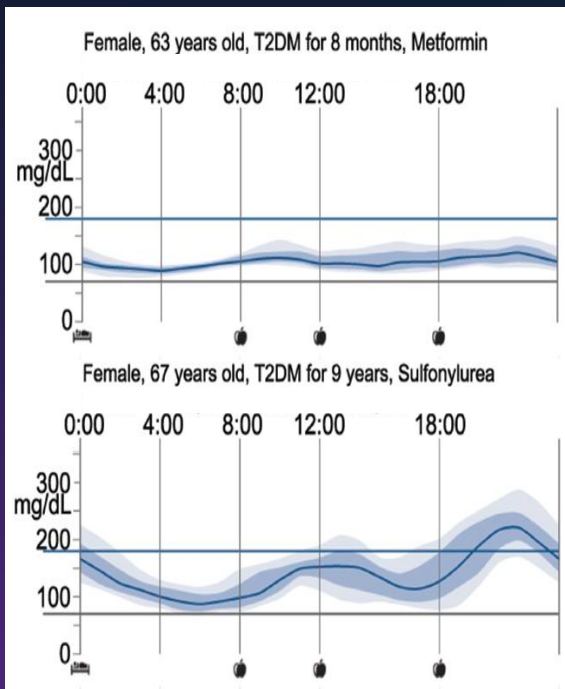




Large individual variation and smaller racial group differences in red blood cell glucose uptake may contribute to discordance between HbA1c and average glucose

JOEL PAPROCKI, PATRICK MACDONALD, YONGJIN XU, ALAN CHENG, TIMOTHY DUNN

CGM data



Midyett et al. Clin Diabetes. 2019 Jan;37(1):57-64.

Average glucose to HbA1c conversion

$$\text{Est Avg Glucose} = (28.7 \cdot \text{HbA1c}) - 46.7$$

HbA1c (%)	Estimated Average Glucose (mg/dL)	14-day Average Glucose (mg/dL)
6.0	126 95% CI (100-152)	105
6.0	126 95% CI (100-152)	143

Why?

Why?



For concentration, intracellular glucose is what matters

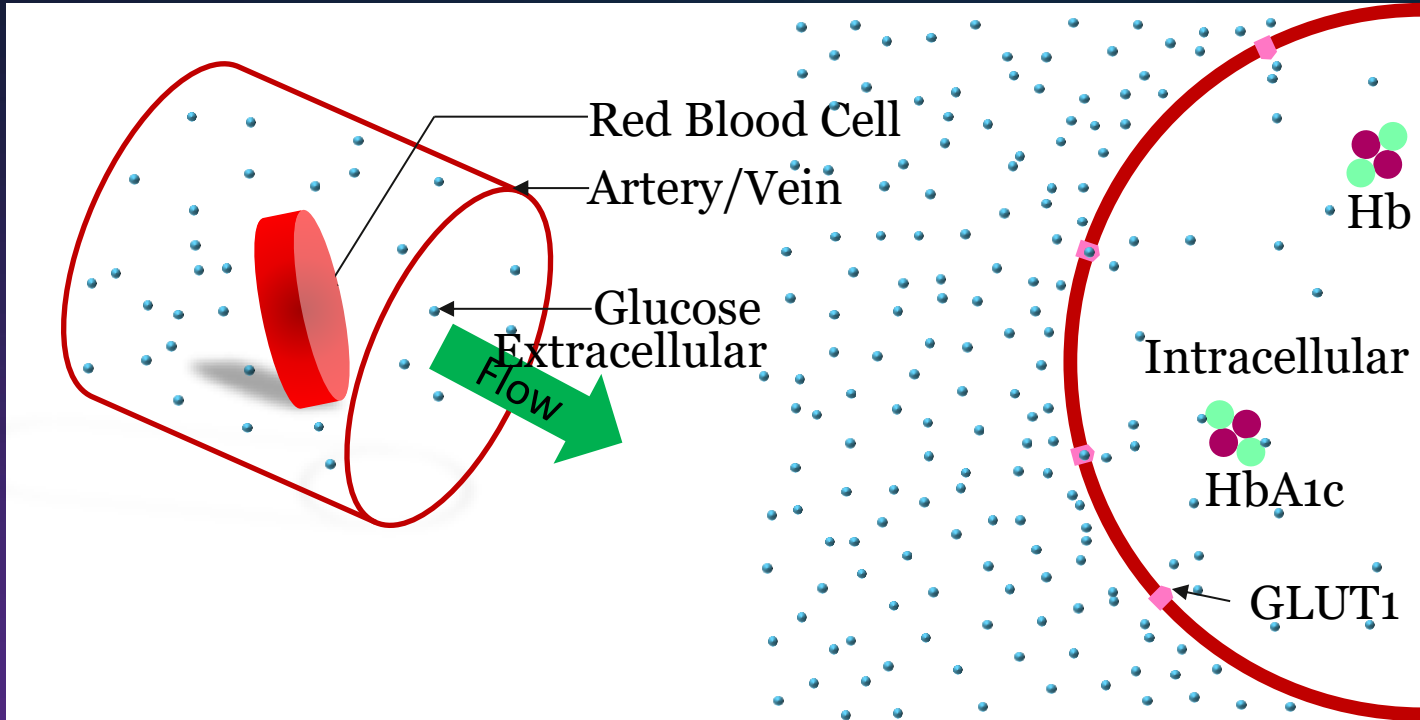
Plasma glucose is measured outside the cells

HbA1c is measured inside the cells

The two glucose levels (outside vs inside) are not necessarily a 1:1 relationship

We aimed to investigate this relationship at a single cell level, across several subjects

GLUT1 transports glucose into and out of RBCs



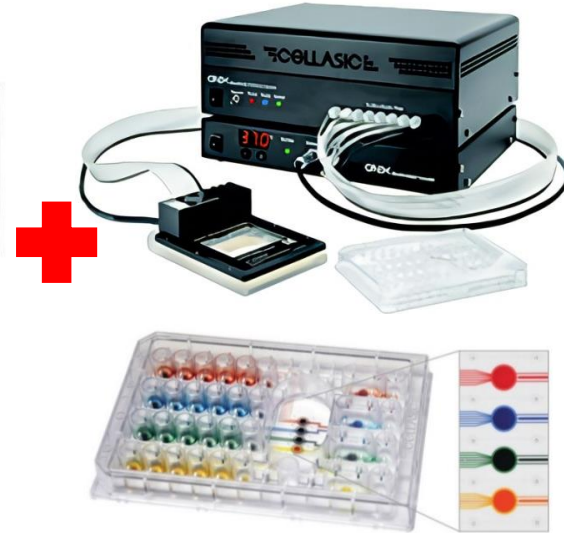
Instrumentation

Fluorescent glucose-analog tracer = **2-NBDG** or 2-(7-Nitro-2,1,3-benzoxadiazol-4-yl)-D-glucosamine

Confocal Microscope

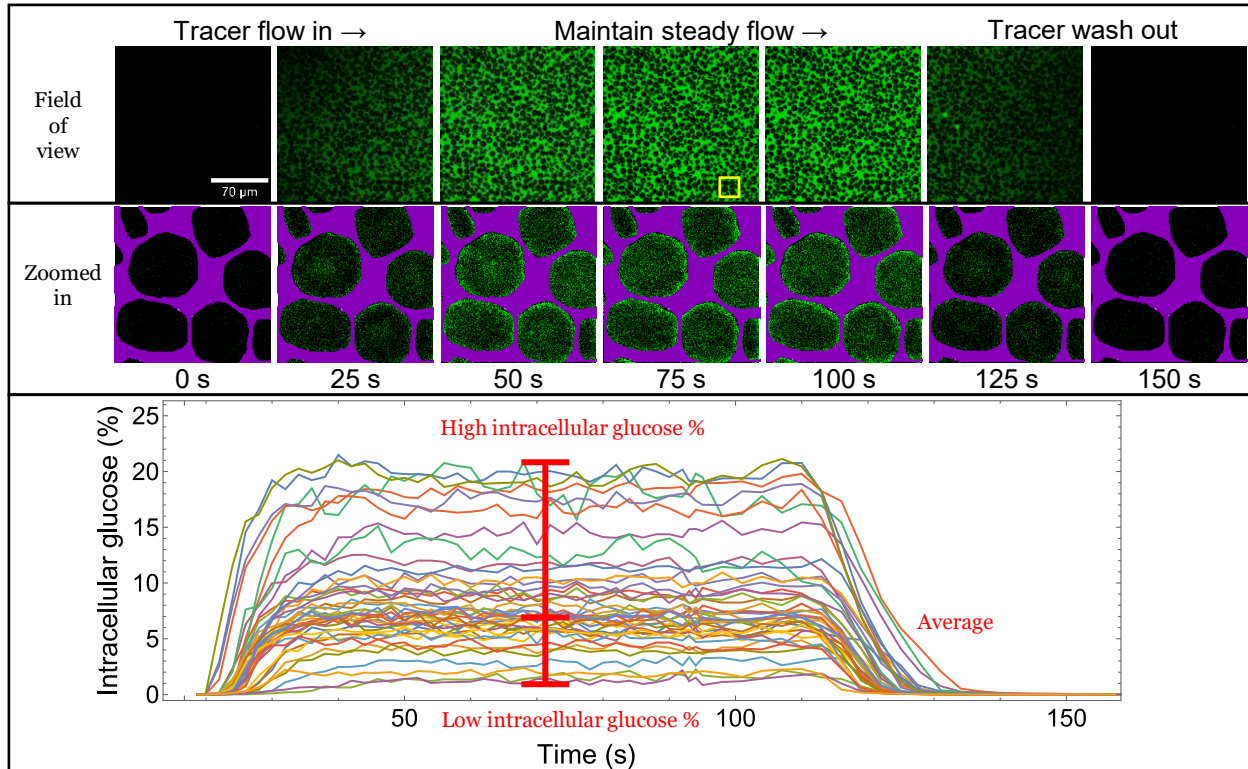


Microfluidics

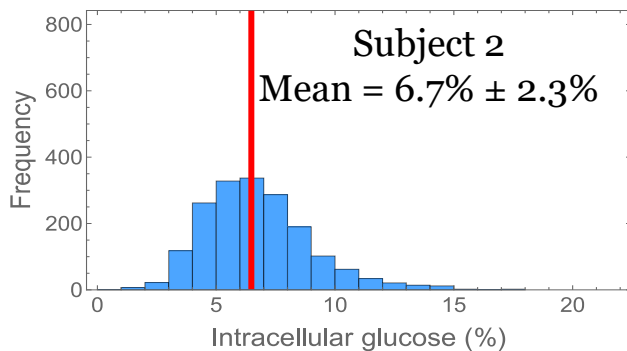
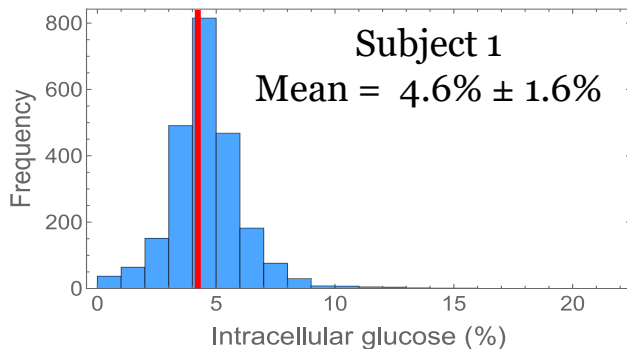


The flow experiment

Intracellular glucose (%) =
median intracellular intensity/
median extracellular intensity

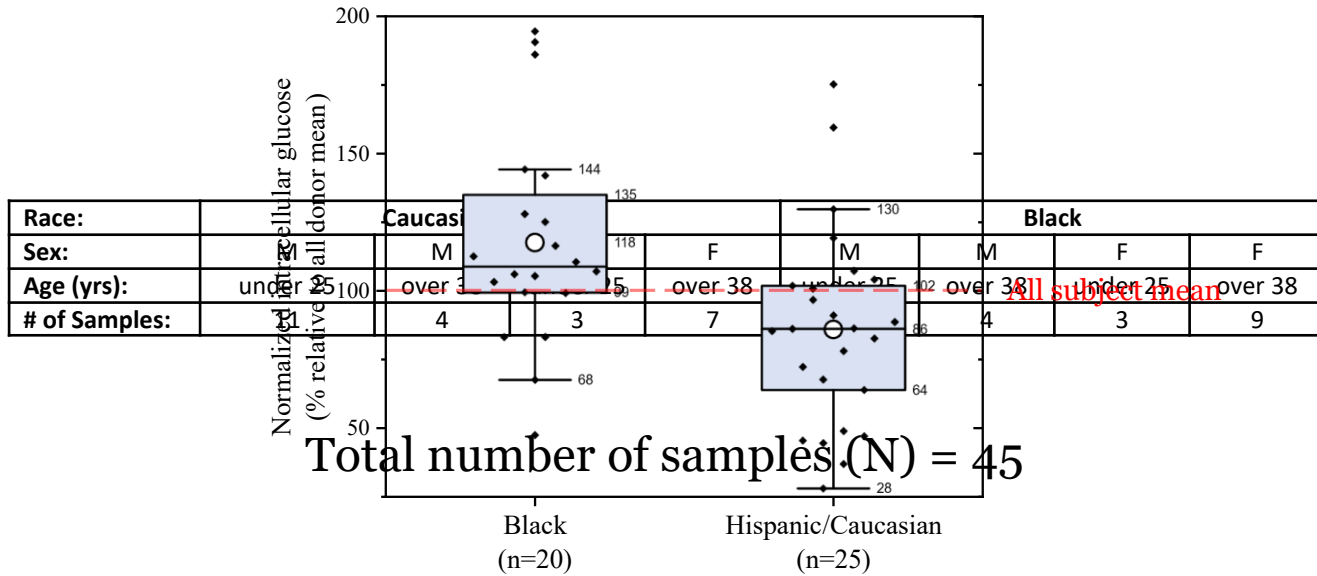


Characteristic intracellular glucose %



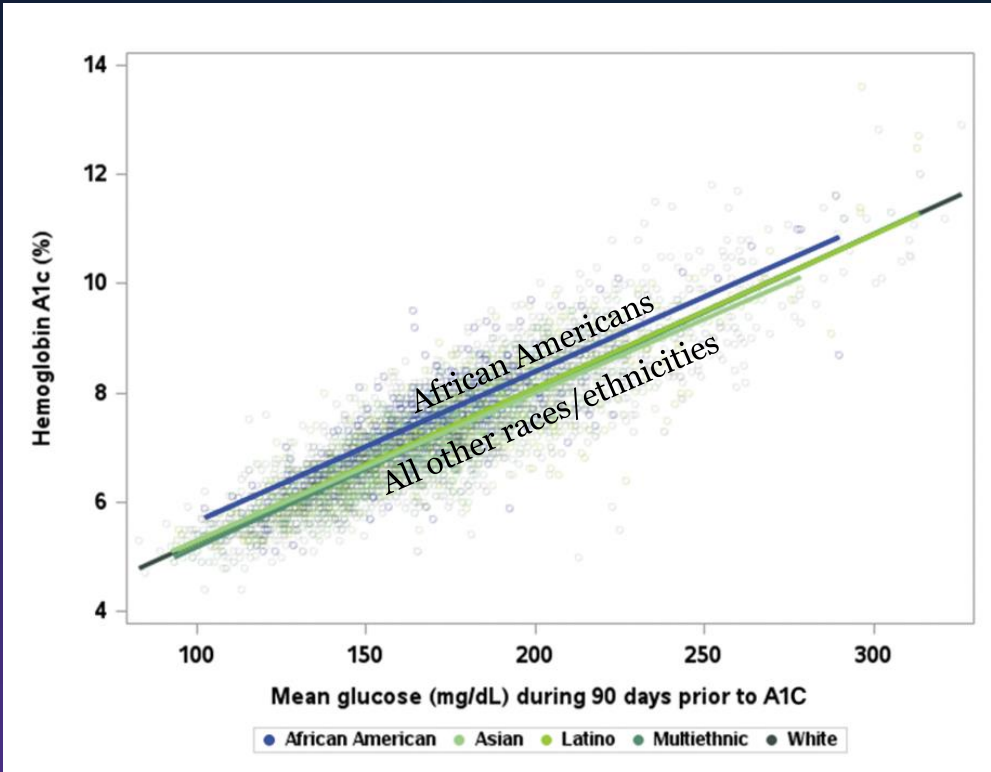
For the same extracellular glucose level, subject 2 has higher intracellular glucose

Subject panel study



Mean	p-value
Black: 6.0%	0.007
Caucasian/Hispanic: 4.4%	0.003

Glucose uptake results correlate with observed racial differences



Karter, A.J., et al., *Racial and Ethnic Differences in the Association Between Mean Glucose and Hemoglobin A1c*. *Diabetes Technology & Therapeutics*, 2023. 25(10)

Summary

- Glucose uptake is highly variable both within and across subjects
- Red blood cells take up glucose differently depending on race of the subject
- Further research is needed into the clinical effects of glucose uptake variation and what the related clinical outcomes are

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Any questions?



Abbott