/day)	1616 (212)	1718 (330)	0.31

Data are reported as means (standard deviations).
* $p \leq 0.05$; others non-significant at $p > 0.05$

TABLE 3: Diet

Parameter	Conditioned Mean	Sedentary Mean	p-value
Fruit and Vegetable Intake (servings/day)	3.8 (2.2)	1.9 (1.1)	0.005*
Caloric Intake (kcal/day)	3022 (951)	2041 (756)	0.004*
Cal from Carbohydrate (%)	51.7 (5.1)	47.5 (6.8)	0.060
Cal from Fat (%)	34.5 (3.9)	35.6 (5.2)	0.488
Cal from Protein (%)	15.4 (2.1)	14.3 (2.7)	0.223
Sugar Intake (g/day)	171.5 (63.2)	104.7 (46.0)	0.002*
Fiber Intake (g/day)	29.0 (11.2)	14.2 (7.5)	< 0.0001*

Dietary data as assessed by ASA24 program. Data are reported as means (standard deviations).
* significant at $p \leq 0.05$

TABLE 4: Lipids

Parameter	Conditioned Mean	Sedentary Mean	p-value
Total Cholesterol (mg/dl)	167.4 (25.3)	168.0 (24.2)	0.95
LDL (mg/dl)*	95.5 (32.8)	95.3 (16.9)	0.99
HDL (mg/dl)	68.0 (10.2)	59.5 (17.4)	0.10
	Mean Rank†	Mean Rank	
Triglycerides (mg/dl)*	13.38	18.80	0.10

Data are reported as means (standard deviations).
No significant differences between groups were identified for lipids.
* 45 mg/dl is the lowest detectable level of triglycerides with the Cholestech LDX; LDL is calculated with the Friedewald formula using triglycerides. For participants with triglycerides lower than the detectable limit, a value of 22.5 was assigned and LDL was calculated using that value. This was done for six participants from the conditioned group and two participants from the sedentary group.
† Triglycerides had a non-normal distribution therefore the Mann-Whitney U test was conducted. The distributions between groups were not similar as assessed by visual inspection therefore mean ranks were compared for analysis. $U = 162.000$, $z = 1.675$

TABLE 5: Glucose and Insulin-Related Labs

| Parameter	Conditioned Mean	Sedentary Mean	p-value
Glucose (mg/dl)	90.8 (8.1)	93.4 (10.4)	0.43
HbA1c (% / mmol/mol)	5.1/32(0.3)	5.0/31 (0.2)	0.49
	Mean Rank*	**Mean Rank**	
Fasting serum insulin (μIU/ml)	13.66	18.50	0.14
HOMA-IR†	13.69	18.47	0.15

Data are reported as means (standard deviations).
No significant differences between groups were identified for the glucose and insulin-related measures.
* Serum insulin and HOMA-IR had non-normal distributions therefore the Mann-Whitney U test was conducted. For both measures, the distributions between groups were not similar as assessed by visual inspection therefore mean ranks were compared for analysis. For insulin $U = 157.5$, $z = 0.483$; for HOMA-IR $U = 157.00$, $z = 1.436$
† HOMA-IR calculation: [fasting serum glucose (mmol/L) * fasting serum insulin (μIU/ml)] / 22.5

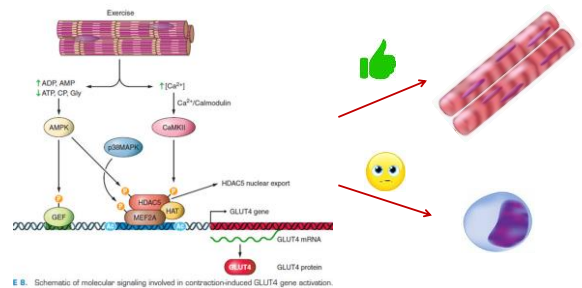## FIGURE 1: GLUT4 Protein in Conditioned vs. Sedentary Participants
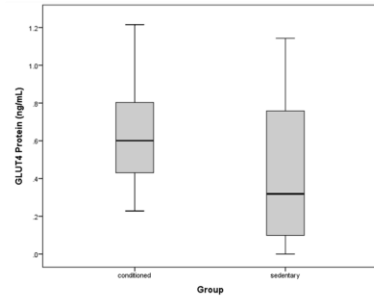
The conditioned group had higher PBMC GLUT4 on the cell surface than the sedentary group, although it was not significantly different (p = 0.07).

My Next Question....Gene Expression
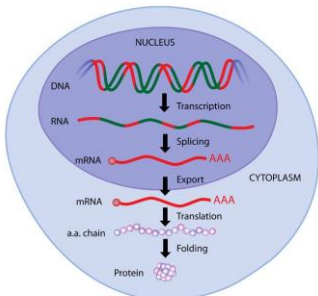
SLC2A4 (*GLUT4*) Gene Expression

Richter & Hargreaves, Phys Rev, 2013

mRNA Analysis: In progress

Thank you!

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