

Insulin vs. Glucagon

The relevance of dietary protein

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INSULIN  TM

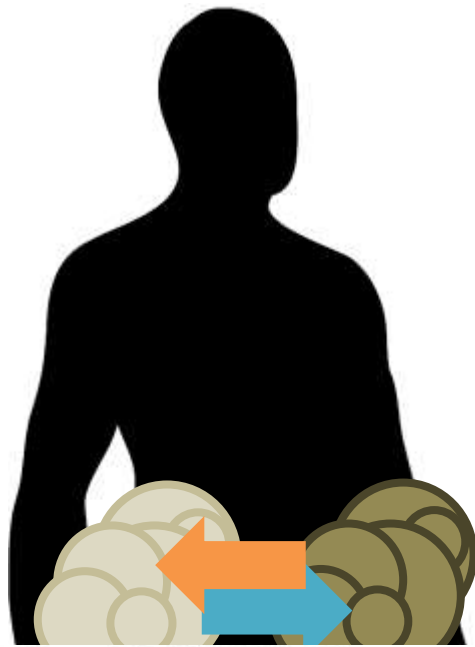
I'm a founder of Insulin IQTM, a group that promotes education for people who are tired of being sick and fat.

InsulinIQ.com

Best **FATS**

I'm a founding partner of Best FatsTM —
a research and nutritional product development
company committed to providing healthy, high-fat
support for better health.

BestFats.com



Update

Final update next year

Biochemical Journal (2018) **475** 561–569
<https://doi.org/10.1042/BCJ20170736>



Research Article

Insulin selectively reduces mitochondrial uncoupling in brown adipose tissue in mice

Blake W. Dallon, Brian A. Parker, Aimee E. Hodson, Trevor S. Tippetts, Mitchell E. Harrison, M. Marissa A. Appiah, Jeffrey E. Witt, Jonathan L. Gibbs, Harrison M. Gray, Thomas M. Sant and Benjamin T. Bikman

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Anabolism

“Feeding and Storing”

Insulin

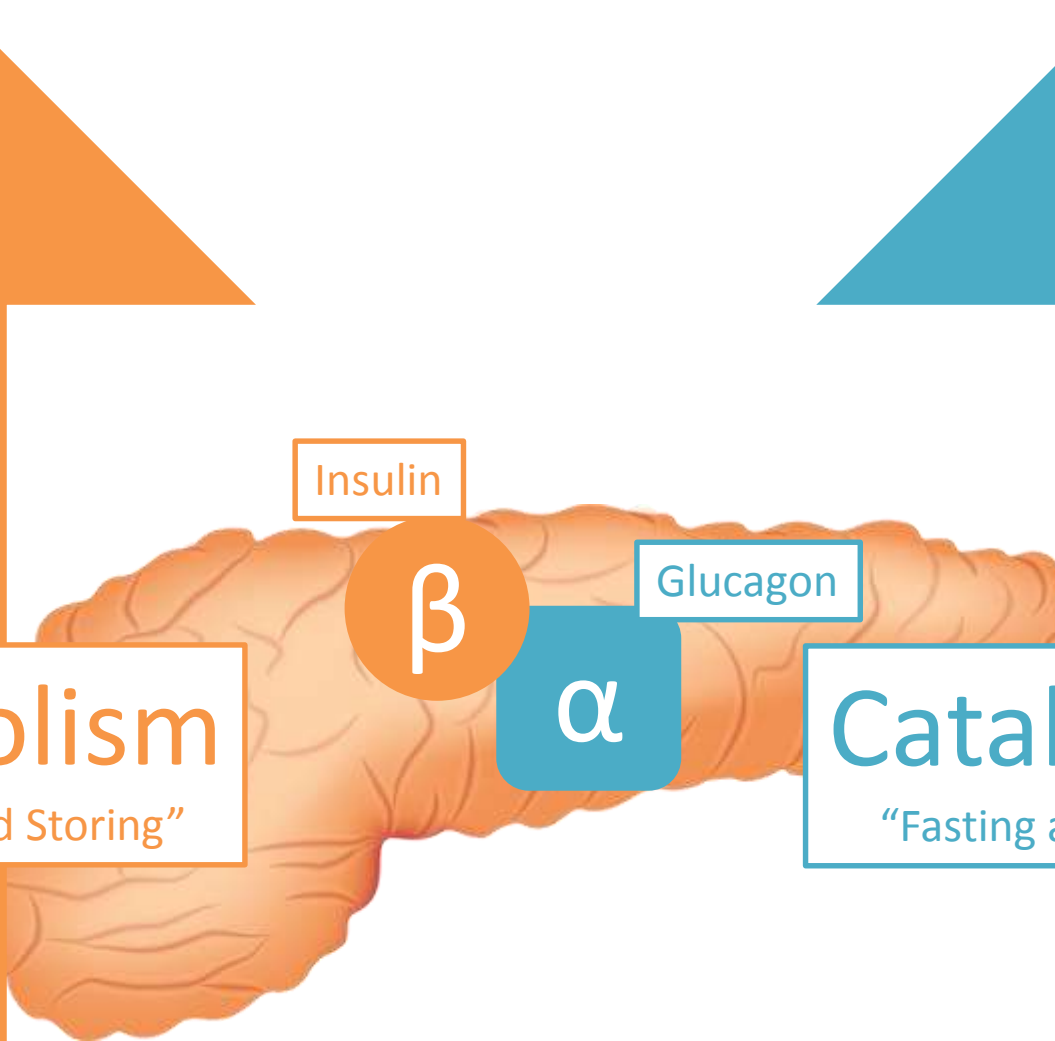
β

Glucagon

α

Catabolism

“Fasting and Burning”



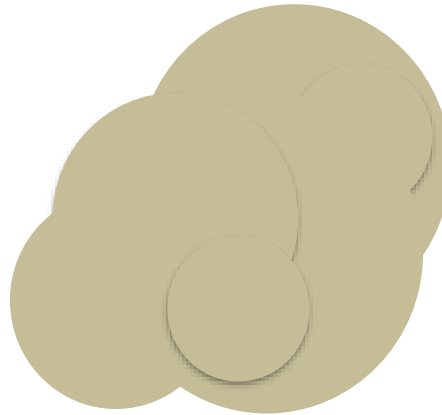
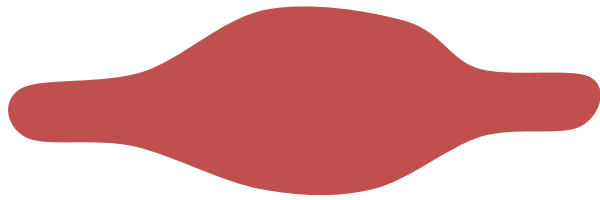
Anabolism

“Feeding and Storing”



Catabolism

“Fasting and Burning”



Glycogenesis
Protein synthesis
Nothing

Lipogenesis
Lipolysis*

Lipogenesis
Glycogenesis
Glycogenolysis
Gluconeogenesis
Lipolysis
Ketogenesis

Anabolism
"Feeding and Storing"



Catabolism
"Fasting and Burning"



Glycogenesis
Protein synthesis
Nothing

Lipogenesis
Lipolysis*

Lipogenesis
Glycogenesis
Glycogenolysis
Gluconeogenesis
Lipolysis
Ketogenesis

Carb

Protein

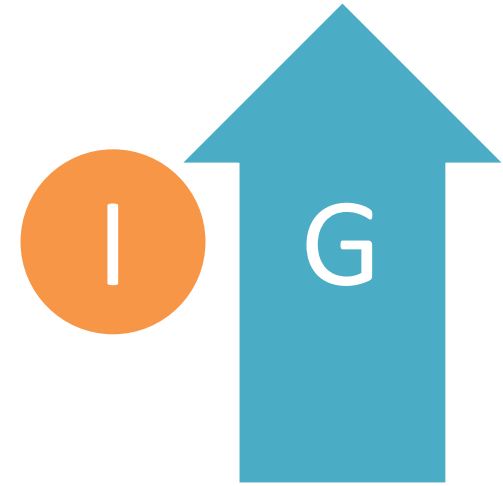
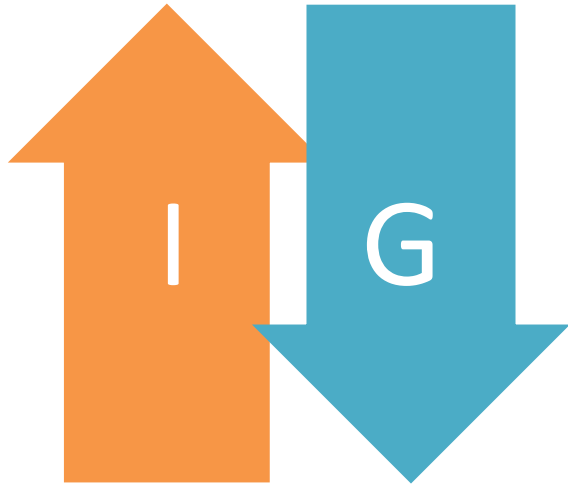
Fat



Carb

Protein

Fat

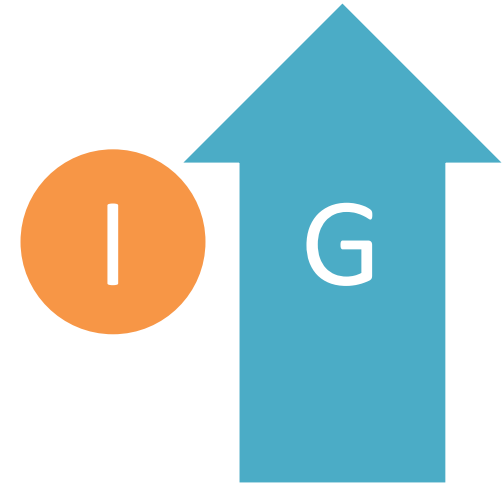
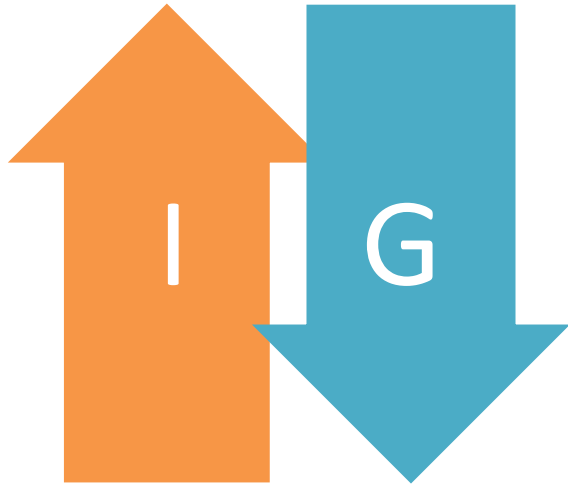


One of these depends on context...

Carb

Protein

Fat



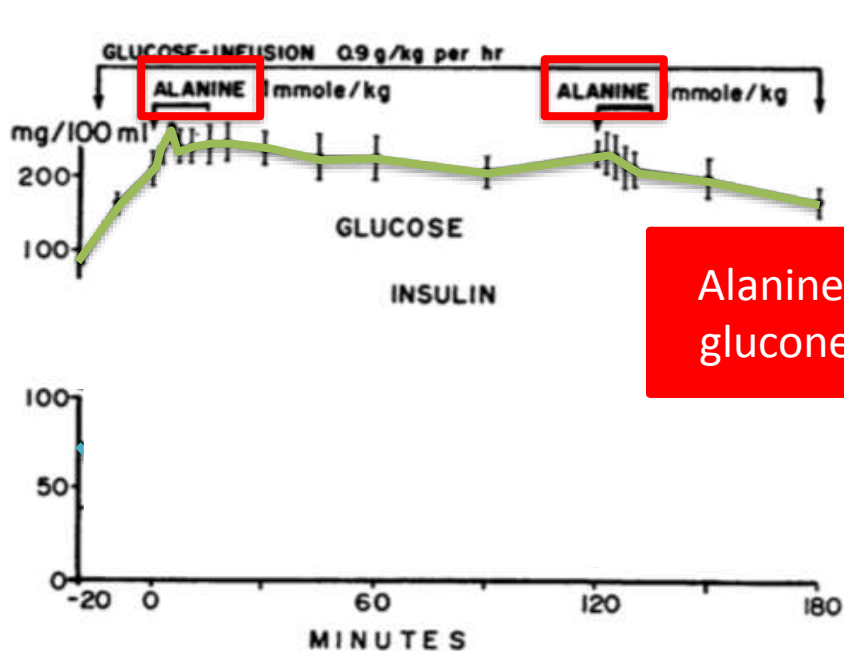
One of these depends on context...

Depends on glycemia

Carb

Protein

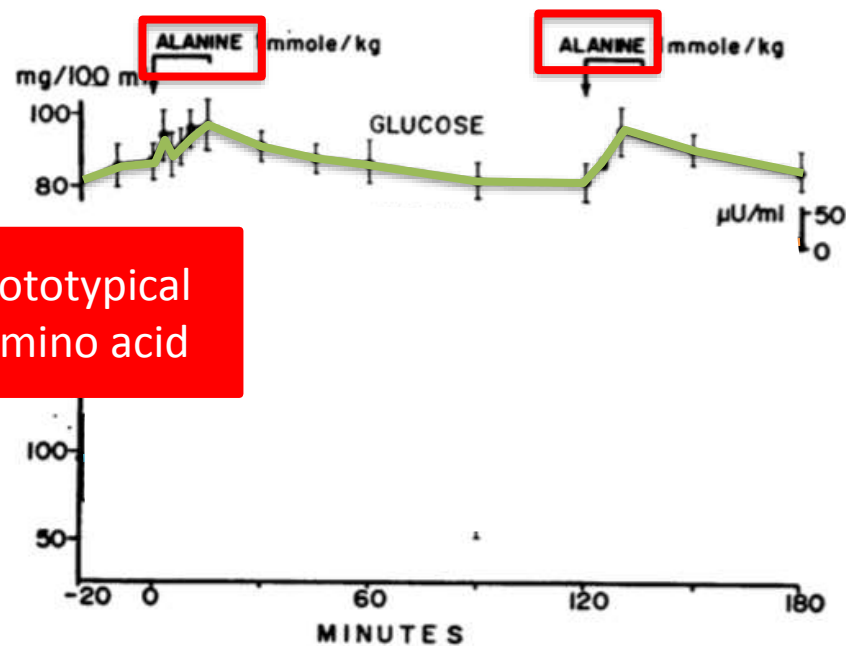
Fat



Alanine is the prototypical gluconeogenic amino acid

- **Glucose** infusion (hyperglycemia)
- Followed by **alanine** infusion

- Significant increase in **insulin** (~130 uU)
- Significant decrease in **glucagon** (~45 pg)



- **Fasted** (euglycemia)
- Followed by **alanine** infusion

- No significant increase in **insulin** (~6 uU)
- Significant increase in **glucagon** (~100 pg)

Carb

Protein

Fat



Lipogenesis

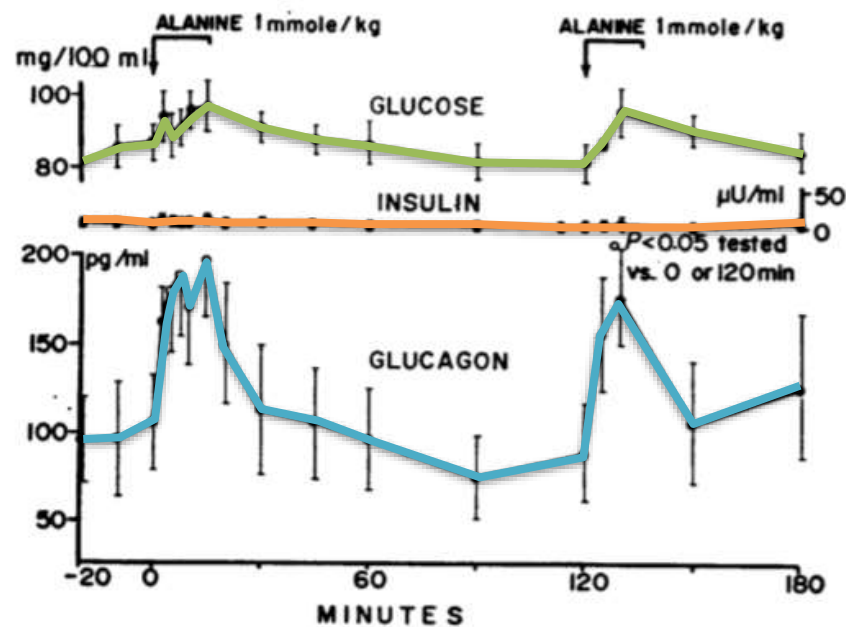
Glycogenesis

Glycogenolysis

Gluconeogenesis

Lipolysis

Ketogenesis

Can't afford to inhibit gluconeogenesis

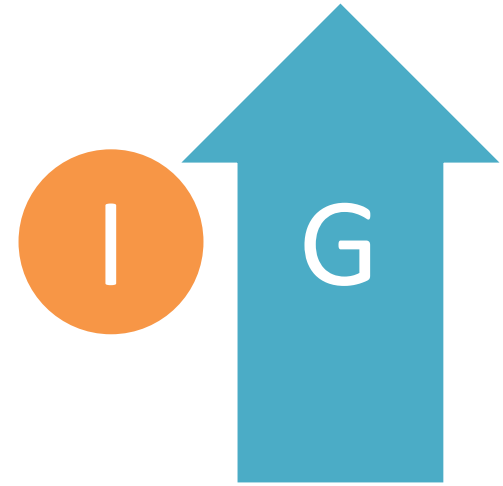
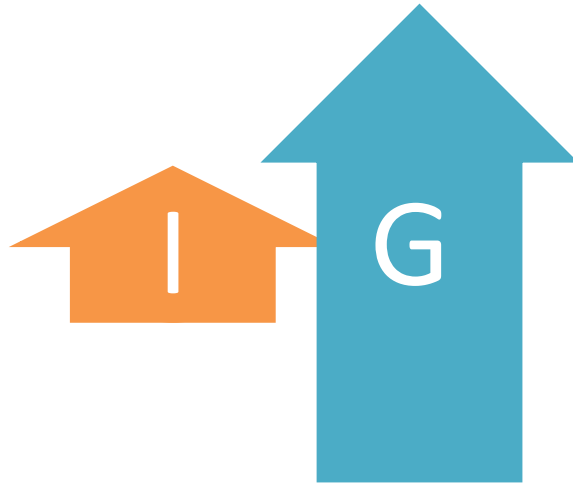
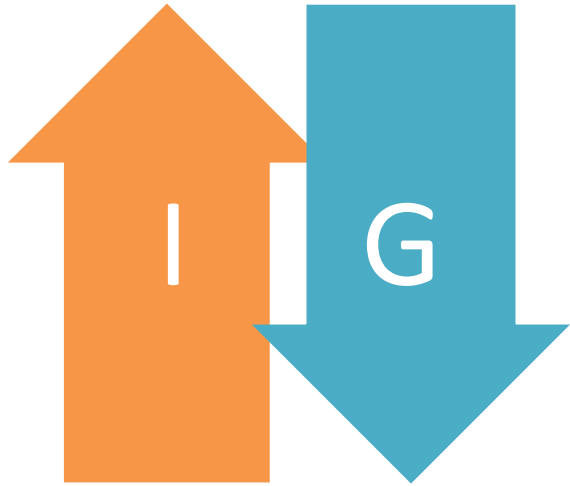
- **Fasted** (euglycemia)
- Followed by **alanine** infusion

- No significant increase in **insulin** (~6 uU)
- Significant increase in **glucagon** (~100 pg)

Carb

Protein

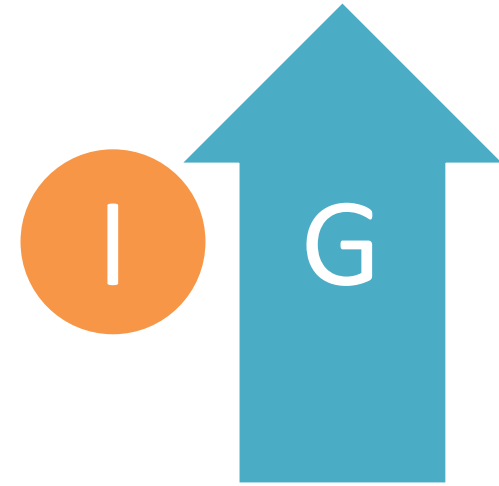
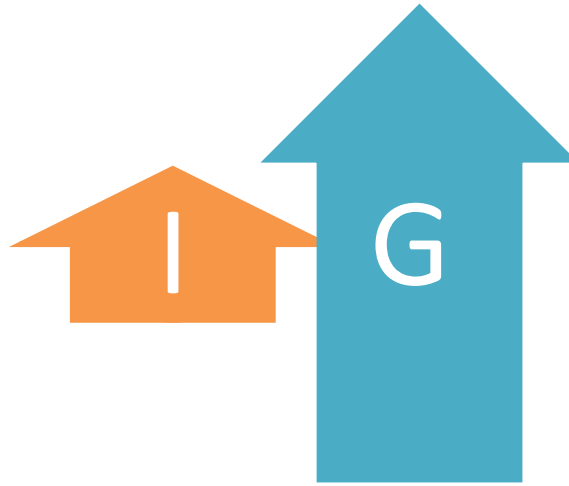
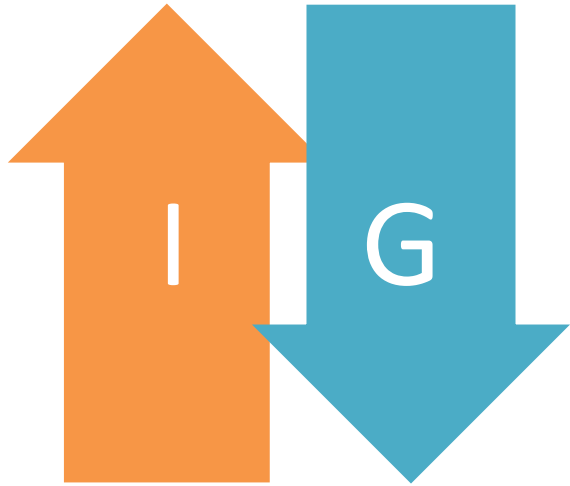
Fat



Carb

Protein

Fat



Insufficient stimulus?

Anabolic
Anabolic
No effect

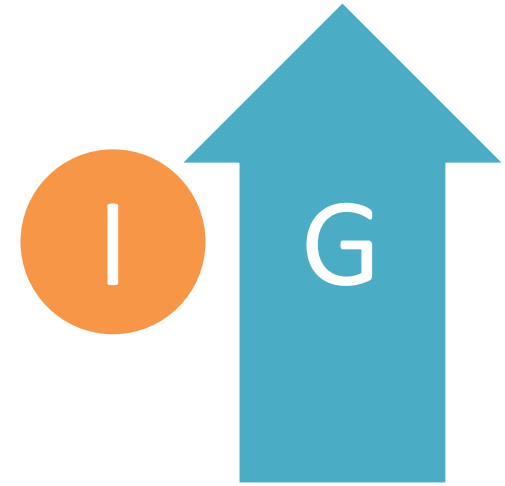
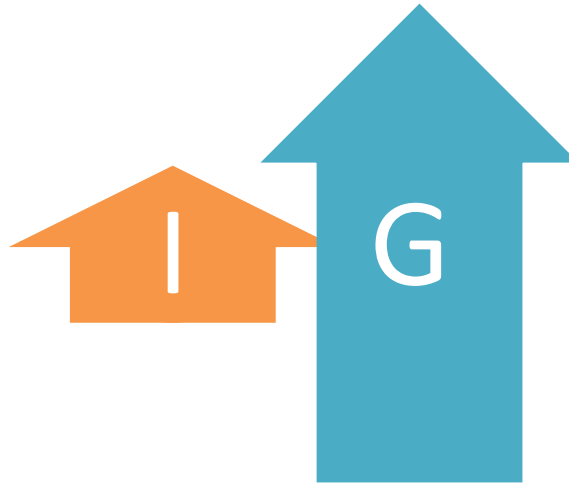
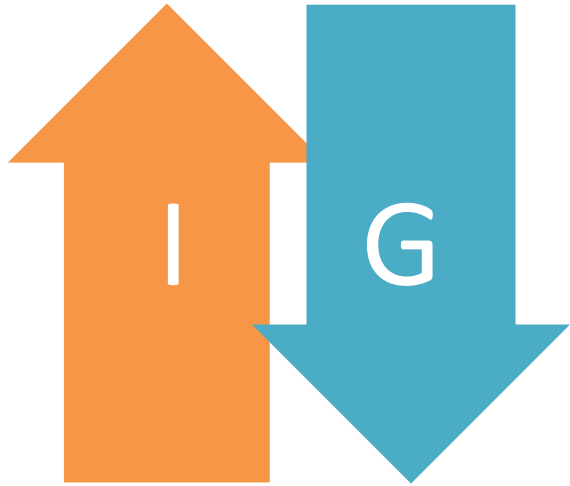
Anabolic
Anabolic/Catabolic
Catabolic

Anabolic
Anabolic/Catabolic
Catabolic

Carb

Protein

Fat



Insufficient stimulus?

Anabolic
Anabolic

Anabolic
Anabolic/Catabolic

Anabolic
Anabolic/Catabolic

A helpful way to appreciate the relevance is to know the
Insulin:Glucagon ratio

The insulin:glucagon ratio is an indicator of the predominating metabolic function



Anabolism

“Feeding and Storing”



Catabolism

“Fasting and Burning”

A helpful way to appreciate the relevance is to know the
Insulin:Glucagon ratio

The Relevance of a low I:G



A low I:G elicits the *benefits of a fasted state*

1. Insulin sensitivity

2. Autophagy

a. Mitophagy

3. Lipolysis

4. BAT activation

...without calorie restriction





I



~.8

Fasting

Catabolic

- Glycogenolysis
- Gluconeogenesis
- Lipolysis
- Ketogenesis



~4



Anabolic

Glycogenesis
Lipogenesis
Inhibition of:
Autophagy
Ketogenesis



~1.3

Catabolic

- Glycogenolysis
- Gluconeogenesis
- Lipolysis
- Ketogenesis



S.A.D.

Fasting

Protein

Low-carb



I



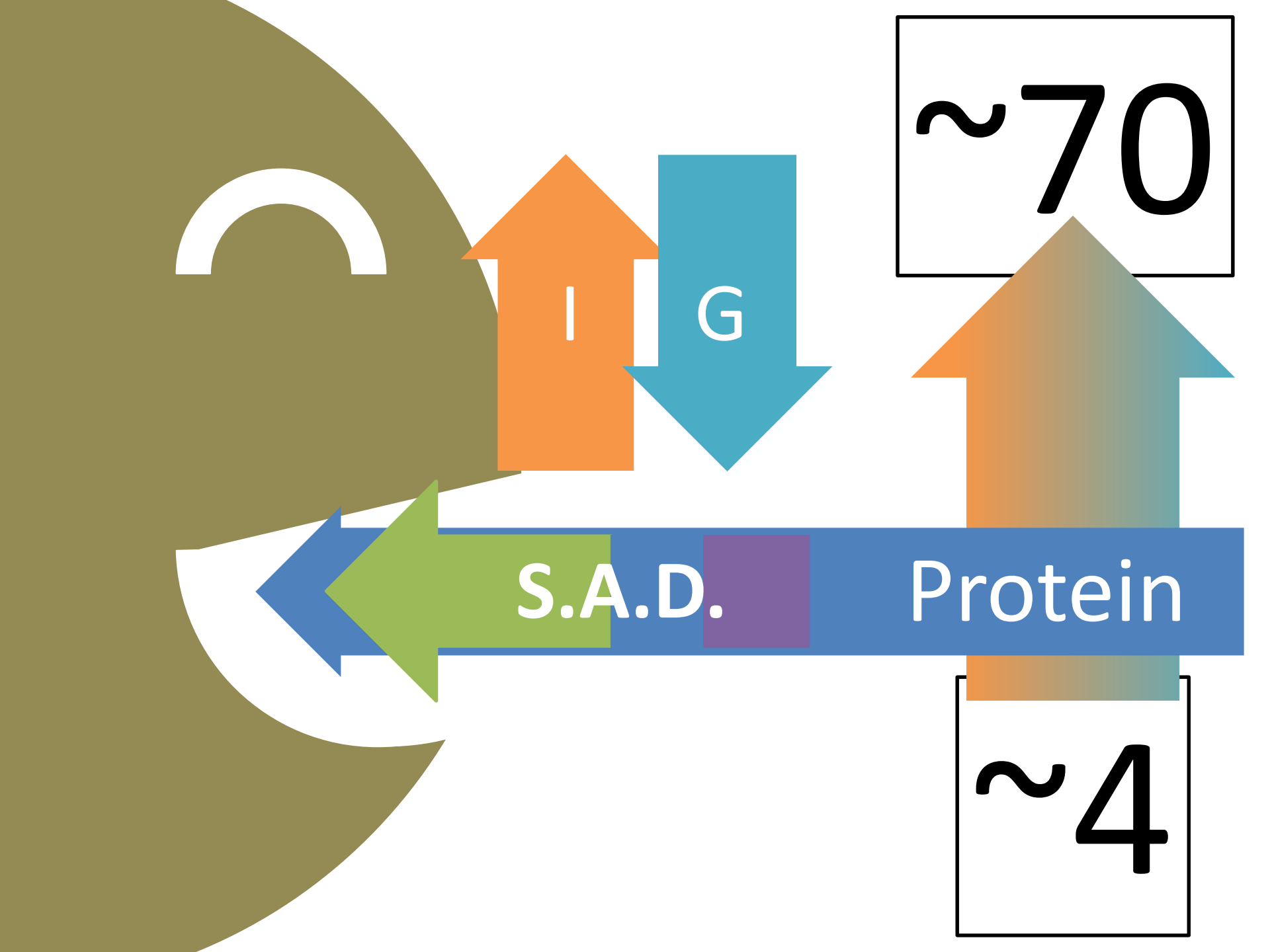
~.8



~.5

Fasting

Protein



~70

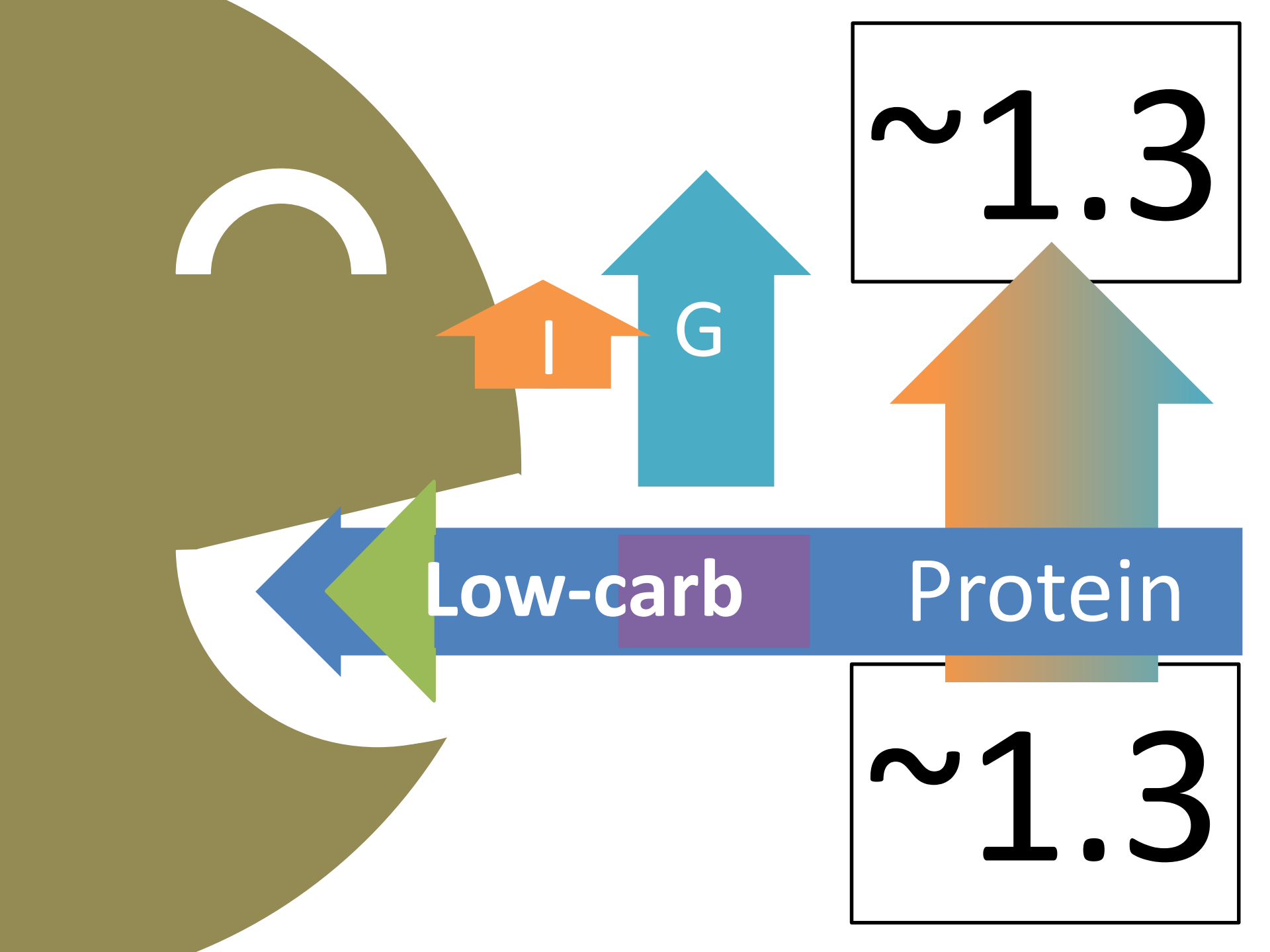
I

G

S.A.D.

Protein

~4



~ 1.3

I

G

Low-carb

Protein

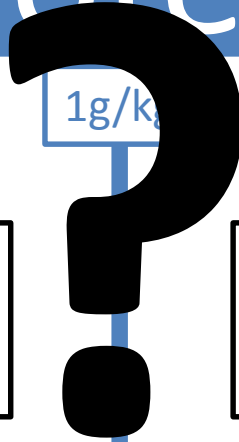
~ 1.3

Protein

1g/k

~4

~70



~1.3

~1.3

S.A.D.

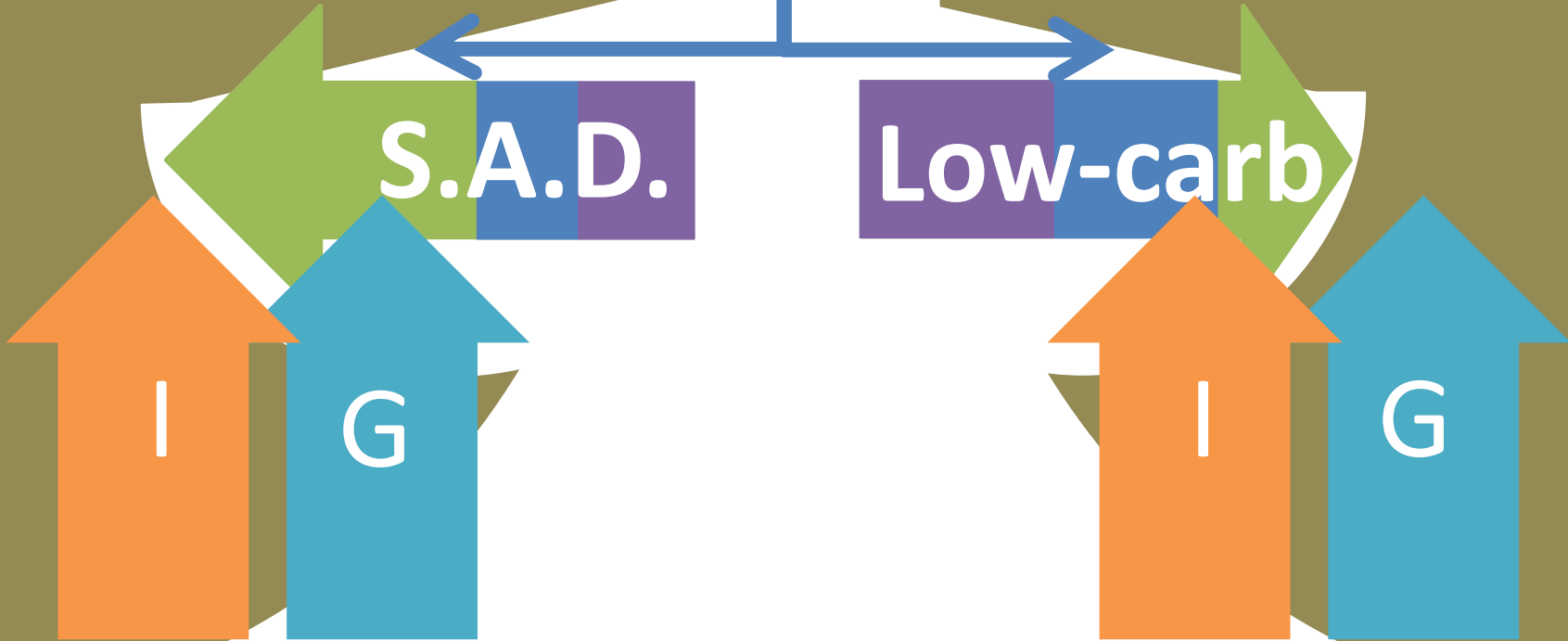
Low-carb

I

G

I

G

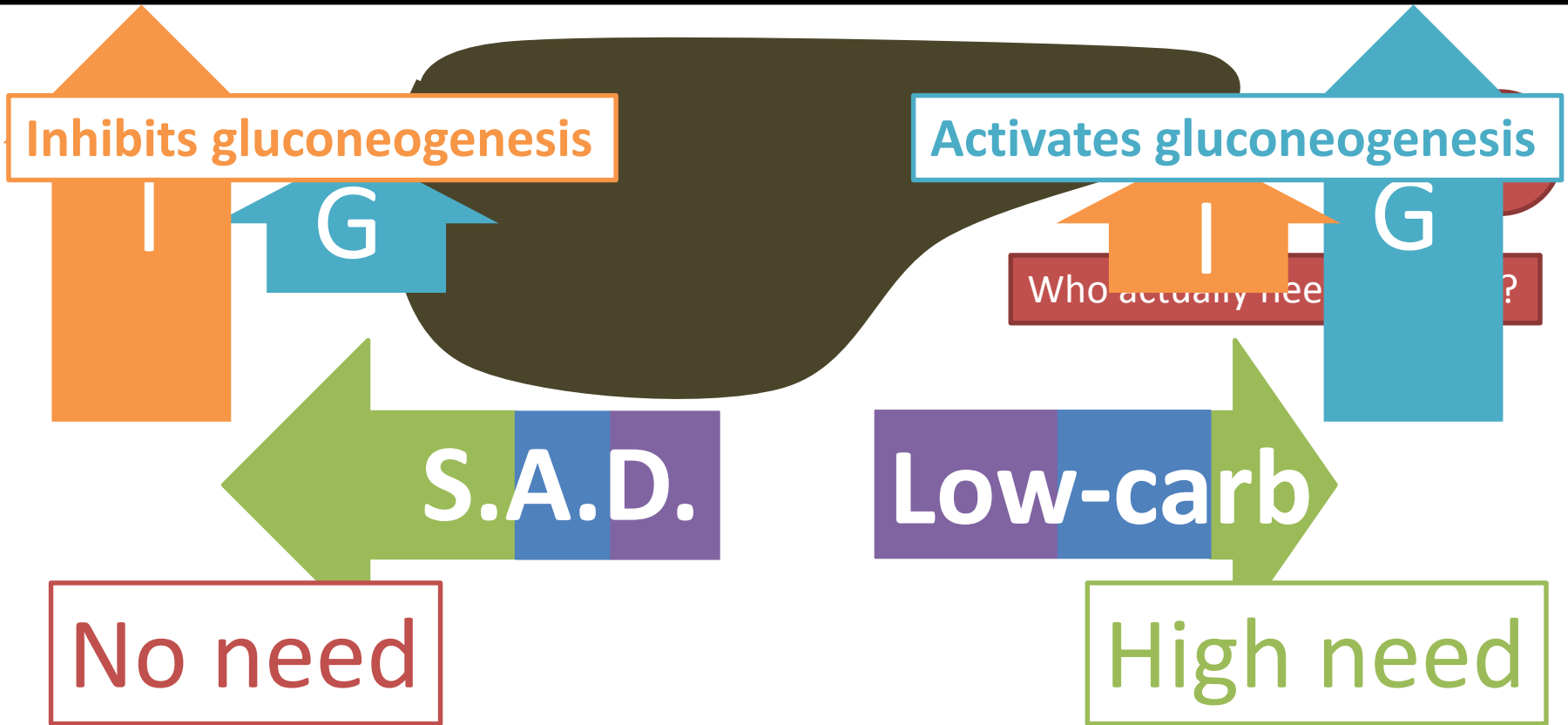


“Without exception, the insulin:glucagon ratio declines as need for endogenous glucose production and/or fuel production increases.”

Roger Unger, 1971



The need for the **liver** to create glucose determines the I:G response to protein



Gluconeogenesis

But what else do **insulin** and **glucagon** regulate
at the liver

Protein

Is the potential increase in insulin
sufficient to inhibit ketogenesis?

I

G

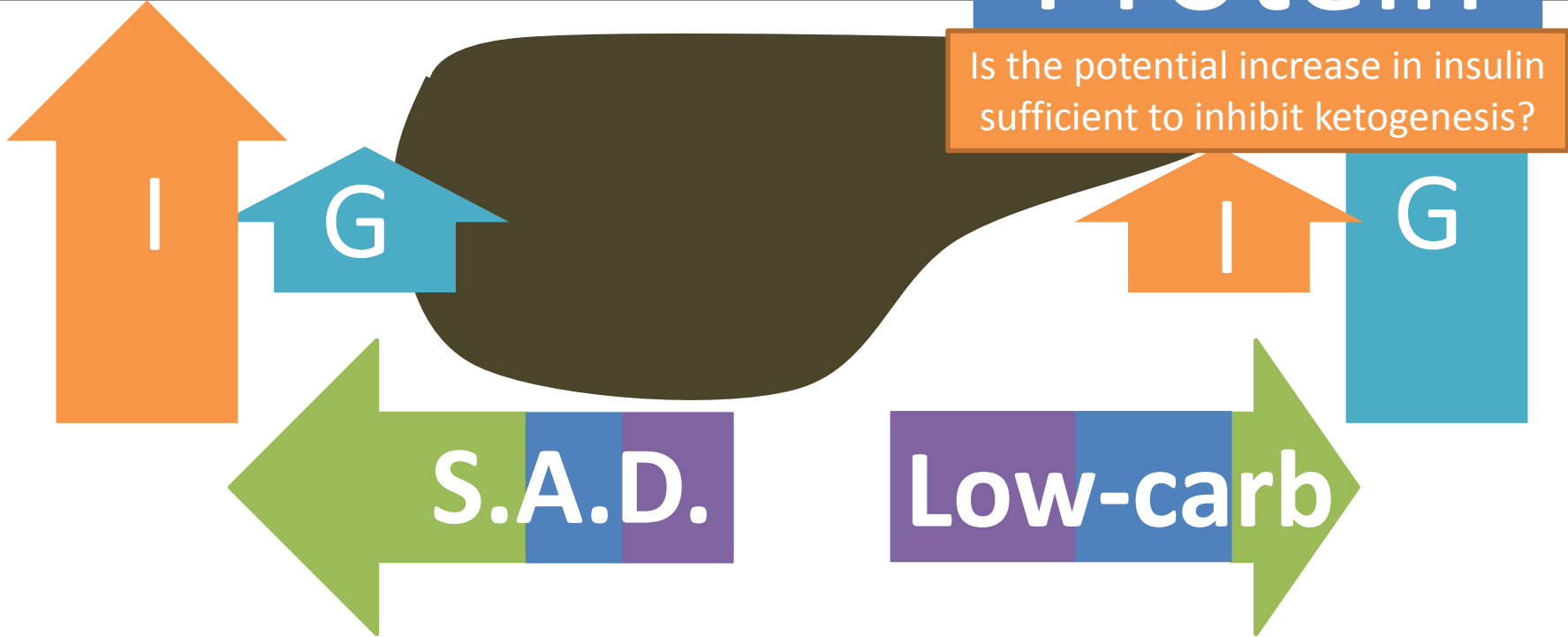
I

G

S.A.D.

Low-carb

Ketogenesis



Ketogenesis

How are ketones made?



Ketogenesis

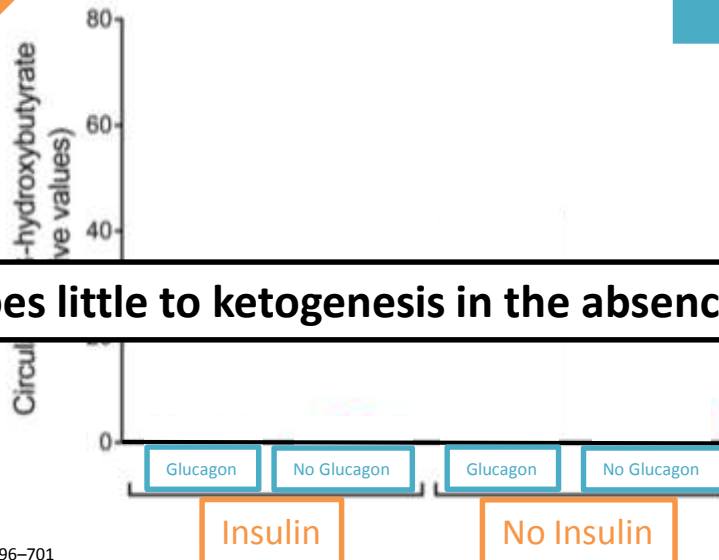
How are ketones made?

Low insulin is one part...

G

Increased glucagon is another part

Low **insulin** does little to ketogenesis in the absence of increased **glucagon**



Ketogenesis

How are ketones made?

Low insulin is one part

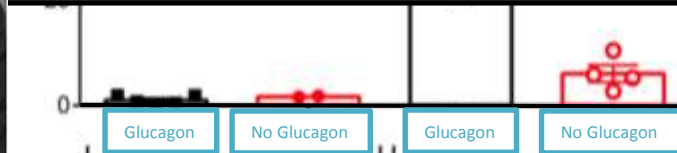
“Glucagon appears to be the primary hormone in the induction...of ketogenesis in the liver.”

Denis McGarry, 1982

Increased glucagon is another part



little to ketogenesis in the absence of increased glucagon

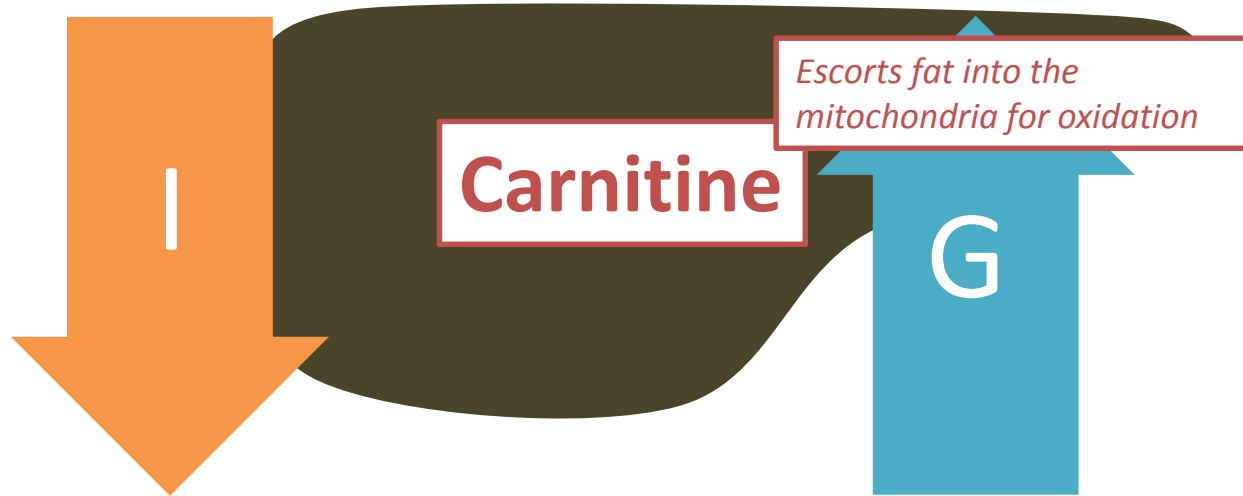


But it's more than just hormones...



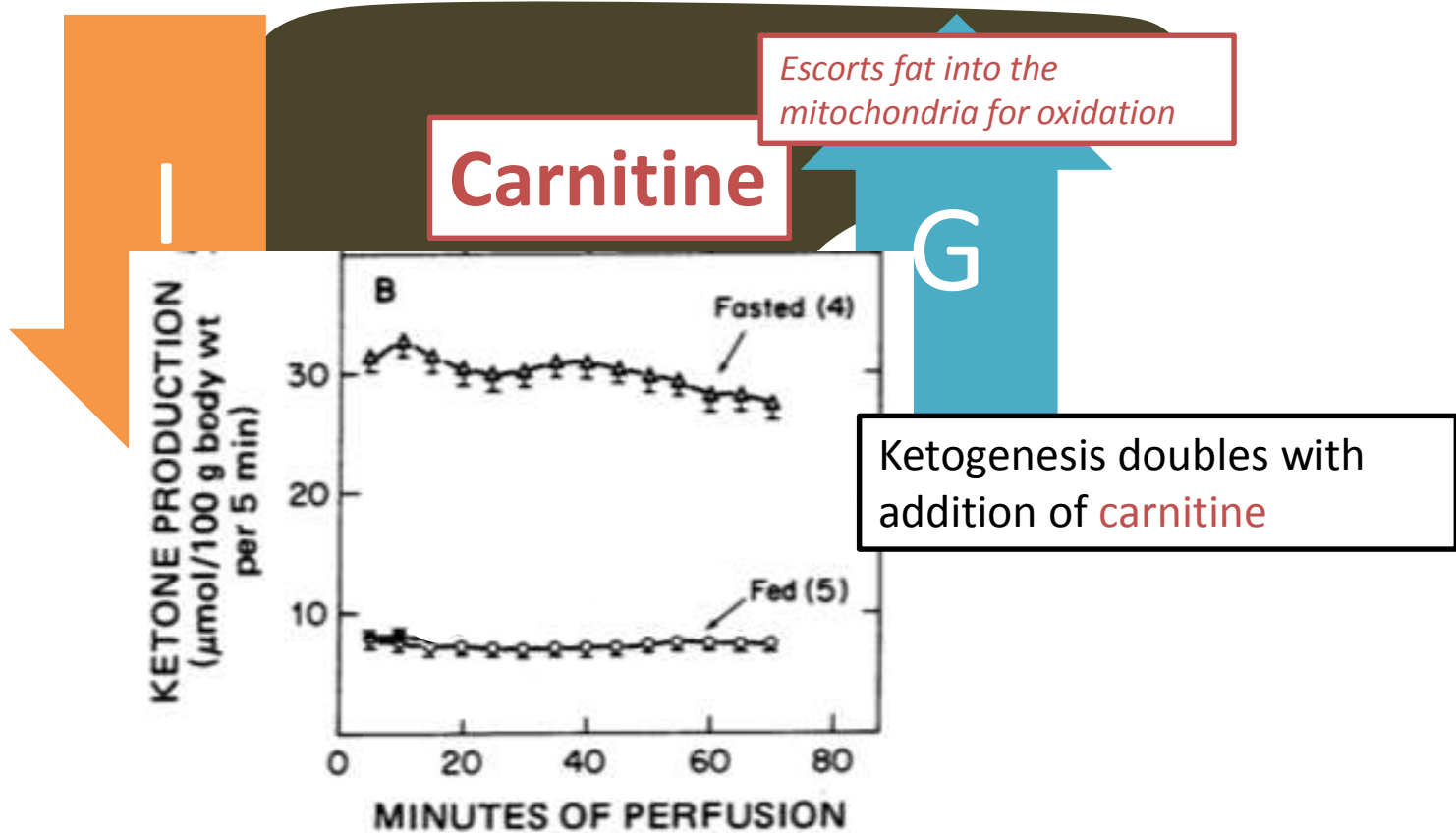
Ketogenesis

How are ketones made?



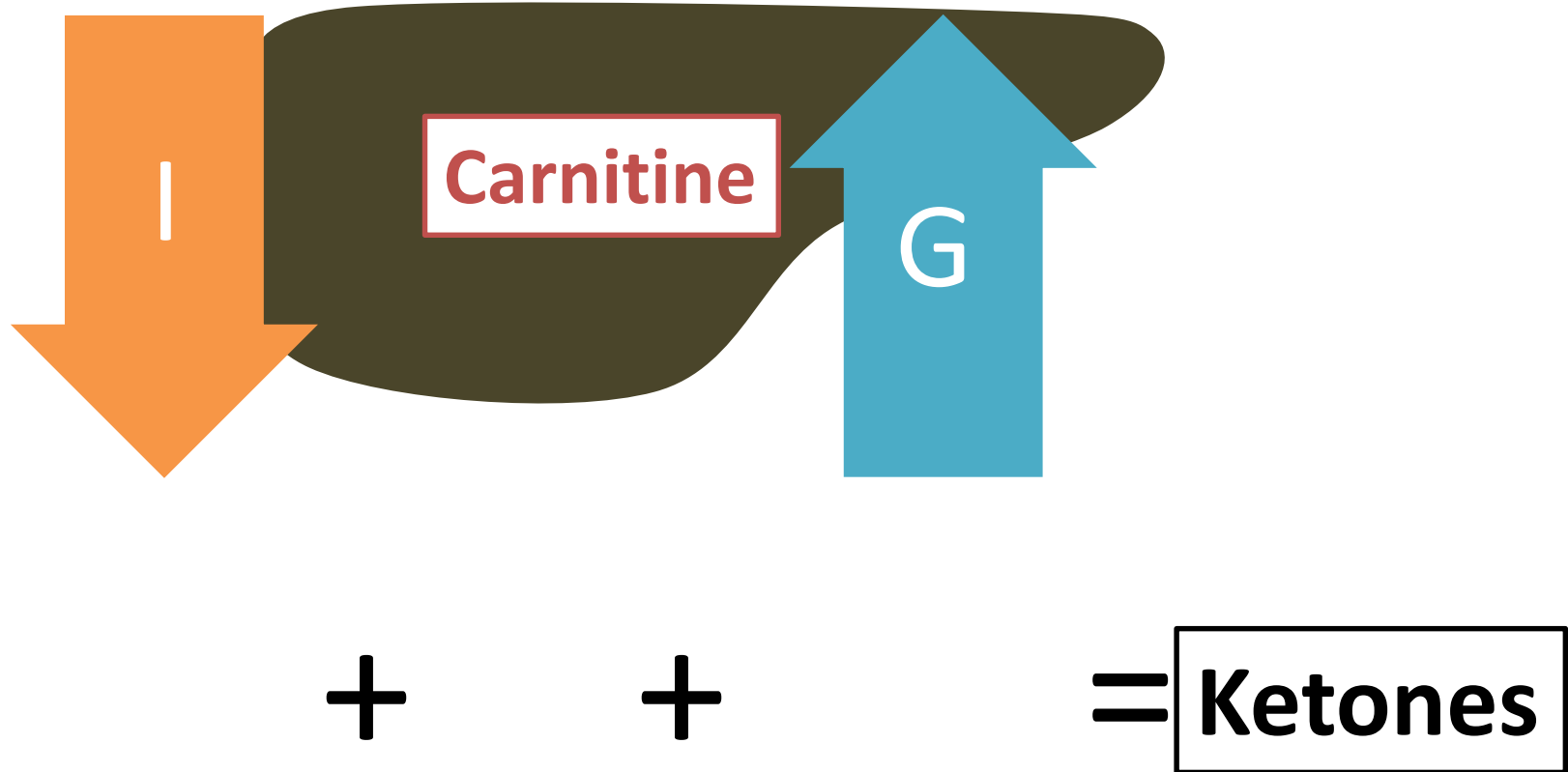
Ketogenesis

How are ketones made?



Ketogenesis

How are ketones made?

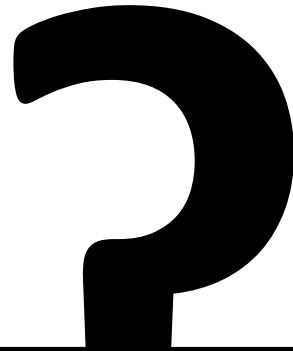


Ketogenesis

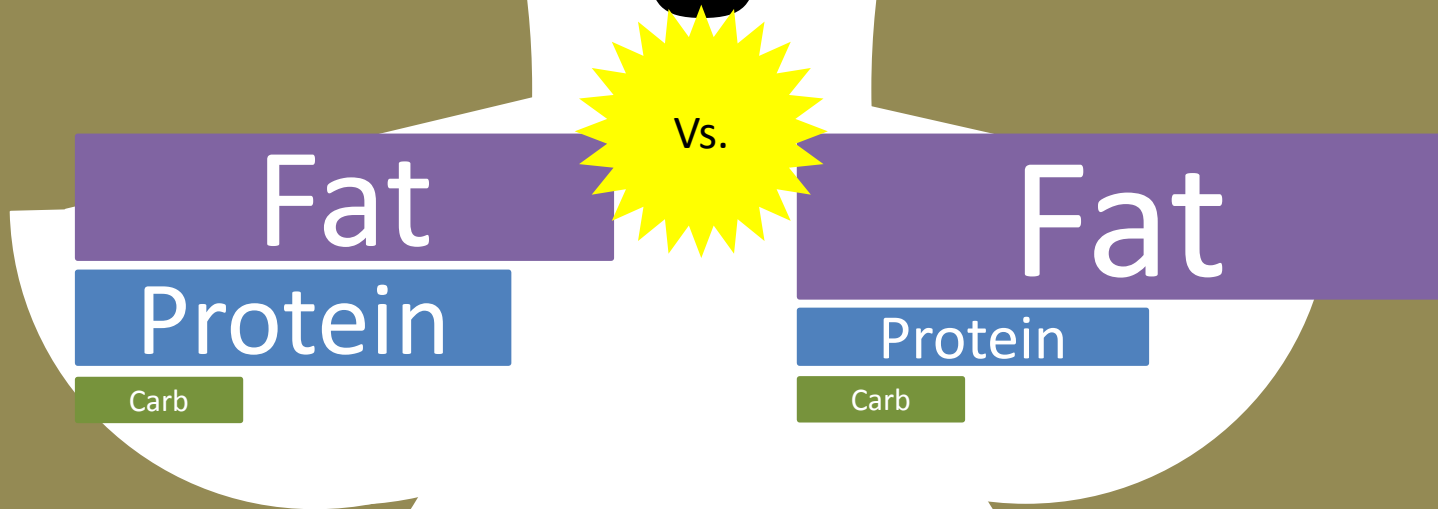
How are ketones made?



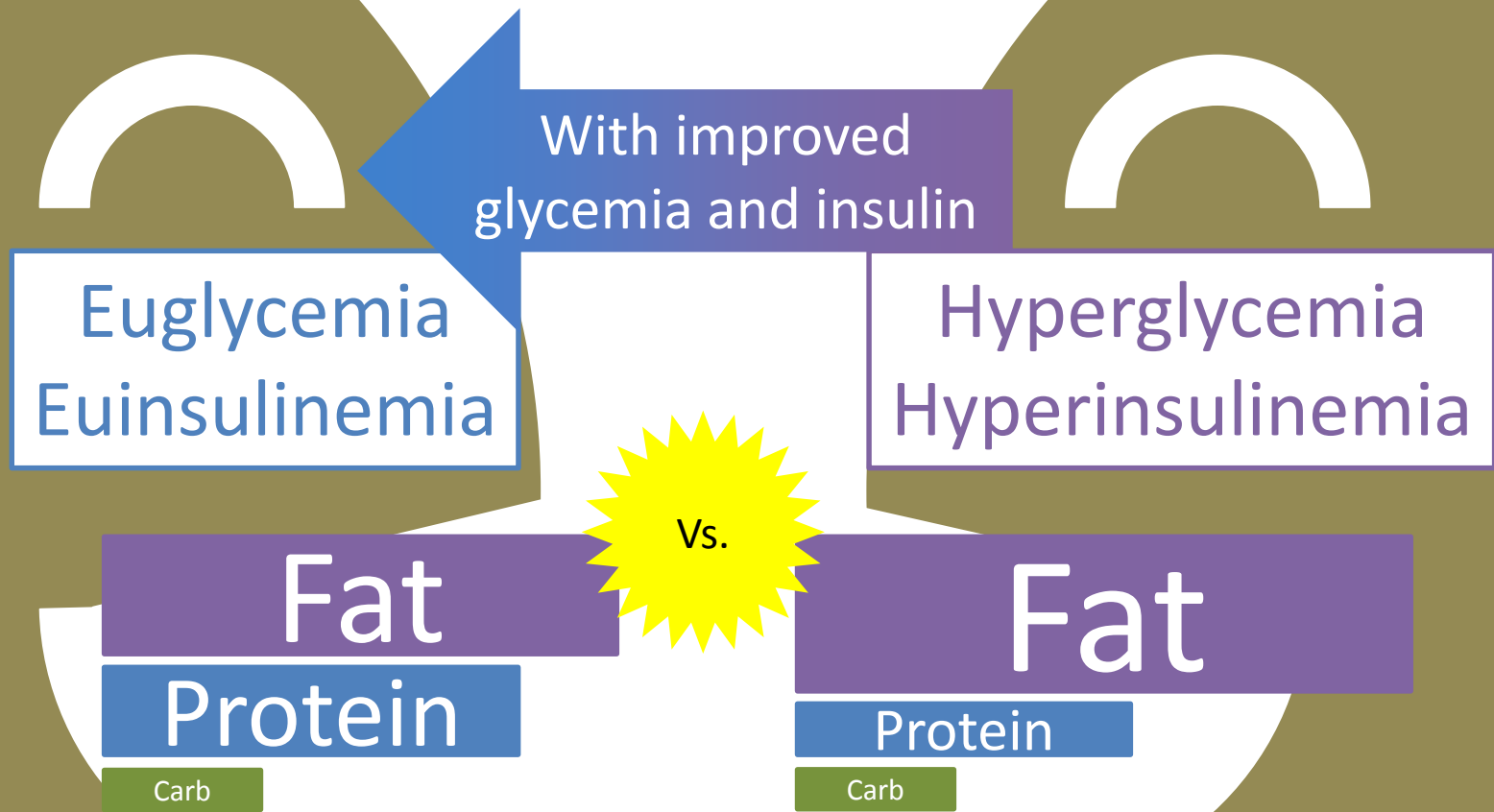
ne = Ketones



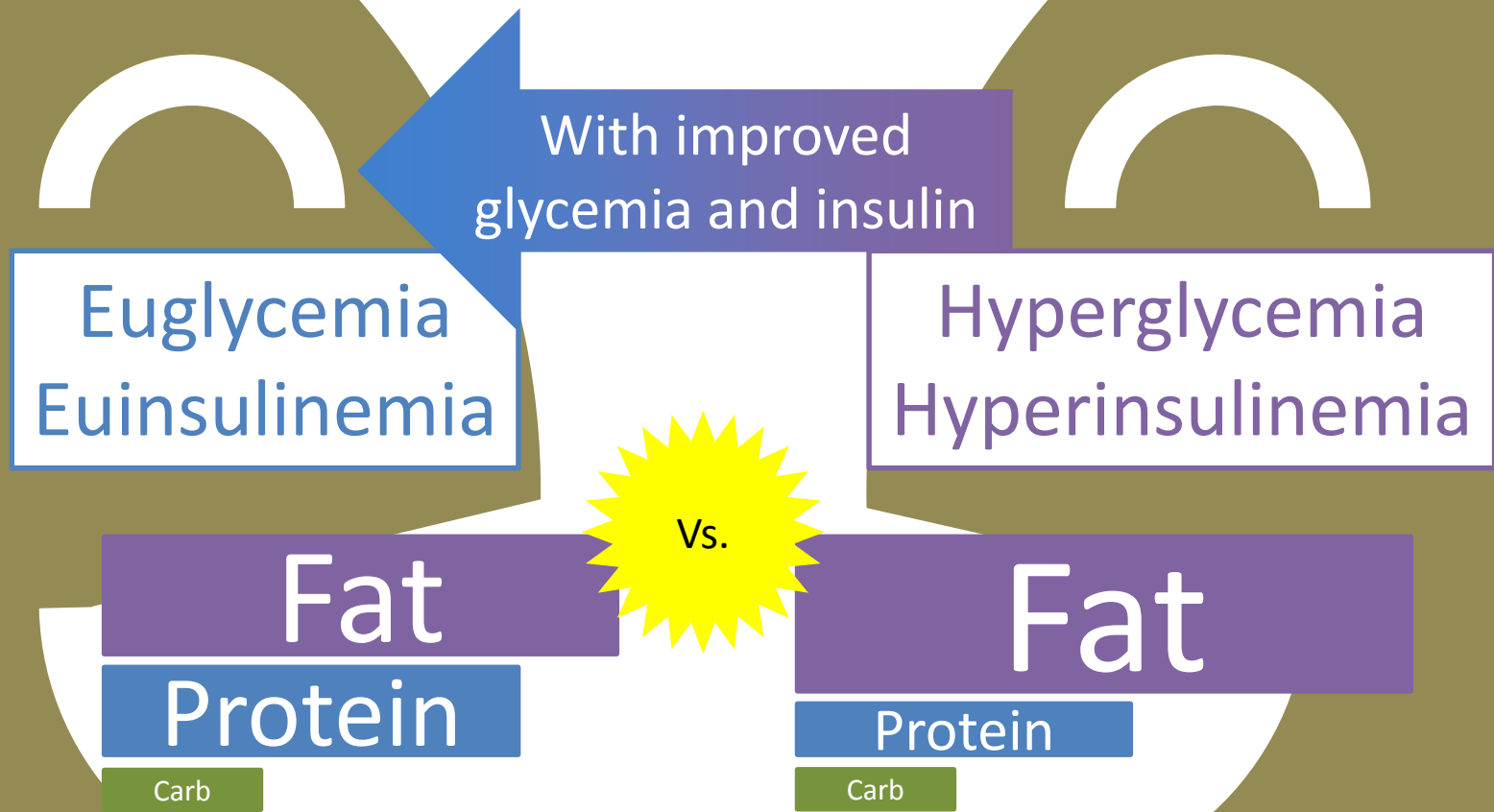
Both emphasize a reduced consumption of carbohydrates



Underlying glycemic state may be useful for determining which is best



Underlying glycemic state may be useful for determining which is best



Once glucose and insulin are controlled, a shift may be helpful

How To Maintain a Low I:G

Fat

Protein

Carb



3. Fill with Fat

2. Prioritize Protein

1. Control Carbohydrates

How To Maintain a Low I:G



Good

Little insulin effect



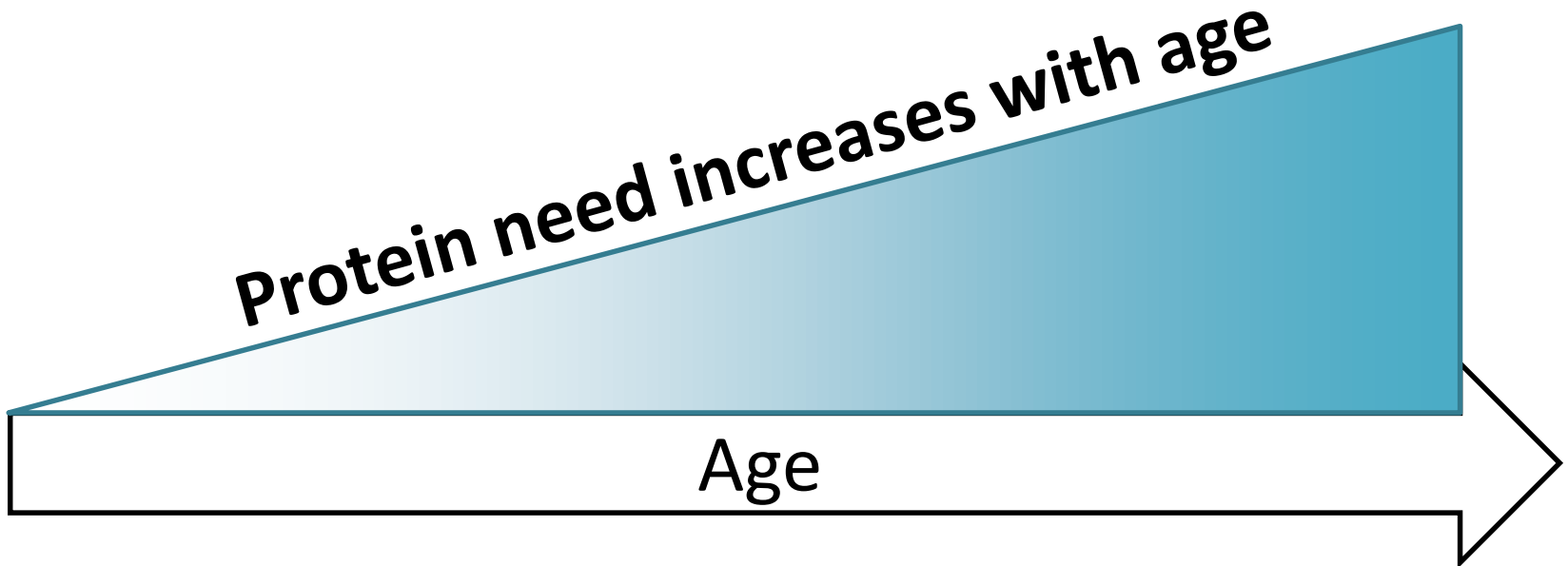
Not so Good

Large insulin effect

< 50 g/day

1. Control Carbohydrates

How To Maintain a Low I:G



1-2 g/kg BW/day

2. Prioritize Protein

How To Maintain a Low I:G



Constitutes all remaining caloric needs

3. Fill with Fat

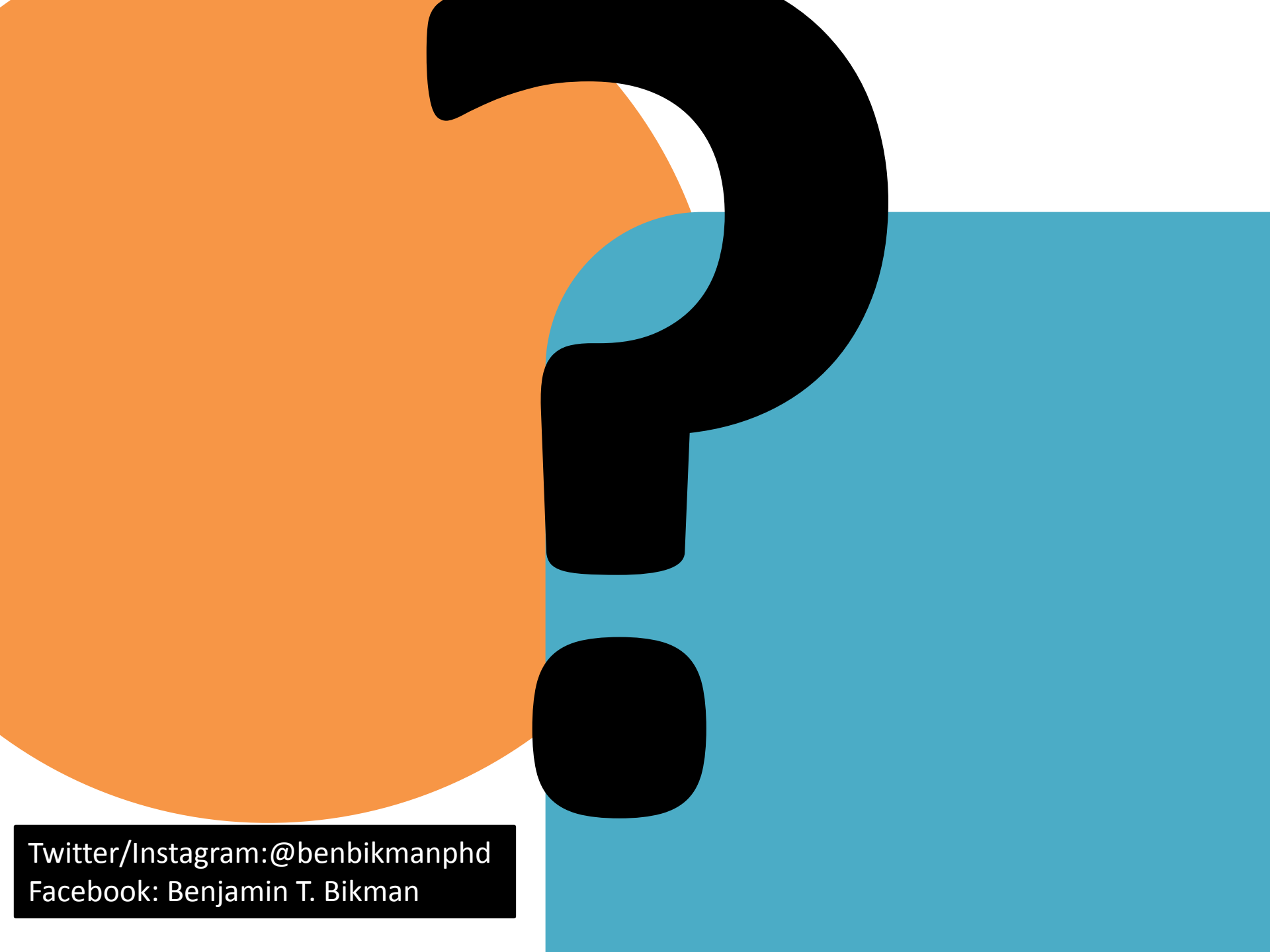
How To Maintain a Low I:G



3. Fill with Fat

2. Prioritize Protein

1. Control Carbohydrates



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Facebook: Benjamin T. Bikman