NON-INSULIN DEPENDENT DIABETES MELLITUS: SUGAR IN THE BLOOD

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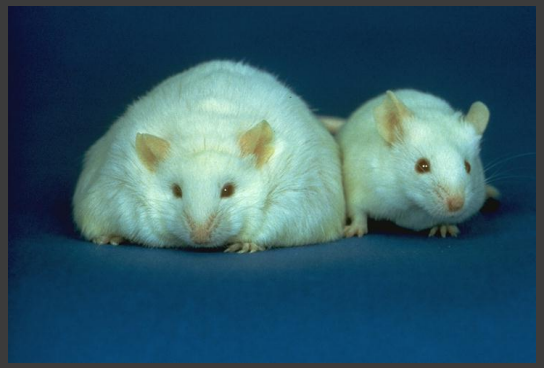
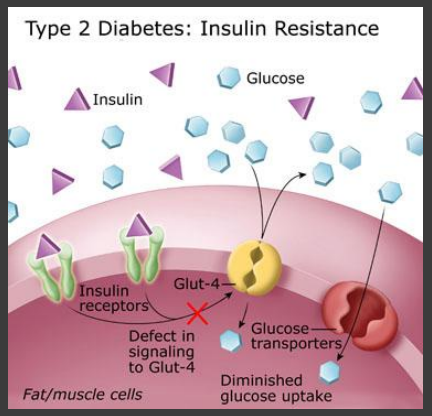
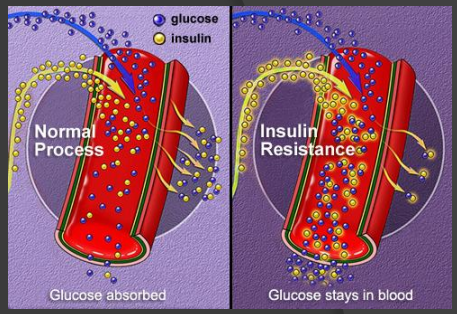
Human Genetics Period 3

Physiology

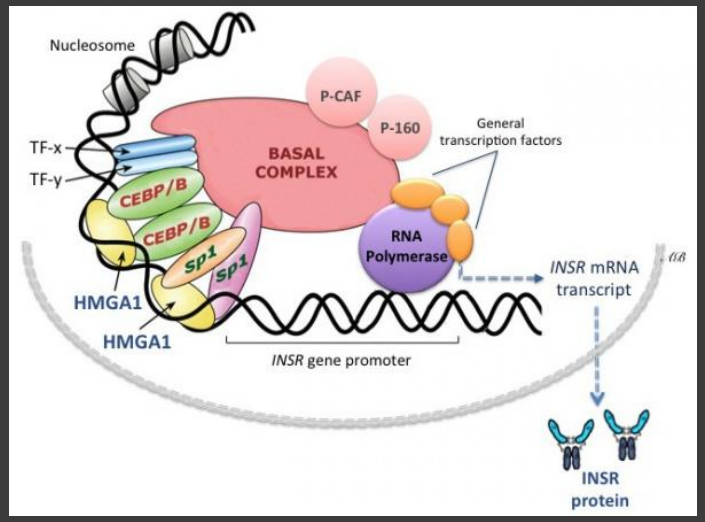


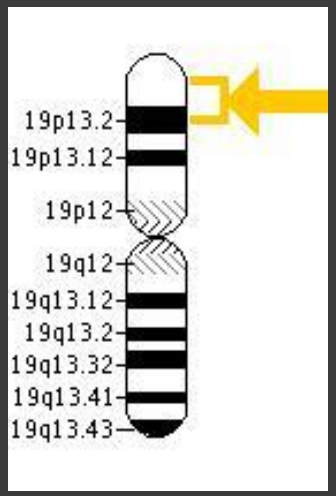


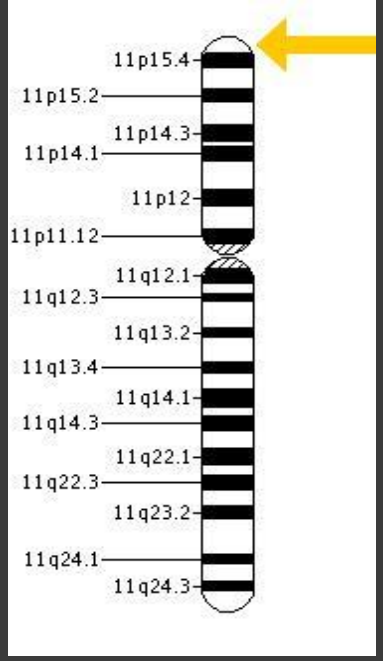


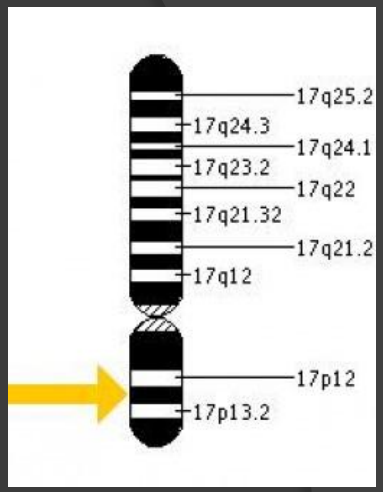
- Also known as diabetes mellitus type 2.
- Most common form of diabetes.
- Metabolic disorder: high blood glucose content, obesity and constant hunger, thirst, urination.
- Insidious onset: develops slowly and unnoticeable.
- Age of onset: childhood through adulthood. More likely to surface at older age
- Occurrence is influenced by environmental factors such as stress, race, obesity, and diet.
- Targets beta-islet cells of pancreas and cell receptors (endocrine system), causes insulin resistance (less cell response to insulin) and partial insulin deficiency.
- Not as severe as insulin dependent diabetes mellitus.
- Results in issues with the heart, eyes, kidneys, nerves, gums, and teeth.

Molecular Cause









- Polygenic disease: multiple genes are defective.
- Does not follow Mendelian inheritance patterns.
- Not all genetic factors are identified currently.
- Mutated insulin gene (INS, chromosome 11, location 11p15.5) and insulin receptor (INSR, chromosome 19, location 19p13.3 – p13.2) genes are major contributors to disease
- Deficient GLUT4 gene (chromosome 17, location 17p13) results in less effective glucose transporter in cells.
- Faulty INS gene causes reduced insulin production, defective INSR gene causes insulin resistance in cells.
- Defective genes cause decreased functionality of proteins or complete inactivation.

Treatment/Risks and Limits

- Currently, there are no viable cures for NIDDM. However, the effects of the disease can be limited.
- Most common treatment is through lifestyle changes such as a healthier diet and/or more physical activity.
- The changes can be adjusted to accommodate the severity of the disease.
- Lifestyle changes can be rejected or simply not be effective enough to mitigate negative disease effects.
- A more medical approach to treating the disease is to use insulin shots or oral hypoglycemic pills to decrease glucose levels in the body and thus decrease the impact of the disease.
- An severe lack of response to insulin would negate the benefits of direct introduction of insulin into the body.
- The body may also respond negatively to medication introduced to the body.

Proposed Cure/Limitations

- Gene therapy is under development for use as a cure for NIDDM.
- As a polygenic disease, all genetic factors must identified in order to successful cure disease.
- Identified genes are found as normal genes, isolated, copied, and placed into vector as a genetic “package” which introduces the genes into cells with active defective genes.
- Adenovirus vector would be effective as it would replace DNA, which is the source of the mRNA and proteins that are constantly produced to accommodate the needs of the body against high glucose levels.
- Usage of synthetic versions zinc proteins known as zinc fingers permit targeting of cell through control of the genetic code that identifies the cells
- All genes must be identified or the “cure” would be ineffective as there would still be active genes affecting the body.
- There is a possibility that the vector would be unable to target all affected cells, rendering the corrected genes useless.
- Even with a “successful” therapy, it may be possible for the disease to resurface since there may still be unidentified remainders of NIDDM.

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