

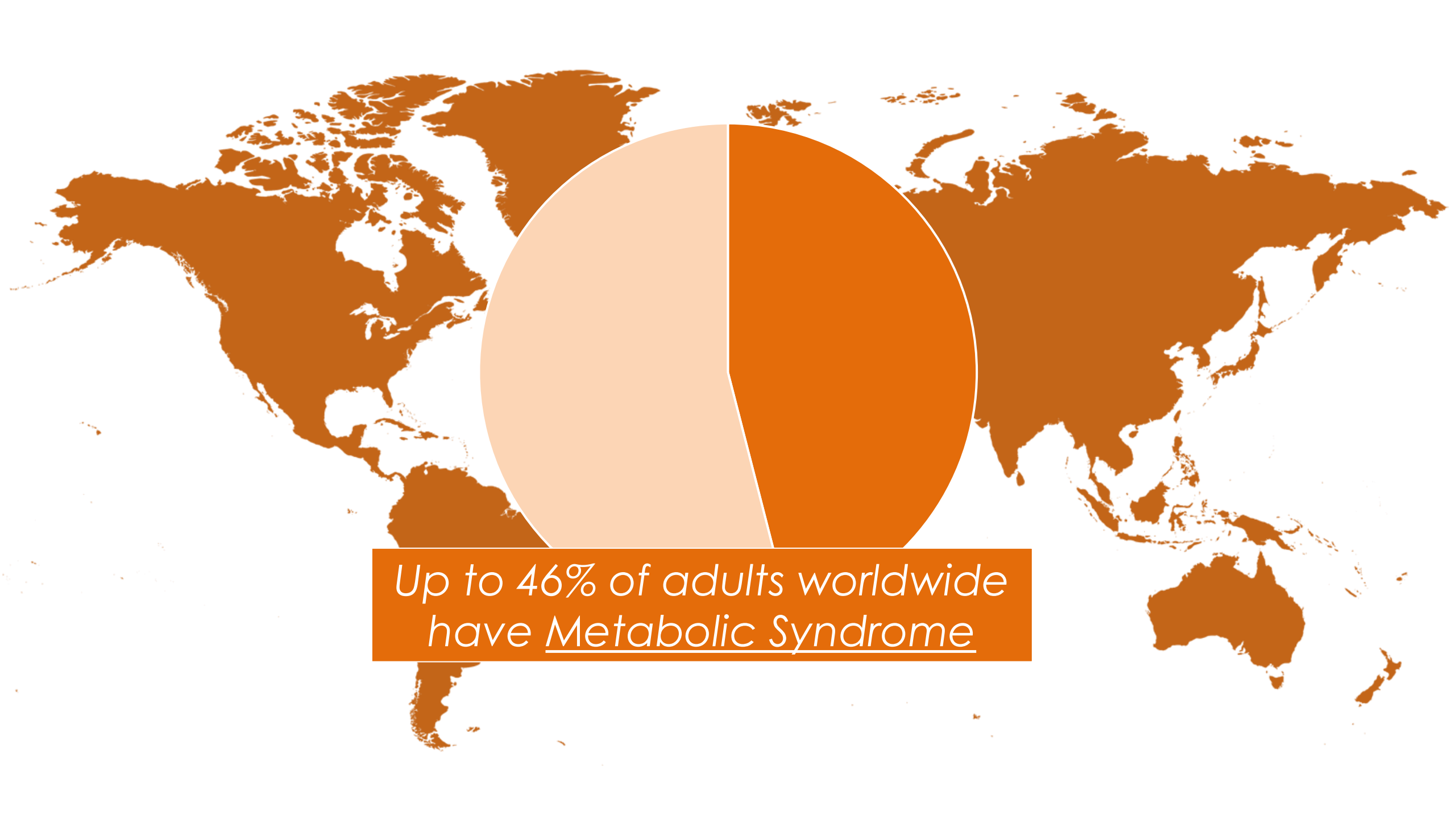
Hyperinsulinemia Causes

Benjamin Bikman, Ph.D.

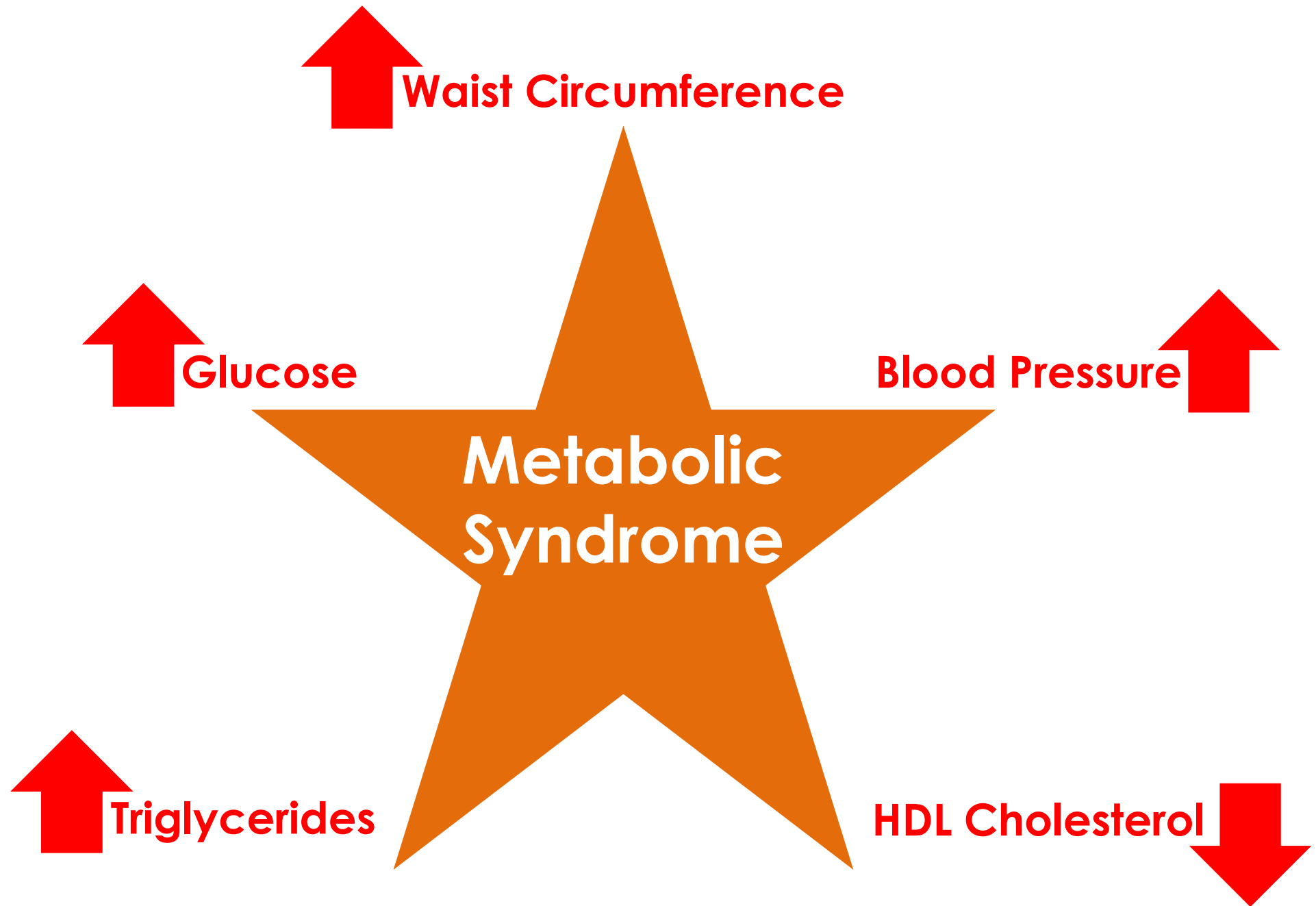
Professor

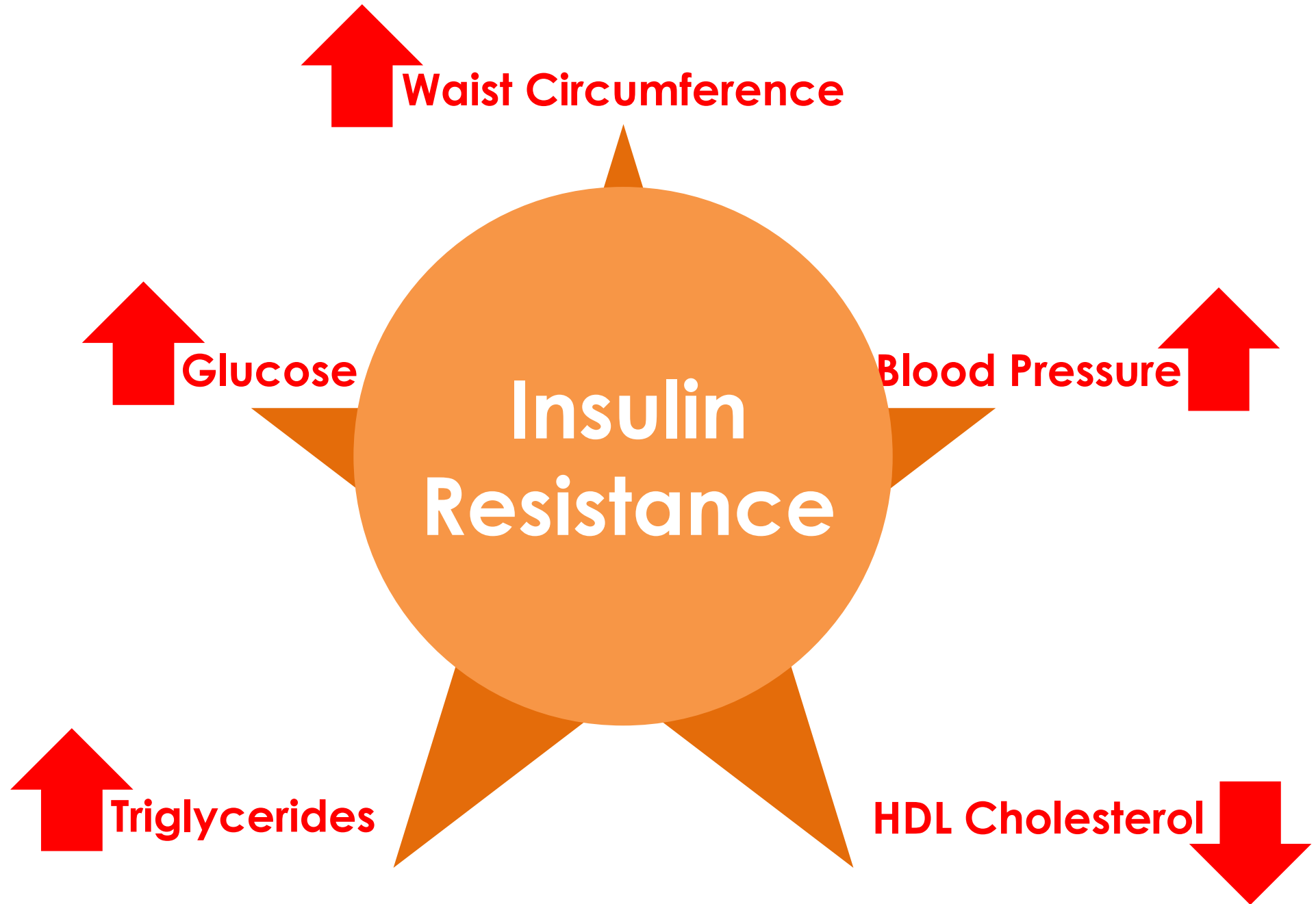
Cell Biology and Physiology

Brigham Young University



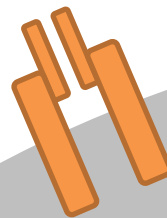
*Up to 46% of adults worldwide
have Metabolic Syndrome*



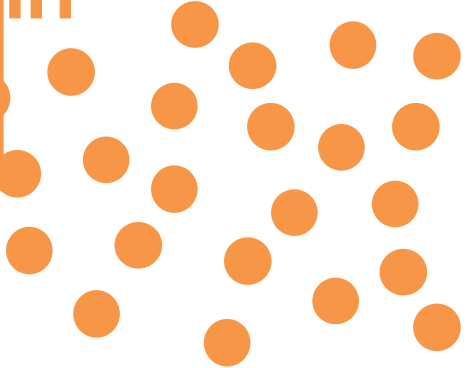




What is insulin resistance?



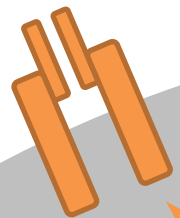
Insulin



Glucose



In some cells...





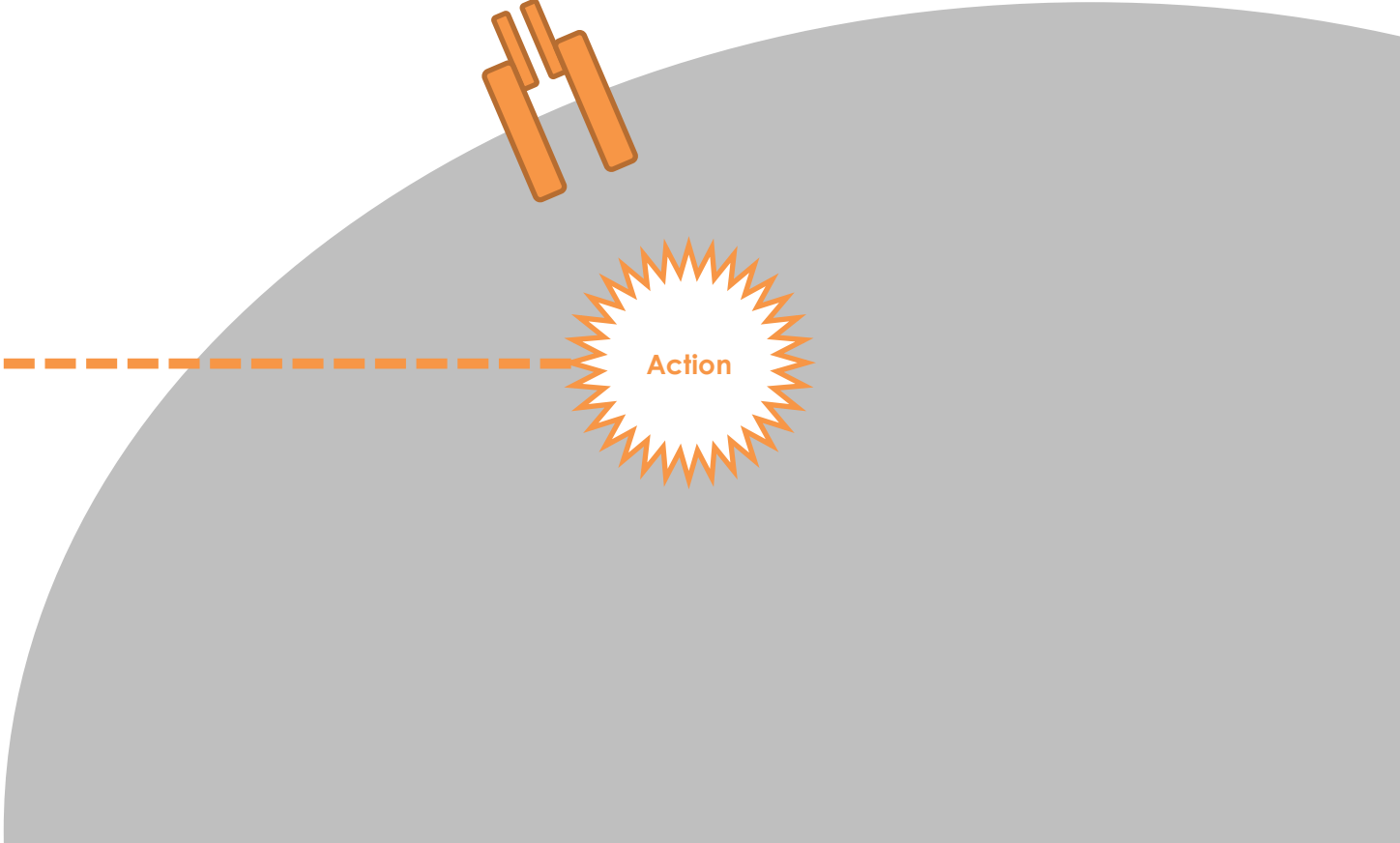
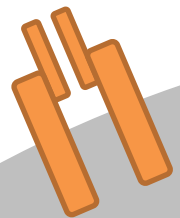
Some cells fail to fully respond to insulin

Insulin levels are high

There is no “insulin resistance” without hyperinsulinemia

**Except in starvation...*

Insulin



What is insulin resistance?



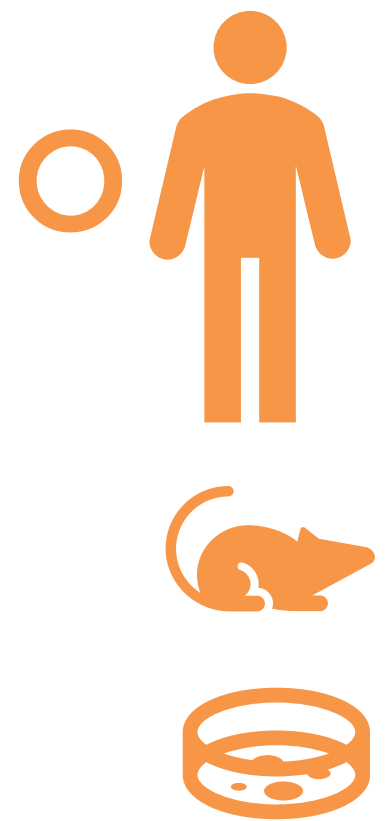
Where does it come from?

Insulin
Resistance
Stress

Inflammation

Hyperinsulinemia

1



Stress

**Insulin
Sensitivity**

Cortisol

Epinephrine

Insulin

Stress

Sleep deprivation



Insulin

Glucose

Cortisol



Inflammation

**Insulin
Sensitivity**

Infection/Illness

Insulin

Air Pollution

**Autoimmune
Disorders**

**Enlarged
Fat Cells**

PMID: 29362018
PMID: 31717476
PMID: 25269485
PMID: 27777170

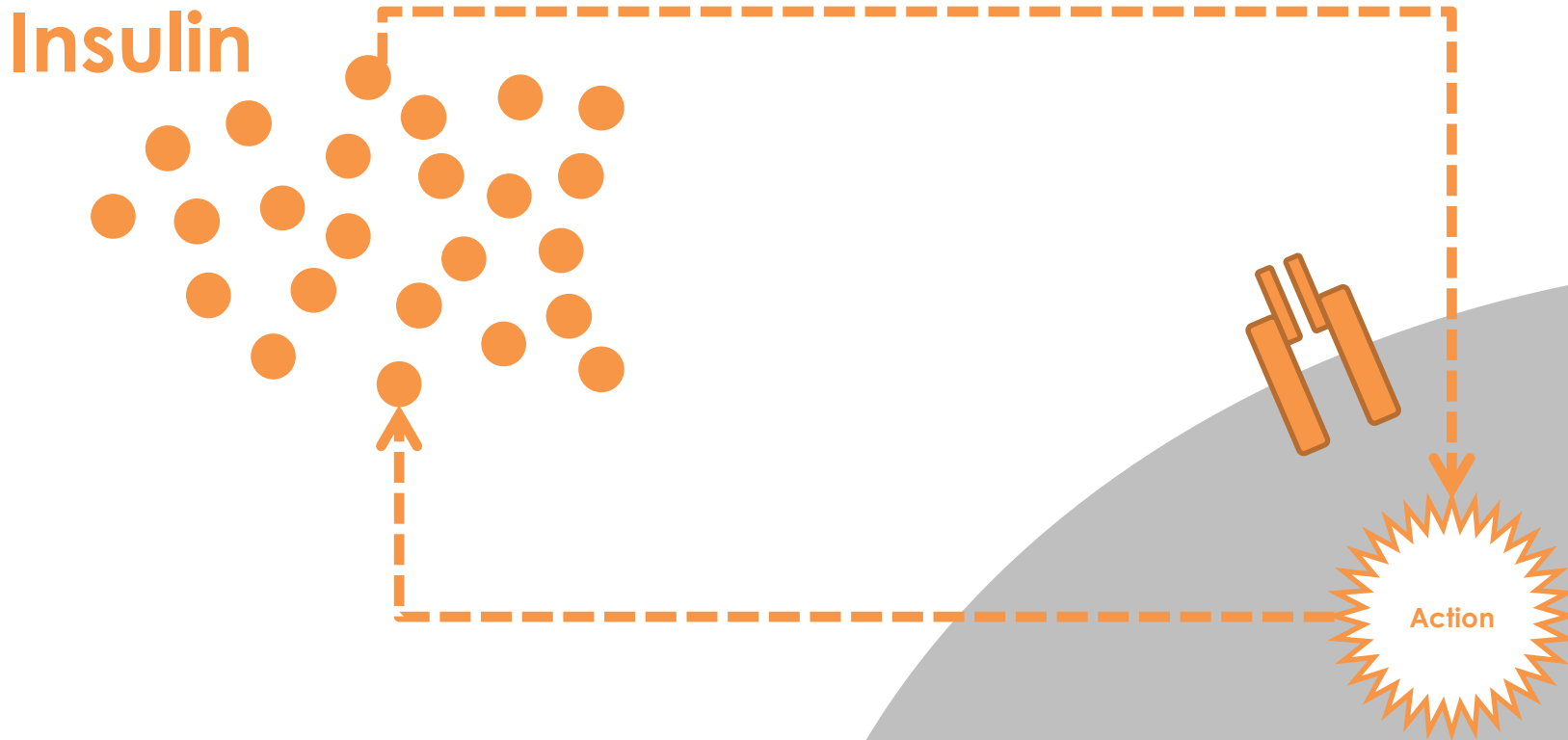
Hyperinsulin

Insulin Sensitivity

Any constant stimulus will eventually lead to a
resistance to that stimulus

Insulin

Hyperinsulinemia



Any constant stimulus will eventually lead to a resistance to that stimulus

Hyperinsulinemia



Any constant stimulus will eventually lead to a resistance to that stimulus

Hyperinsulinemia

Insulin

Glucose uptake



Protein synthesis



Cellular growth



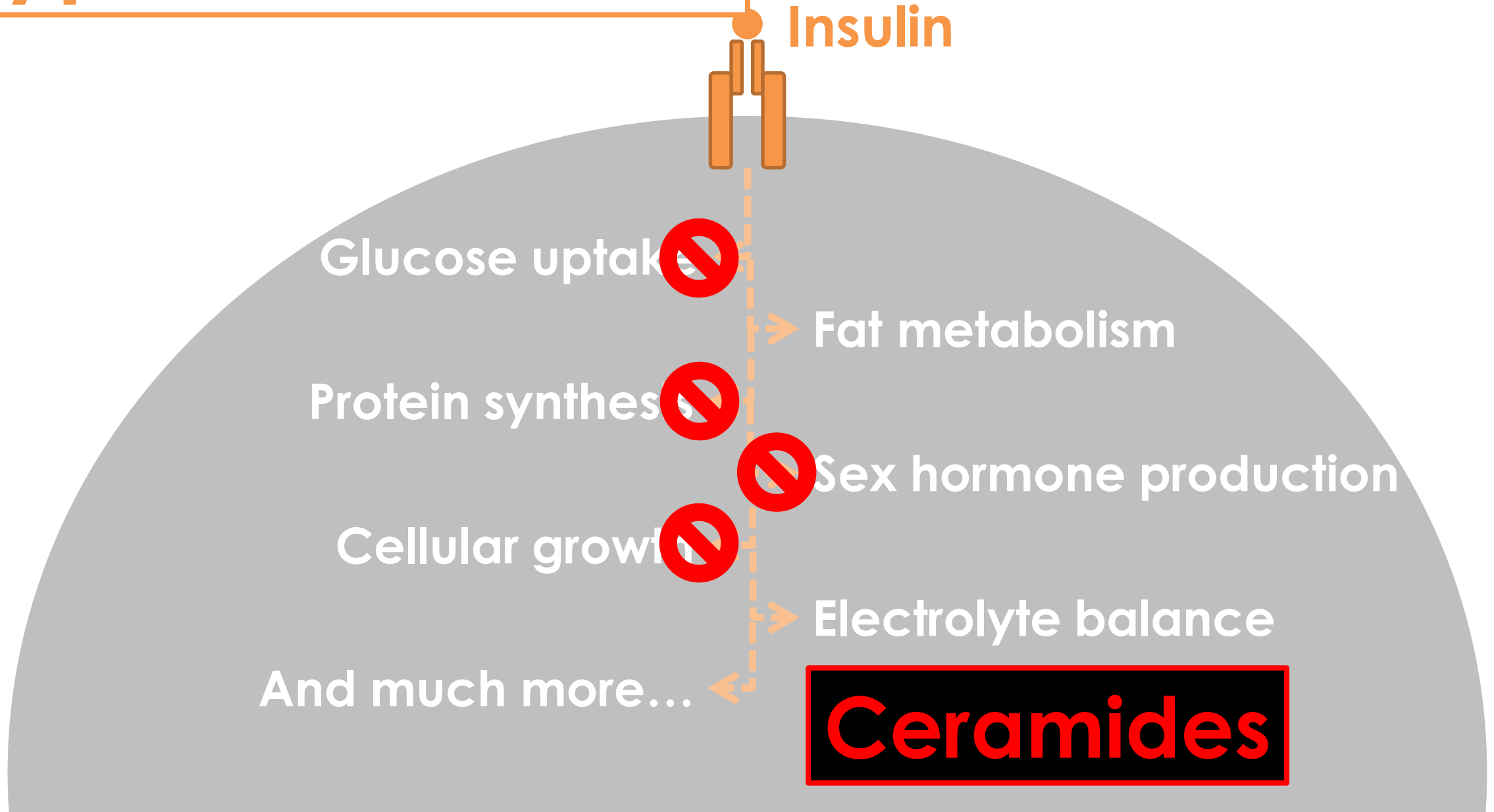
And much more...

Fat metabolism

Sex hormone production

Electrolyte balance

Ceramides



Hyperinsulinemia

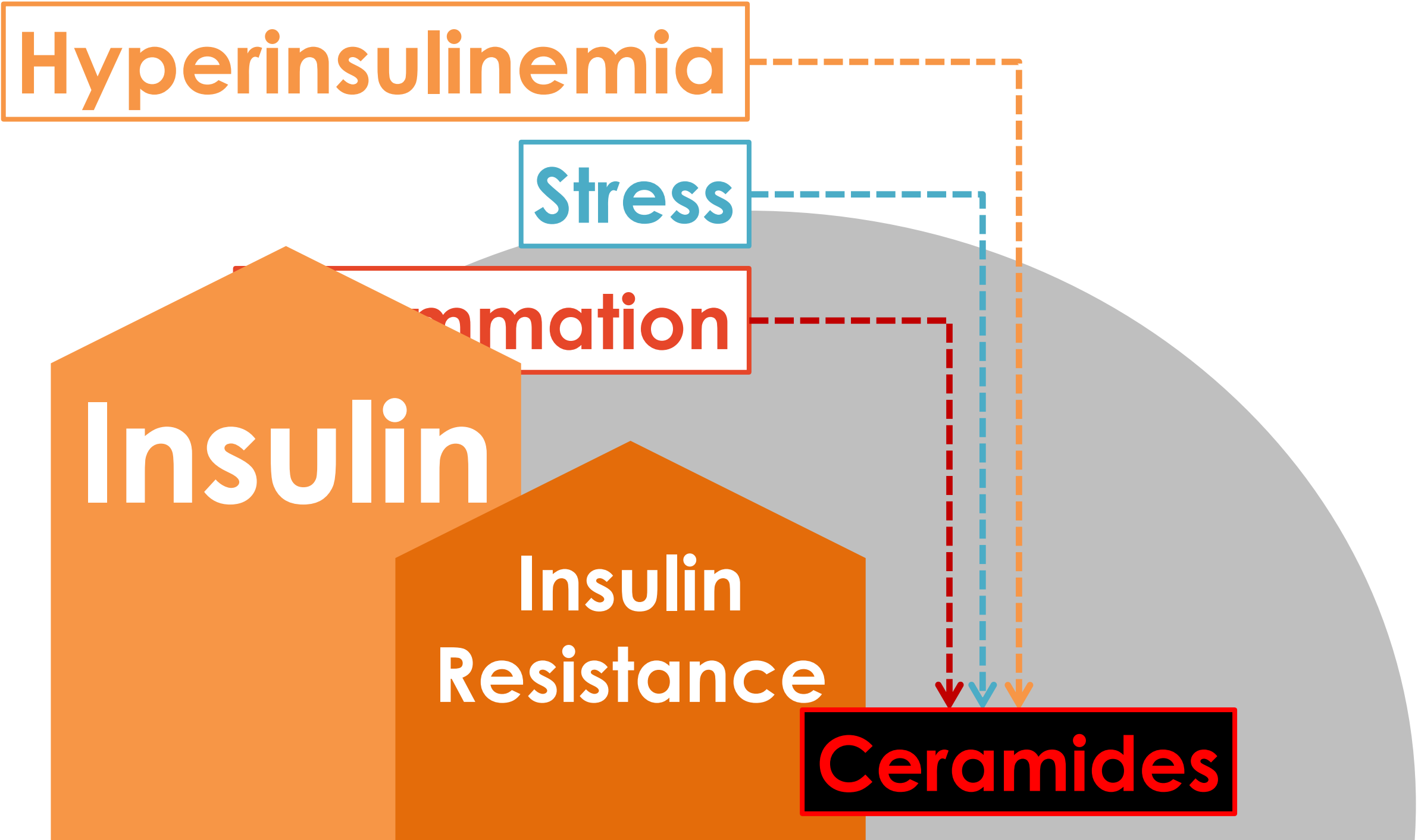
Stress

Inflammation

Insulin

Insulin Resistance

Ceramides



What is insulin resistance?



Why has it become so common?

? Why has it become so common?

Hyperinsulinemia

Stress

Sleep deprivation

Inflammation

Pollutants?
Sensitivities?

Insulin
Resistance



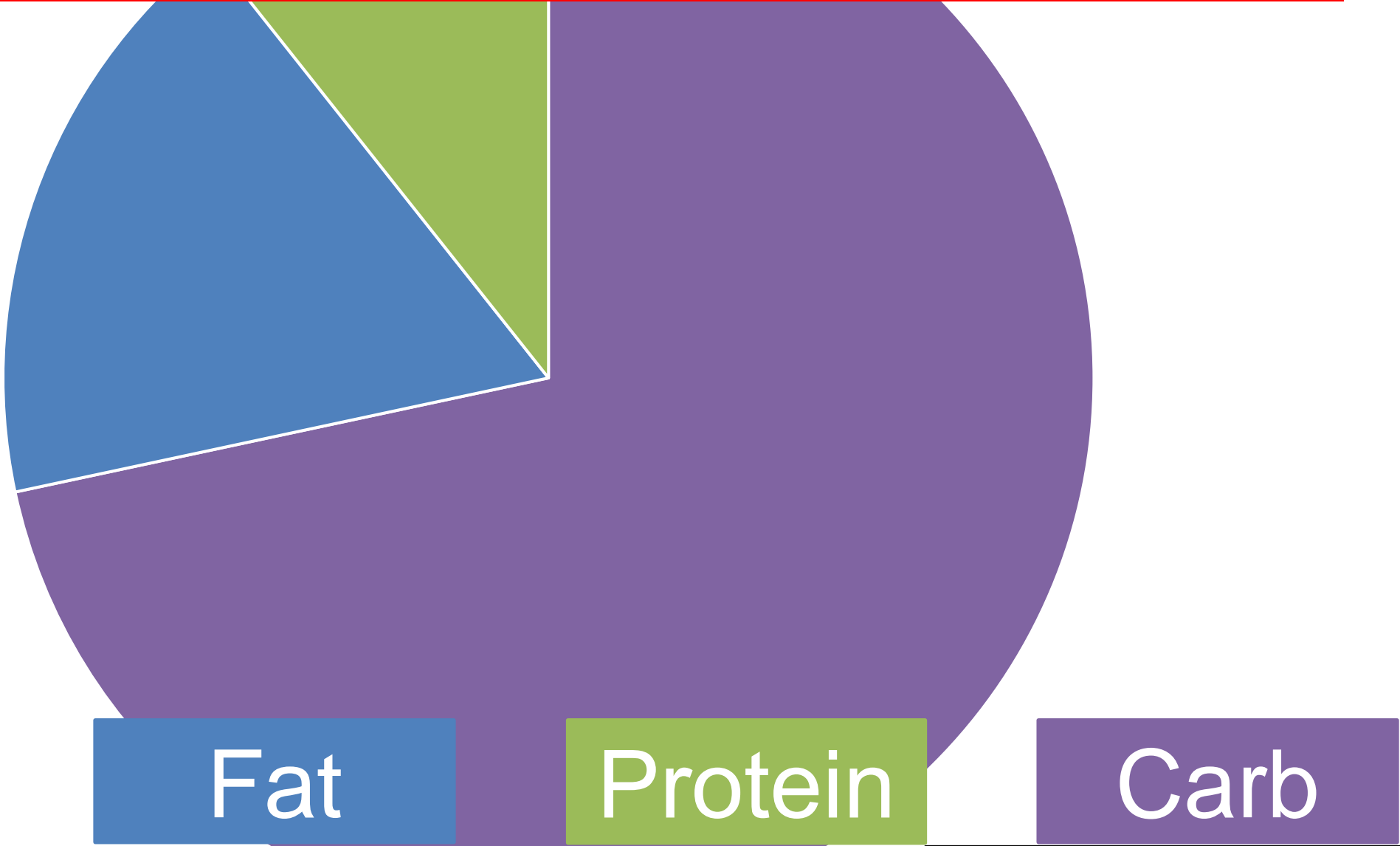
Why has it become so common?

Hyperinsulinemia

**Insulin
Resistance**

?

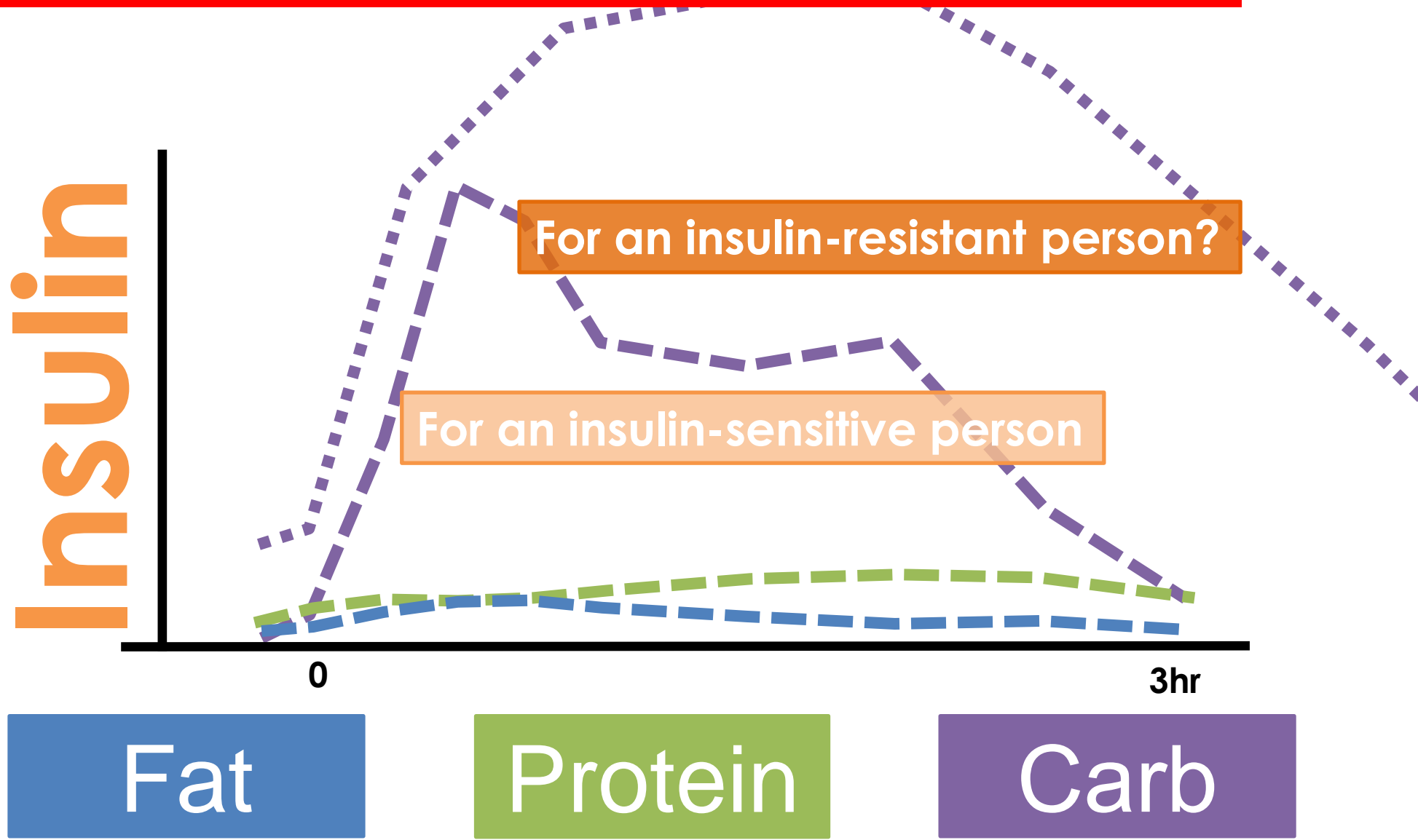
Why has it become so common?



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Why has it become so common?

?



For an insulin-resistant person?

For an insulin-sensitive person

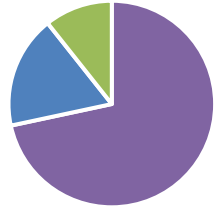
Fat

Protein

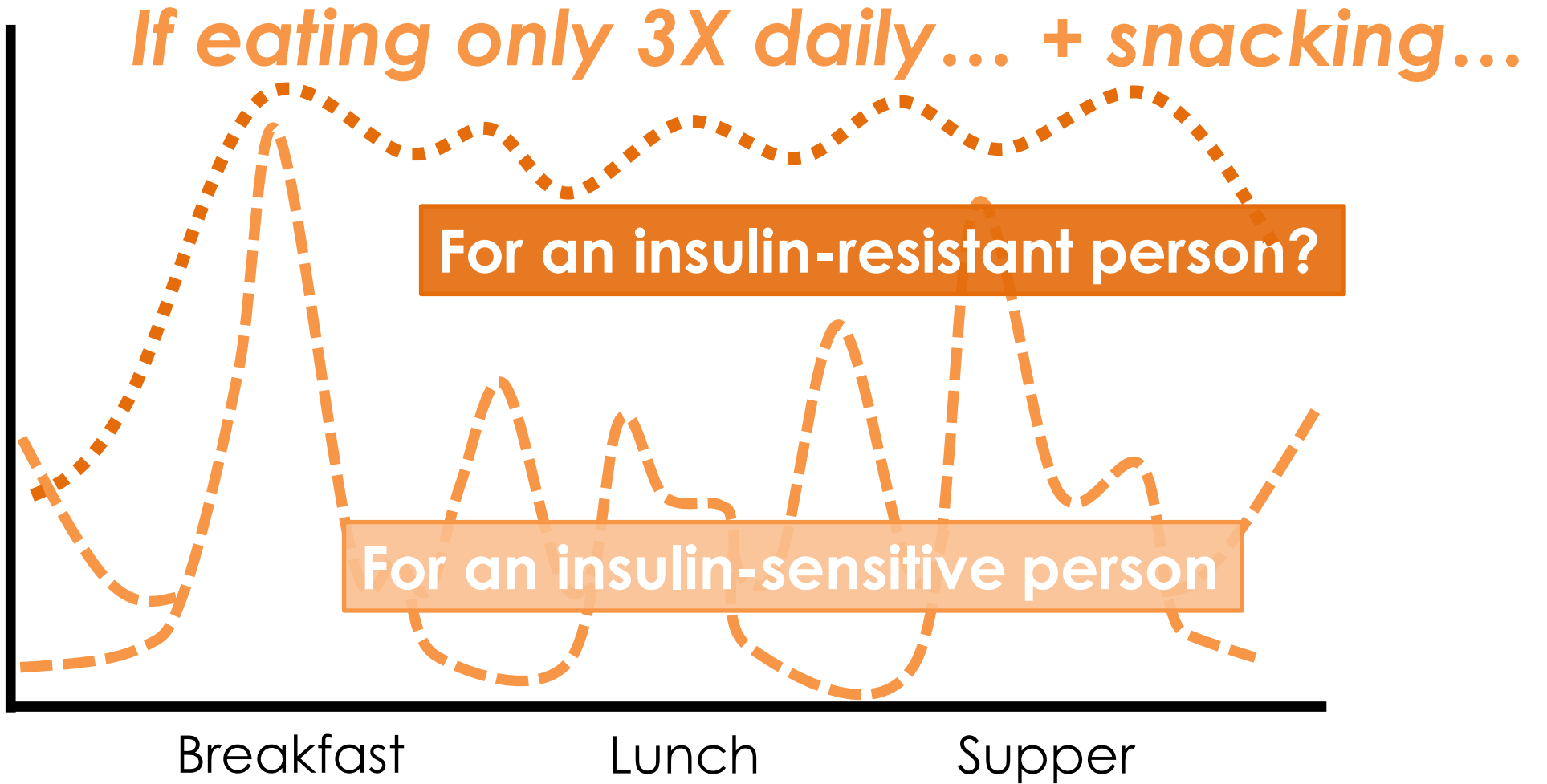
Carb



Why has it become so common?



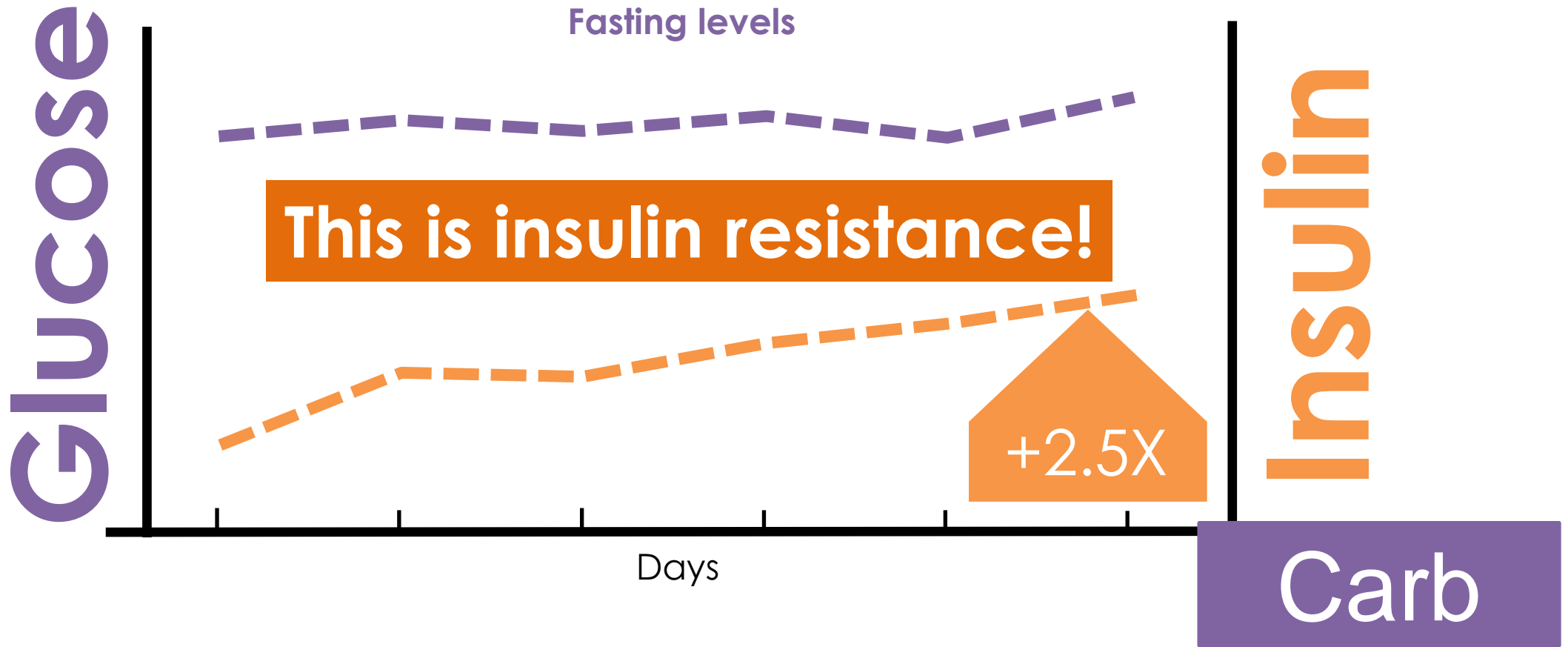
Insulin





Why has it become so common?

Overeating carbohydrates for one week



1^o



Hyperinsulinemia

Stress

Inflammation

Insulin Resistance

2^o



Uric acid

Linoleic acid



Hyperinsulinemia

Causes

