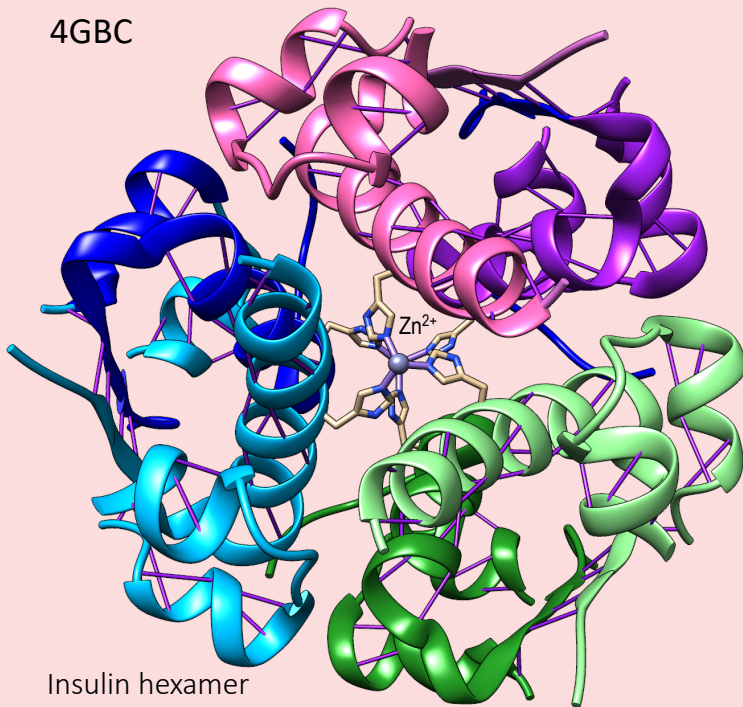


# SIGNALING MOLECULE

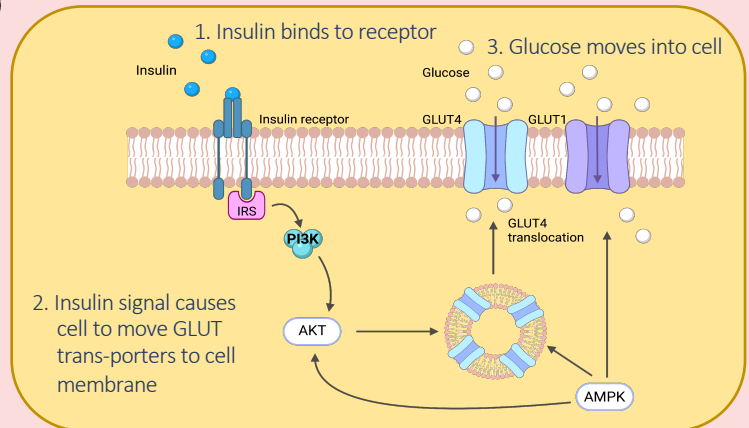
4GBC



Insulin hexamer

## Insulin

- a hormone secreted by the  $\beta$  cells of pancreas
- decreases blood glucose levels by prompting cells to use or store glucose



### LOCATION

- **gene** coding for insulin located on human chr. 11
- produced by  $\beta$  cells of Islets of Langerhans in **pancreas**
- synthesis of **pre-proinsulin** (110 aa) directed by signal peptide to RER
- in RER signal peptide removed yielding **pro-insulin** (86 aa)
- processed in GA by removal of **C-peptide** and folding into insulin (51 aa)
- secreted into blood in response to increased blood glucose levels

### STRUCTURE

- human insulin (monomer) is made of 51 amino acids
- monomer consists of **A chain** (21 aa) and **B chain** (30 aa) linked by **disulfide bridges** (between two cysteine residues)
- monomer has three alpha helices and one beta strand stabilized by **hydrogen bonds**
- stored as a **hexamer** (six monomers) coordinated by central **zinc ion** ( $Zn^{2+}$ )

### FUNCTION

- **decreases glucose level** in bloodstream by signaling cells to uptake glucose
- cells respond by moving **glucose transporters** (GLUT) into the membrane for trans-port of glucose into the cell
- cells metabolize glucose or stored it as **glycogen** in liver and muscle
- also inhibits metabolism of carbo-hydrates, fats, and proteins.

## Diabetes, a condition of high blood glucose<sup>1</sup>

- **Type 1 Diabetes:** caused by genetic factors, autoimmune disease or viruses;  $\beta$  cells in pancreas are destroyed and cells do not produce insulin
- **Type 2 Diabetes:** developed; body becomes resistant to effects of insulin, therefore requires more
- **Symptoms:** thirst, hunger, increased urination, fatigue, irritability, blurred vision

<sup>1</sup> American Diabetes Association; Figure created with BioRender.com; Model made in UCSF Chimera

## References

American Diabetes Association. (n.d.). Insulin basics. Insulin Basics | ADA. Retrieved November 8, 2021, from <https://www.diabetes.org/healthy-living/medication-treatments/insulin-other-injectables/insulin-basics>.

DiGiacinto, J. (2021, October 5). About insulin: What it is, how it works, and more. Healthline. Retrieved November 4, 2021, from <https://www.healthline.com/health/type-2-diabetes/insulin>.

Jaffe, L., & Hess-Fischl, A. (2021, October 3). What is insulin? EndocrineWeb. Retrieved November 4, 2021, from <https://www.endocrineweb.com/conditions/type-1-diabetes/what-insulin>.

Utiger, R. D. (2020, March 13). insulin. Encyclopedia Britannica. <https://www.britannica.com/science/insulin>