

# Type 2 Diabetes Increases the Risk for Cardiovascular Disease

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## Abstract

Type 2 diabetes is a disorder that impacts 90-95% of individuals diagnosed with diabetes in the US. Type 2 diabetes impacts the production of insulin resulting in higher levels of glucose in the blood. A 21% increased risk of developing cardiovascular disease (CVD) is observed in individuals with type 2 diabetes. This review compares the mechanisms behind type 2 diabetes and CVD and argues that the similarities between the mechanisms explain increased risk of CVD with type 2 diabetes. This review finds that complications that are commonly associated with type 2 diabetes such as hypertension have been identified as one of the possible explanations for the increased risk for CVD. In addition, insulin resistance and its impact on different risk factors for type 2 diabetes, such as inflammation, may also play a role in how type 2 diabetes increases the risk of CVD. Current research done on the risk factors and complications of type 2 diabetes show that there is a link between CVD and type 2 diabetes, but the research available is limited to a few risk factors emphasizing the need for further research on the complications and risk factors of type 2 diabetes. In addition, future research efforts should focus on the development of new drugs and therapies that address the increase of CVD and treat type 2 diabetes, to reduce the risk of CVD in patients with type 2 diabetes

## Background

- Diabetes affects over 5% of the population
  - 95% of individuals that are diabetic have type 2 diabetes.
- Two forms of diabetes: Type 1 diabetes and Type 2 diabetes
  - Type 1 diabetes: Pancreas are unable to produce insulin. Cannot be prevented
  - Type 2 diabetes: insulin production from pancreas are impacted but the body becomes insulin resistant

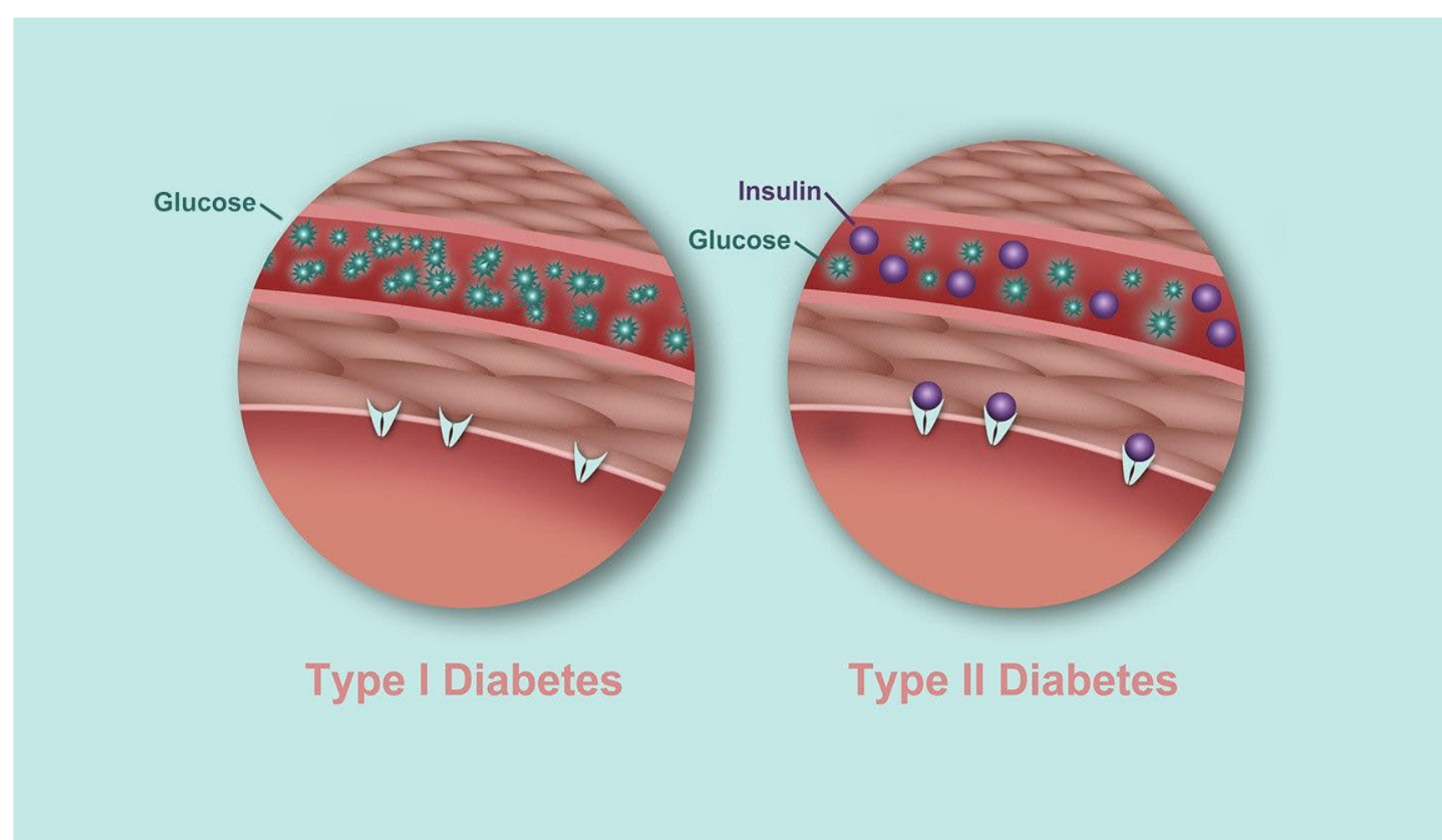


Figure 1. An image showing high levels of glucose from two different causes. Elevated levels of glucose can result an absence of insulin. The body not responding to insulin can also result in high blood sugar

- Type 2 diabetes can be developed through various environmental factors like diet exercise, obesity etc.

## Methods

- Literary review of primary and peer reviewed articles related to type 2 diabetes and cardiovascular diseases
- Articles reviewed were gathered from PubMed, NCBI, Science direct, etc.

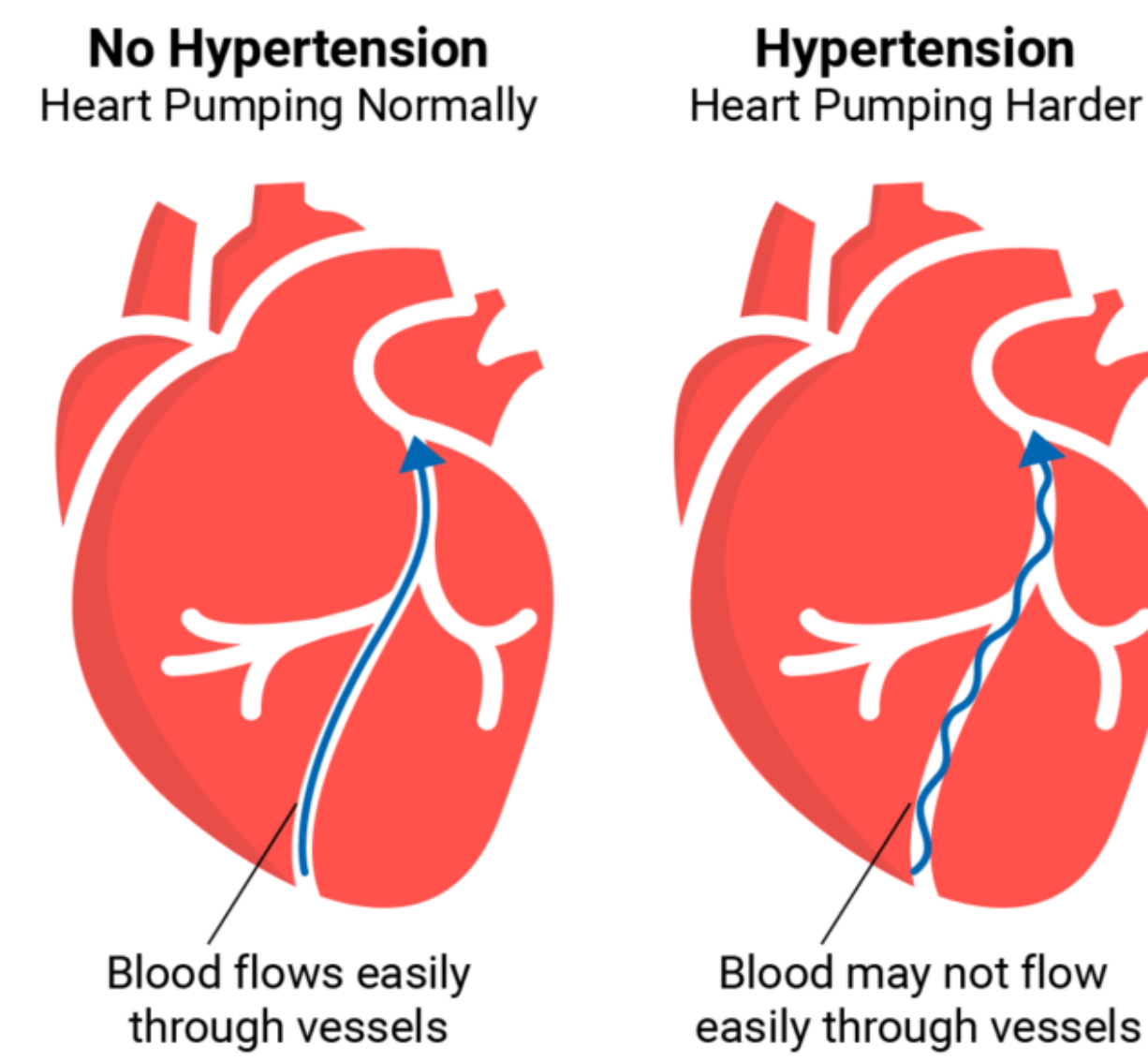


Figure 4. Hypertension is a common risk factor for CVD. Over 69% of individuals with diabetes are hypertensive. Studies showed that 70.5% of participants had high blood pressure and type 2 diabetes supporting the prevalence of hypertension and type 2 diabetes.

## Risk factors

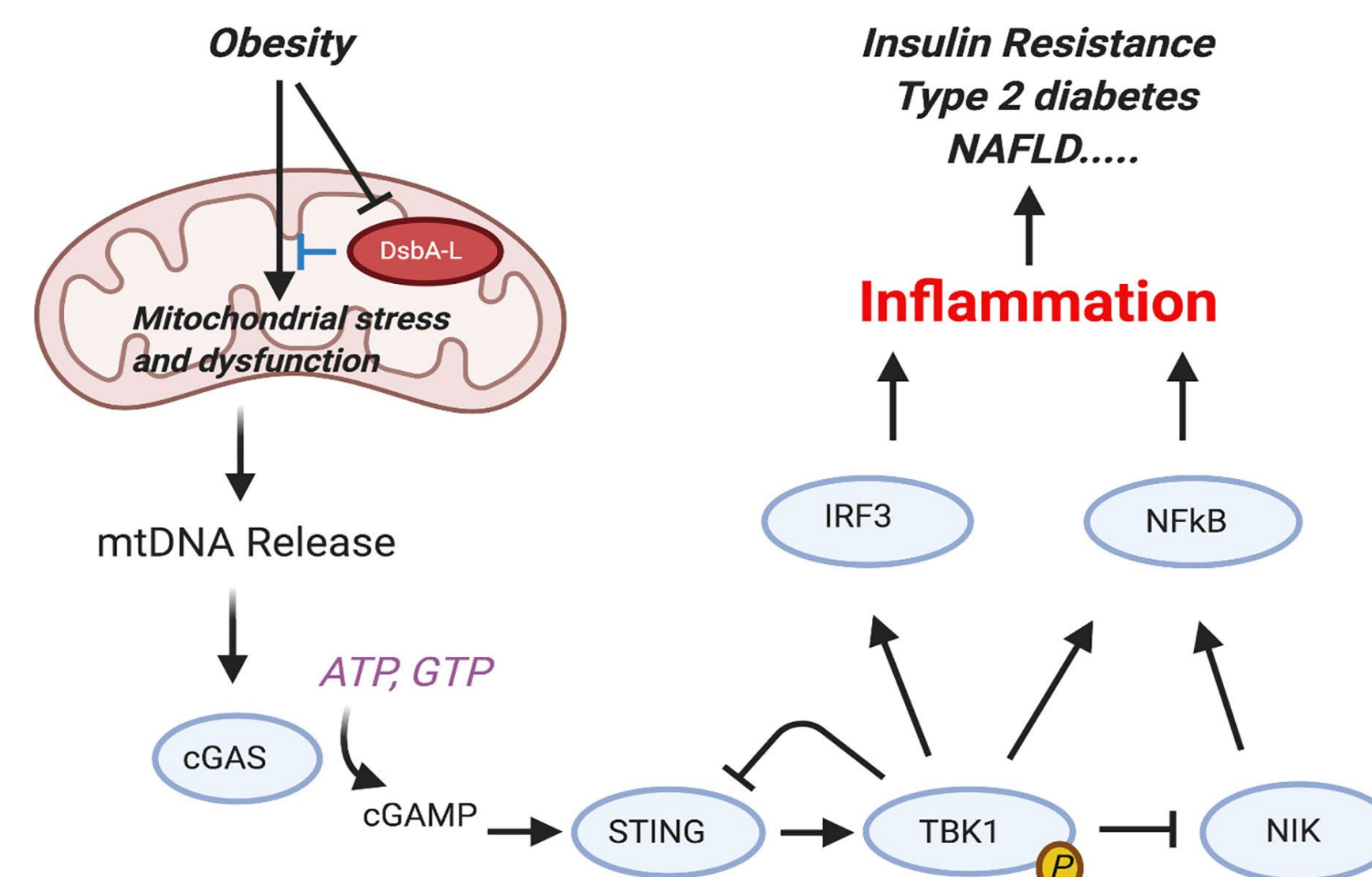


Figure 5. Diagram of inflammation leading to T2DM. Inflammation can lead to the development of insulin resistance. A proinflammatory cytokine can interrupt of insulin-stimulated tyrosine phosphorylation events as a result inducing insulin resistance. Inflammation is also a considered a CVD risk factor and has been reported as the underlying cause for 80% of sudden cardiac deaths. (Frontier et al. 2020.)

## Potential Mechanisms of insulin resistance

- Insulin resistance – The body's inability to respond to insulin signaling

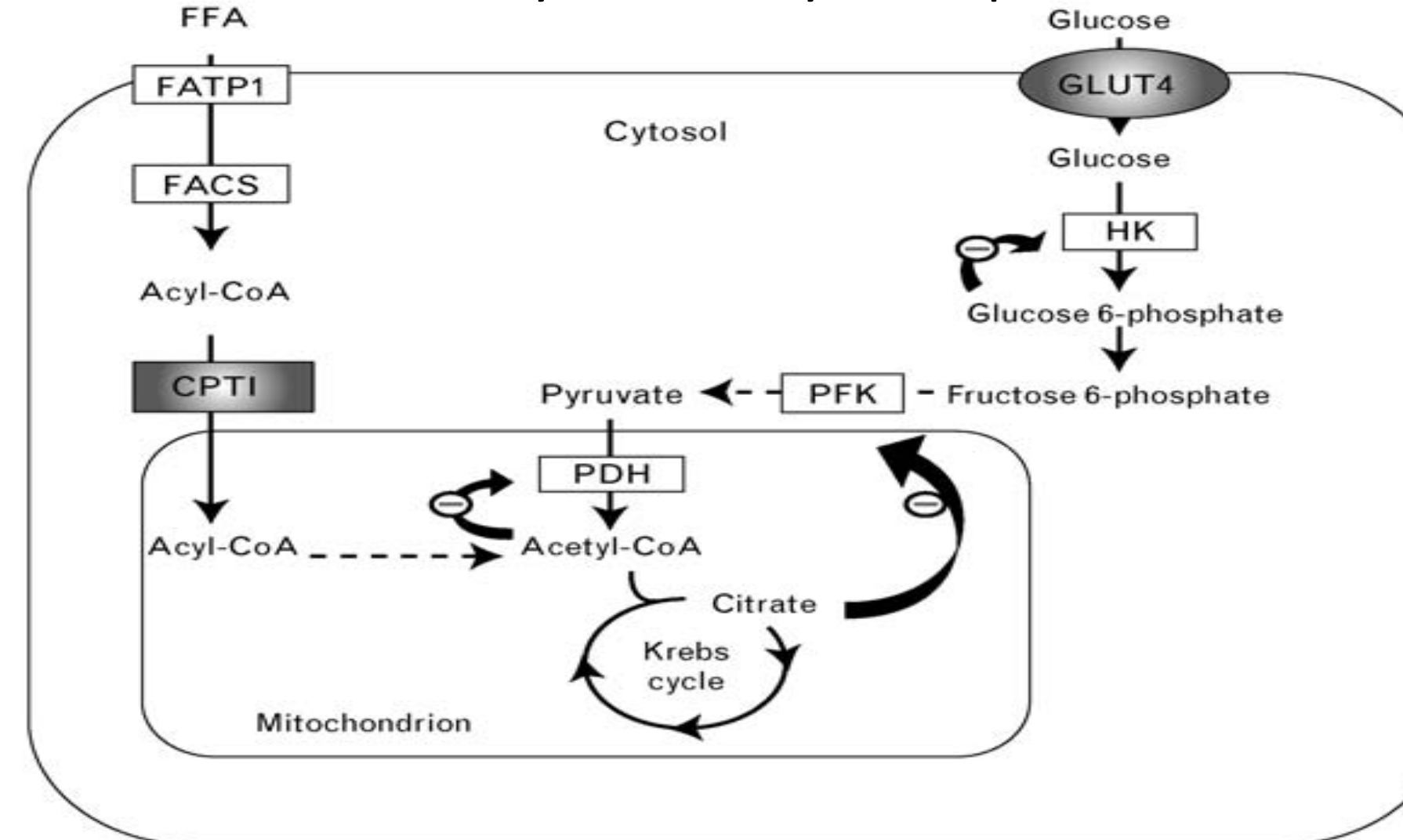


Figure 2. The Fatty acid oxidation cycle. One of the potential mechanisms explaining insulin was the fatty acid oxidation cycle. An increase of Acetyl CoA in the mitochondria would increase citrate levels resulting in the inhibition of PFK (phosphofruktokinase) and pyruvate. Inhibition of PFK and pyruvate would lead to the inhibition of hexokinase activity resulting in decreased glucose uptake. (Delarue et al. 2007)

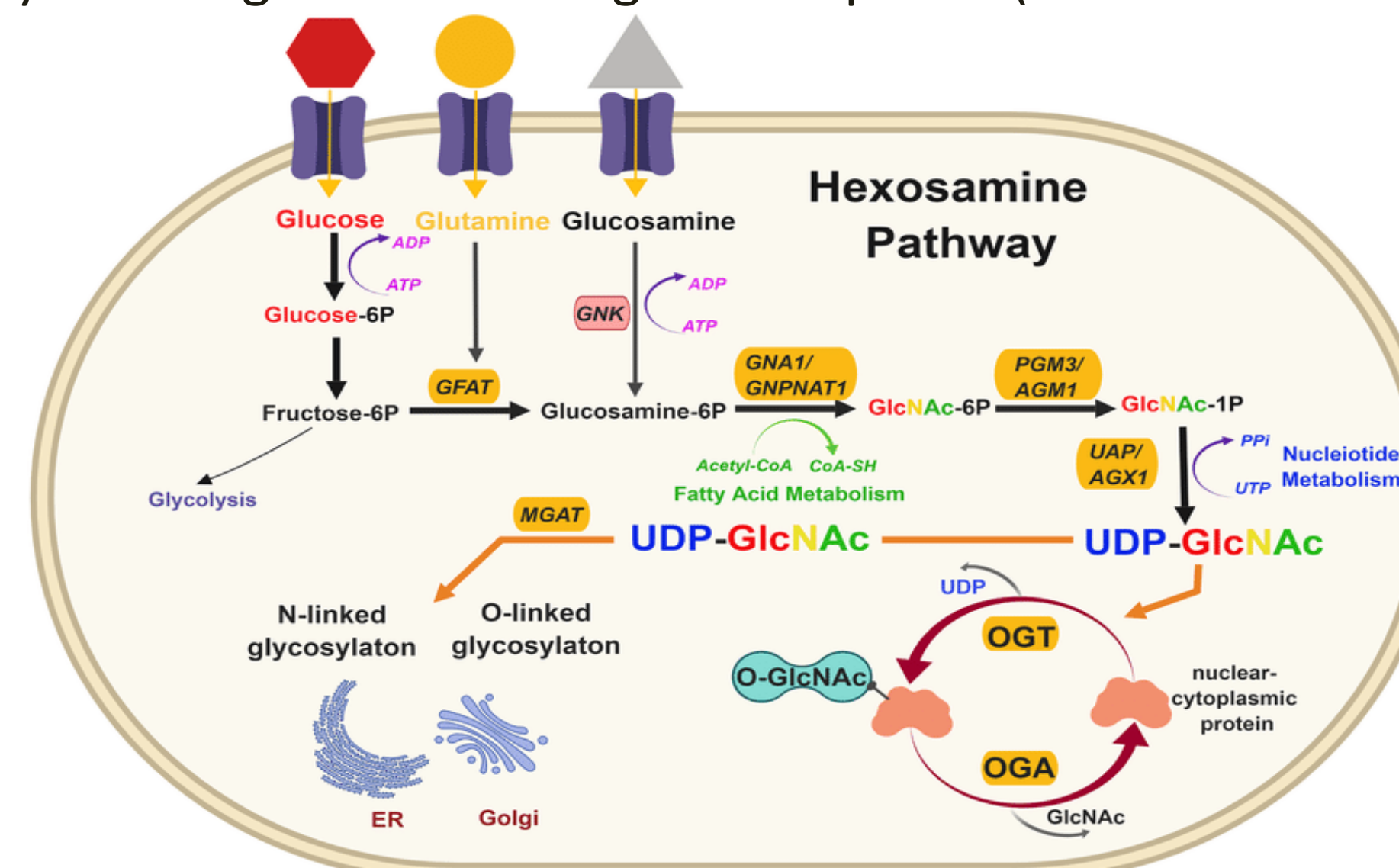


Figure 3. Diagram of the Hexosamine pathway. In this pathway the conversion of fructose 6-phosphate to glucosamine 6-phosphate using glutamine occurs. Glucosamine a substrate of the pathway was found to be able to induce insulin resistance in the glucose transport system (de Queiroz et al. 2019)

## Treatment



Figure 6. Biguanides are one of the many forms of treatment for type 2 diabetes. Metformin is on form of Biguanides that has ant-hyperglycemic effects. Studies have also showed that metformin can reduce the risk of CVD



Figure 7. Thiazolidinediones (TZDs) are insulin sensitizing agents and treat type 2 diabetes by improving insulin sensitivity. TZD increase the risk of CVD

## Conclusions

- Type 2 diabetes and CVD share a couple of risk factors potentially explaining the increased risk of CVD
- The therapies used to treat type 2 diabetes can also increased the risk for CVD
- The risk factors associated with type 2 diabetes can lead to the development of CVD explaining the increased risk

## Future directions

- Additional research on other risk factors of T2DM and CVD
  - Current research available is limited to a few risk factors
  - Studying the mechanisms behind the risk factors
- Determining the mechanism of insulin resistance
  - The mechanism of insulin resistance still remains unknown
- Developing treatments that address the risk of CVD and type 2 diabetes simultaneously

## REFERENCES

