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Current Treatments for Type 1 Diabetes Mellitus and New Therapies for the Disease

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Background

- Two forms of diabetes: **Type 1 Diabetes Mellitus** and **Type 2 Diabetes Mellitus**
- **T1DM**: an uncontrollable autoimmune disease that needs constant insulin supplementation
 - pancreas cannot produce insulin and T1DM induction cannot be prevented
 - Nearly 2 million individuals in the U.S.A. have T1DM
 - Insulin is necessary for regulating blood glucose levels via signaling cells in the body to take up glucose through the bloodstream, thus lowering one's blood sugar

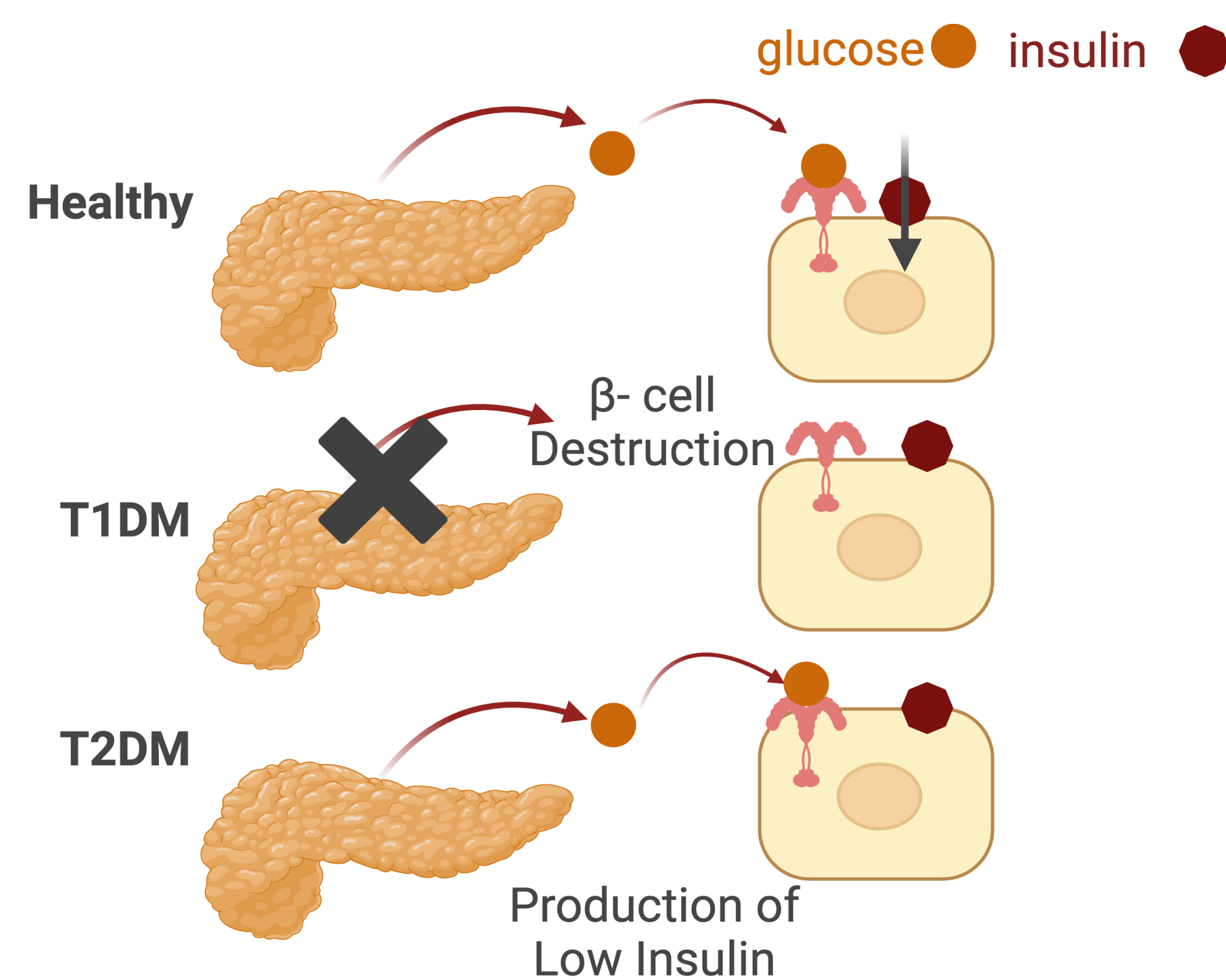


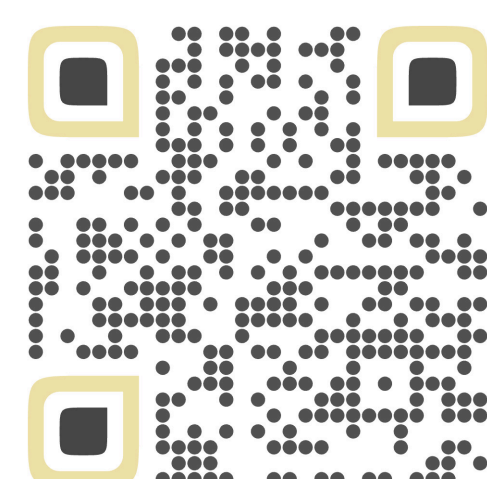
Figure 1. T1DM is caused by the β -cell destruction within the pancreas and natural glycolysis is no longer possible. With the lack of insulin production present, the body can become dangerously hyperglycemic or hypoglycemic if not monitored. Made with BioRender and inspiration came from (VectorMine 2021).

Methods

- Literary review of primary and peer reviewed articles in relation to Type 1 Diabetes Mellitus and potential alternatives for treatment to reverse the disease
- Articles were collected from PubMed, Science Direct, NCBI, etc.

Acknowledgments & References

A moment of gratitude for Dr. Laura Doepker for her mentorship and guidance in this literary research project.



Risk Factors



Figure 2. Differences between blood sugar (glucose) levels that can determine the amount of insulin administration is needed. Image inspiration from (Nalynskaya 2018, (Duca et al. 2019).) and made with (BioRender).

- If insulin is not administered or monitored, the body can reach extreme levels of hypoglycemia or hyperglycemia which can result in Diabetic Ketoacidosis (DKA) which can be fatal

Current Treatments

- Potential precautionary steps that could be taken to prevent onset of T1DM include balanced: exercise, diet, vitamins and minerals
- Every individual with T1DM have unique ranges of insulin needs
- Insulin supplementation via self monitored injection is the main source of treatment for T1DM
- Active maintenance of D_3 and omega-3 vitamins supplements
- Utilization of blood glucose monitoring (BGM) with finger pricking provides initial readings of high or low blood sugar levels to determine amounts of insulin needed
- The two current main administration techniques are:
 - Numerous injections throughout the day with long and short-term insulin
 - Use of continuous glucose monitoring (CGM) systems that

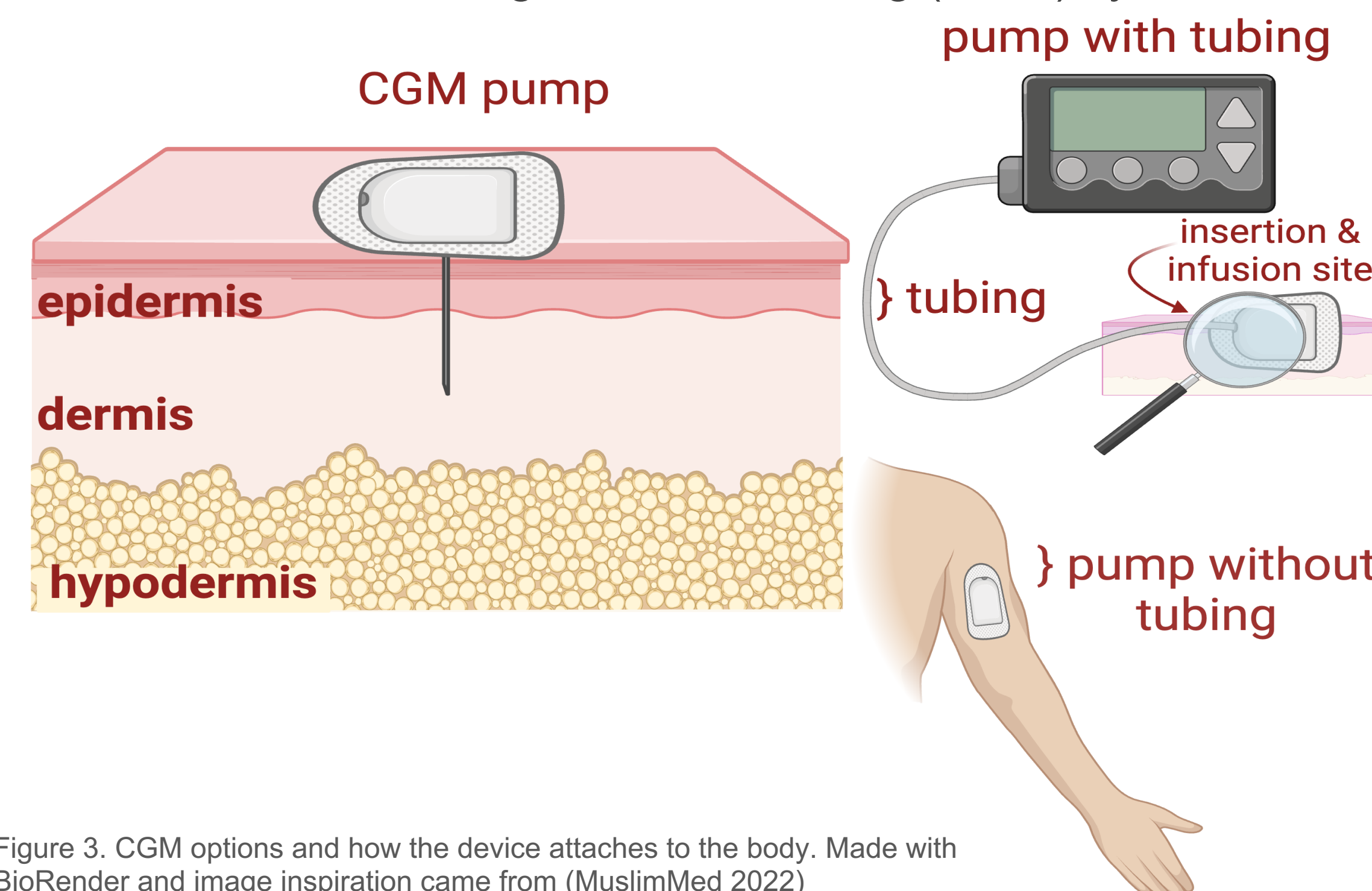


Figure 3. CGM options and how the device attaches to the body. Made with BioRender and image inspiration came from (MuslimMed 2022)

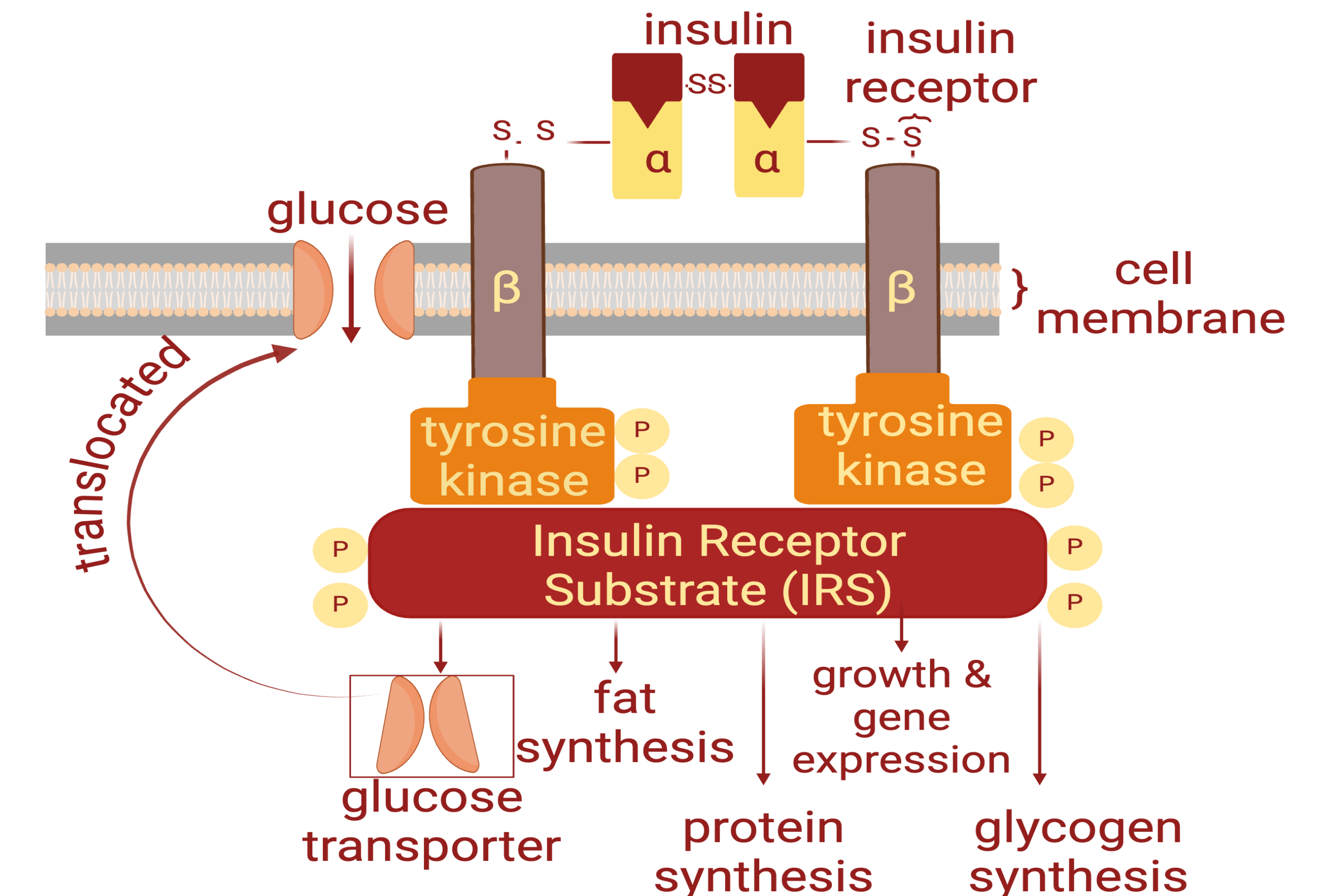


Figure 4. Mechanism of insulin receptors in the pancreas. Image was made with BioRender and image inspiration came from (Piliński A., Otto-Buczkowska E. 2023)

Future Directions

- **Possible Therapies for Type 1 Diabetes Mellitus Alternatives:**
 - **Gene Therapy:** currently only done on animals, includes over-expression of proteins and genes and mediation of stem cells
 - **Cord Blood Usage and Analysis:** pancreatic islet cells along with Neo-islet (NI) 3-D organ-like islet cell configurations in mice through the umbilical cord; islet cell donors are limited
 - **Islet Cell Transplants and Research:** islet cell neogenesis has only been performed on Indium Gallium Phosphide (INGaP)-treated hamsters in 2004

Conclusions

- Type 1 Diabetes Mellitus is an incurable autoimmune disease and requires administration of insulin via limited techniques to avoid dangerous levels of low or high blood sugars
- Regardless of how necessary the supplies and prescriptions of insulin are for the increasing number of patients worldwide, only two common techniques are practiced and are expensive
- More cost effective and environmentally conscious options are needed
- More attainable treatments are needed for global needs that provide access to more people
- More research needs to be done for potential therapies to determine safety and efficacy of treatments