



## Glucose Sensitive Regulator of Insulin Transcription (VA Reference No. 99-003)

*Unique insulin regulator nucleic acid constructs designed to deliver insulin in patients with type 1 diabetes*

### Technology

Insulin regulator nucleic acid constructs

### Inventor

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### Key Features

- Gene therapy for diabetes treatment
- Provides better control of glucose levels in patients
- Could be used for both type 1 and type 2 diabetes

### Stage of Development

Reduced to practice with successful demonstration in both *in vitro* and animal models

### Keywords

- Therapeutic
- Diabetes mellitus
  - Insulin
  - Glucose control
  - Glucose responsive elements (GIREs)
  - Transgenic production

### Patent Status

[US Pat. No. 7,790,690](#)

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### Technology

The Department of Veterans Affairs has developed a set of insulin regulator nucleic acid constructs designed to deliver insulin in a patient with type 1 insulin-dependent diabetes in a manner responsive to glucose levels.

### Description

Type 1 diabetes mellitus is usually precipitated by autoimmune destruction of pancreatic  $\beta$ -cells, leading to insufficient insulin production. Since clinical symptoms are caused by diminished production of a single protein, diabetes is a natural candidate for treatment by gene therapy. The basic components of insulin gene therapy are widely available. Functional insulin genes can be transferred to multiple tissues and the capacity of non  $\beta$ -cells to secrete biologically active transgenic insulin in sufficient quantities to affect metabolism is well established. However, attempts to regulate transgenic insulin production have proven inadequate. Consequently, in a variety of insulin gene transfer protocols secretion of transgenic insulin has been either insufficient to normalize blood glucose, has affected glycemia only moderately, or for short periods of time, or has produced lethal hypoglycemia. Thus, for insulin gene therapy to be effective, it is widely accepted that insulin production must be regulated.

The key features of the nucleic acid construct developed by the VA are glucose responsive elements (GIREs) and an insulin sensitive element that confer two important properties for transgenic production of insulin-stimulation by glucose and inhibition by insulin. In addition, the technology includes vectors comprising the insulin regulator constructs, pharmaceutical compositions comprising the insulin regulator construct, and methods of treating or preventing diabetic conditions in a subject.

### Competitive Advantage

The nucleic acid constructs, which may prove useful in gene therapy to treat type 1 diabetes, appear to represent an important technological advance.

This invention:

- Could lead to a new treatment that provides better control of glucose levels with less risk of hypoglycemia.
- Could also prove efficacious in treating patient with insulin-dependent type 2 diabetes.

### Status

The Department of Veterans Affairs is looking for a partner for further development and commercialization of this technology through a license, and the VA inventors are available to collaborate with interested companies through a Cooperative Research and Development Agreement (CRADA).