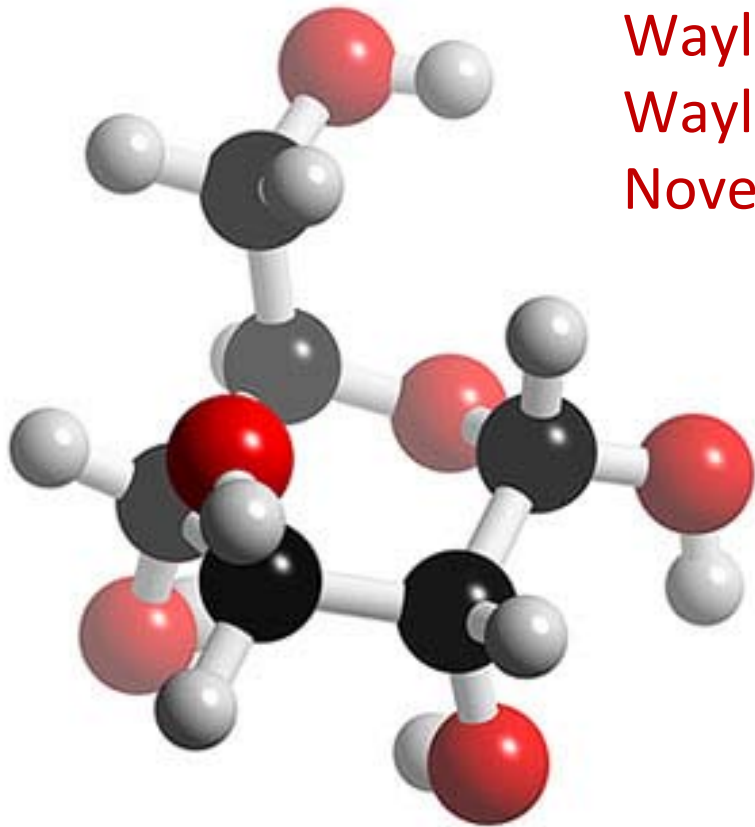# TYPE 1 DIABETES CLUSTER INVESTIGATION: WESTON, WELLESLEY AND NEWTON
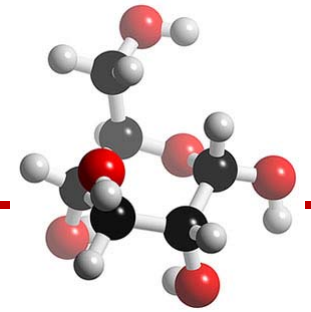
Wayland Great Presenter Series 2011-2012
Wayland Public Library
November 1, 2011

Suzanne K. Condon, Associate Commissioner
Director, Bureau of Environmental Health
Massachusetts Department of Public Health

Outline
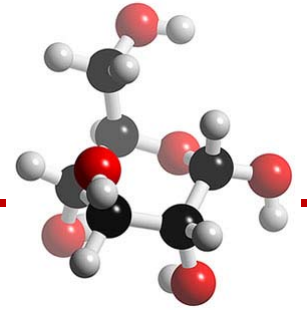
I. Introduction to the Bureau of Environmental Health

II. Massachusetts Pediatric Diabetes Surveillance

III. Type 1 Diabetes in Massachusetts and Selected Communities

IV. MDPH Investigation of Type 1 Diabetes in Weston, Wellesley, and Newton

V. Risk Factors for Diabetes

VI. Autoimmune Diseases and Environmental Exposures

VII. Next Steps Related to Investigating Diabetes in Weston, Wellesley and Newton

VIII. Questions
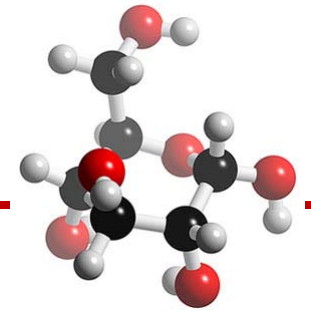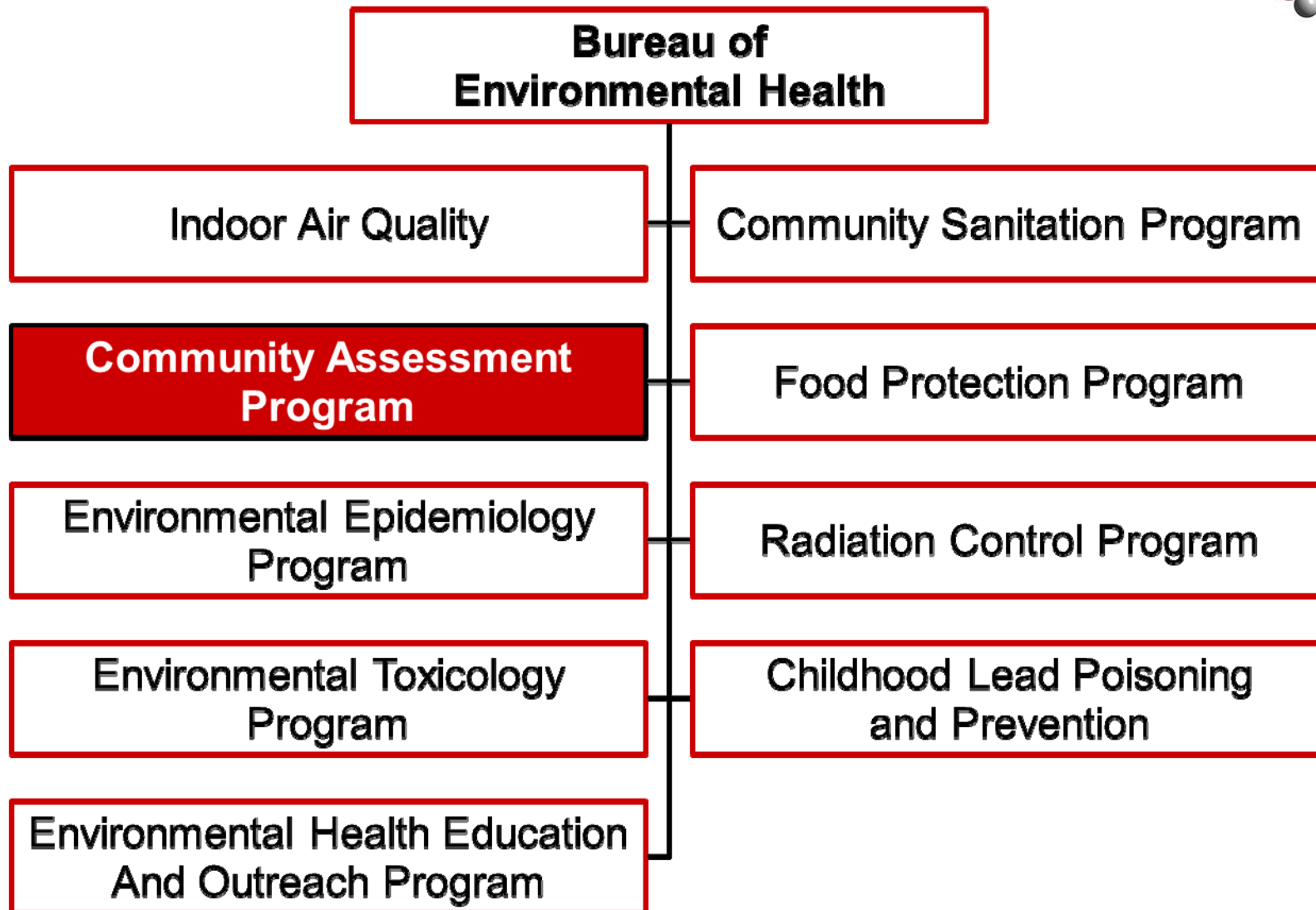
I. Introduction to the Bureau of Environmental Health

- The Bureau of Environmental Health has a broad mission of protecting the public health from a variety of environmental exposures. The Bureau responds to environmental health concerns and provides communities with epidemiologic and toxicological health assessments.

- The Bureau comprises nine programs.

- The Bureau also ensures regulatory compliance related to food and radiation safety, as well as the state sanitary code.

I. Introduction to the Bureau of Environmental Health


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                    ┌─────────────────────┐
                    │      Bureau of       │
                    │ Environmental Health │
                    └─────────────────────┘

┌──────────────────────┐        ┌──────────────────────────────┐
│   Indoor Air Quality  │        │  Community Sanitation Program │
└──────────────────────┘        └──────────────────────────────┘

┌──────────────────────┐        ┌──────────────────────────────┐
│  Community Assessment │        │    Food Protection Program    │
│       Program         │        └──────────────────────────────┘
└──────────────────────┘

┌──────────────────────┐        ┌──────────────────────────────┐
│ Environmental         │        │   Radiation Control Program   │
│ Epidemiology Program  │        └──────────────────────────────┘
└──────────────────────┘

┌──────────────────────┐        ┌──────────────────────────────┐
│ Environmental         │        │    Childhood Lead Poisoning   │
│ Toxicology Program    │        │        and Prevention         │
└──────────────────────┘        └──────────────────────────────┘

┌──────────────────────────────┐
│ Environmental Health Education│
│   And Outreach Program        │
└──────────────────────────────┘
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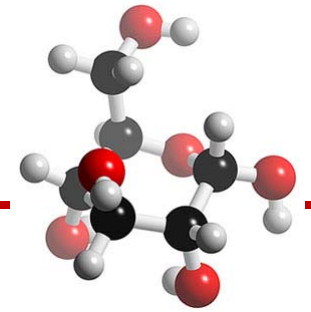# I. Introduction to the Bureau of Environmental Health
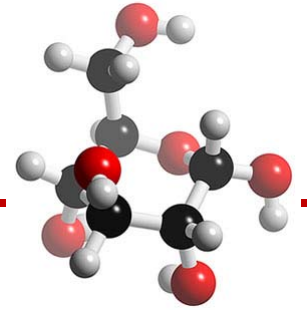
How do we evaluate health?

- Assess the potential impact of exposure on the population

- Evaluate disease frequency in the population

- Investigate possible associations between exposure and disease

II. Massachusetts Pediatric Diabetes Surveillance

- Funded through the U.S. Centers for Disease Control and Prevention's Environmental Public Health Tracking program

- Coupled with pediatric asthma surveillance

- Previous verification effort resulted in 97% agreement between school reports and child's medical record

- Mailed survey to 2100 public and private school nurses/administrative staff

- 2008-2009 response rate 99.5%

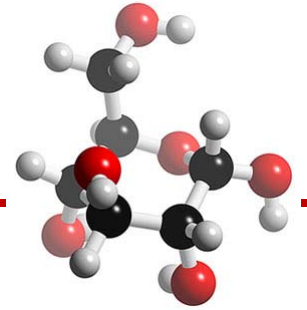# II. Massachusetts
Pediatric Diabetes Surveillance
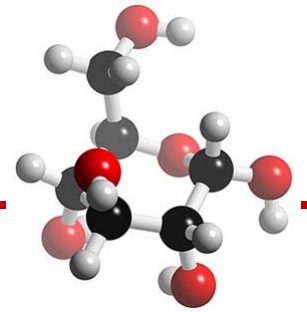
- Prevalence of Type 1 in MA students in grades K-8 is 253 per 100,000 students

- Nationally, the prevalence of Type 1 among individuals 5-14 year of age is 214 per 100,000*

- Counts are provided by type of diabetes (Type 1, Type 2, Unknown Type), race/ethnicity, grade, gender, and community of residence

*SEARCH for Diabetes in Youth Study
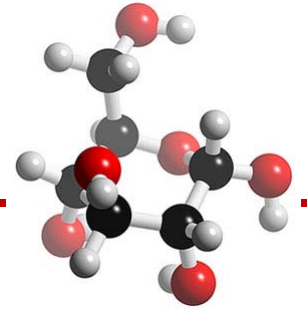
II. Massachusetts
Pediatric Diabetes Surveillance

Type 1 Diabetes in K-8 Students for the 2008-2009 School Year in Massachusetts

- Children with Type 1 diabetes represented 93% of cases (n=1,761)

- Children with Type 2 diabetes = 6% (n=111)

- Unknown type was 1% (n=18)

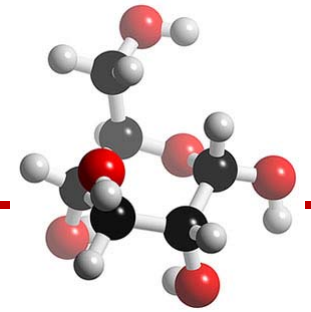## II. Massachusetts Pediatric Diabetes Surveillance

Type 1 Diabetes in K-8 Students for the 2008-2009 School Year in Massachusetts

- Although the national prevalence is lower than the MA rate, the methods for determining the rates were very different and could account for some of the difference

- SEARCH estimates are based on a sample of individuals (0-19 years of age) who participate in their study

- MDPH estimates are based on school health information for all children who attend grades K-8 (approximately 5-14 year olds) in public and private schools in MA

III. Type 1 Diabetes in Massachusetts and Selected Communities
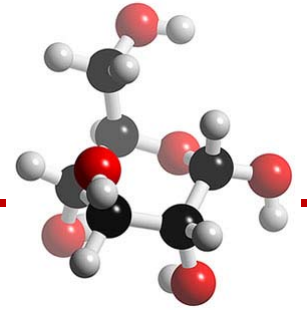
Selected Massachusetts Communities
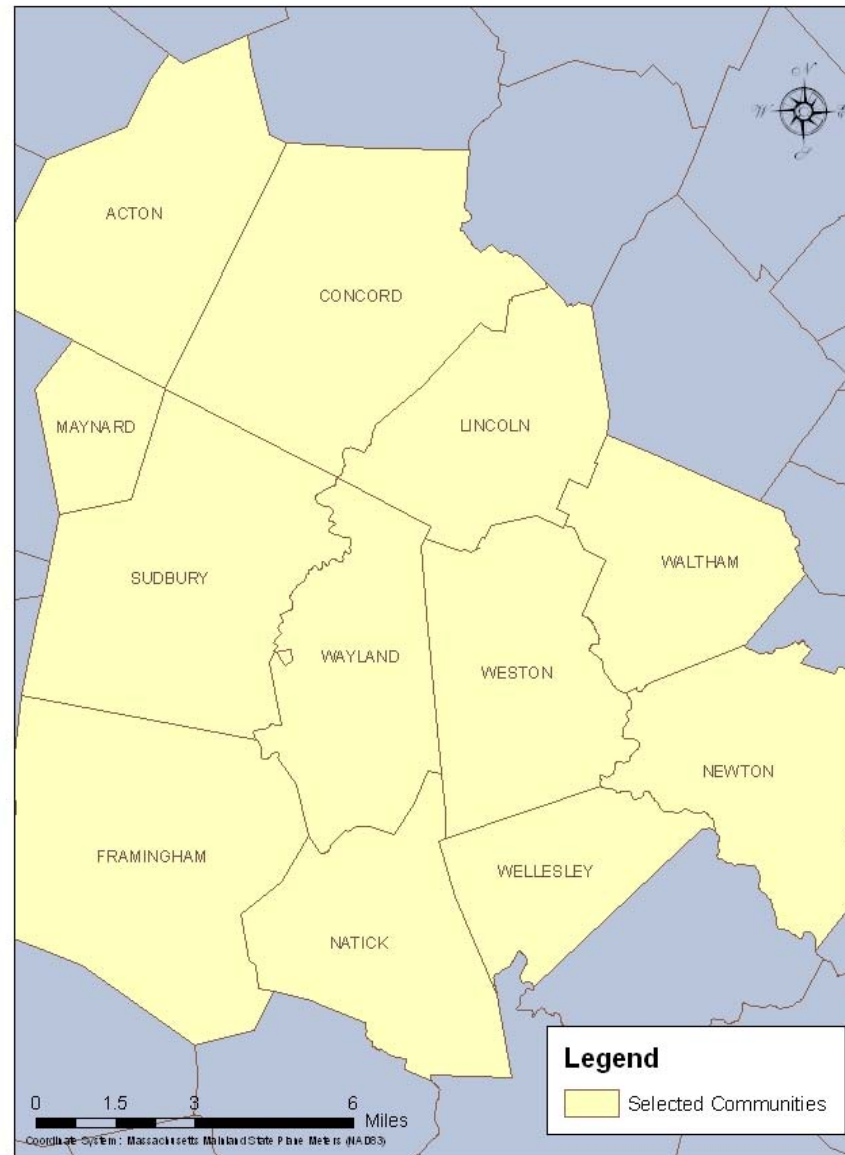
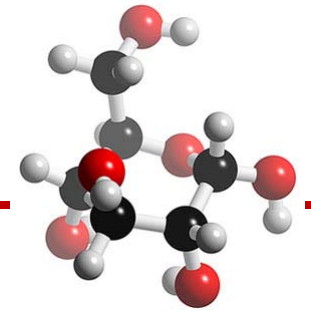# III. Type 1 Diabetes in Massachusetts and Selected Communities

Prevalence Estimates and their Interpretation

- Prevalence estimates are calculated by dividing the number of children with type 1 diabetes in a community by school enrollment totals for that community

- 95% Confidence Intervals (CI) are calculated for each community to measure:
  - statistical significance (overlapping CI)
  - stability of the prevalence estimate (width of the CI)

III. Type 1 Diabetes in Massachusetts and Selected Communities

Prevalence of Type 1 Diabetes in K-8 Students for the 2008-2009 School Year in Selected Communities in Massachusetts
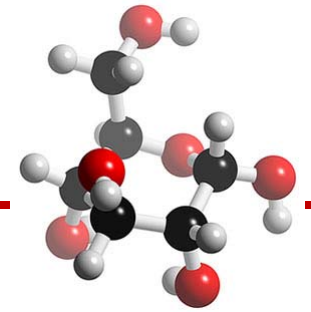
City/Town[†]	Number of Students with Type 1 Diabetes	Total Enrollment	Prevalence*	Lower 95% Confidence Interval	Upper 95% Confidence Interval	Statistical Significance
ACTON	11	3420	322	160	576	Not Statistically Significantly Different
CONCORD	10	2077	481	231	886	Not Statistically Significantly Different
FRAMINGHAM	16	6403	250	143	405	Not Statistically Significantly Different
LINCOLN	NS	NS	NS	NS	NS	NS
MAYNARD	NS	NS	NS	NS	NS	NS
NATICK	9	3909	230	105	437	Not Statistically Significantly Different
NEWTON	22	9261	238	138	337	Not Statistically Significantly Different
SUDBURY	11	3097	355	177	636	Not Statistically Significantly Different
WAYLAND	4	1869	214	58	548	Not Statistically Significantly Different
WELLESLEY	13	4237	307	163	525	Not Statistically Significantly Different
WESTON	7	1829	383	153	788	Not Statistically Significantly Different
STATEWIDE	1761	696105	253	241	265	---

† City/Town refers to the city/town of the child's residence

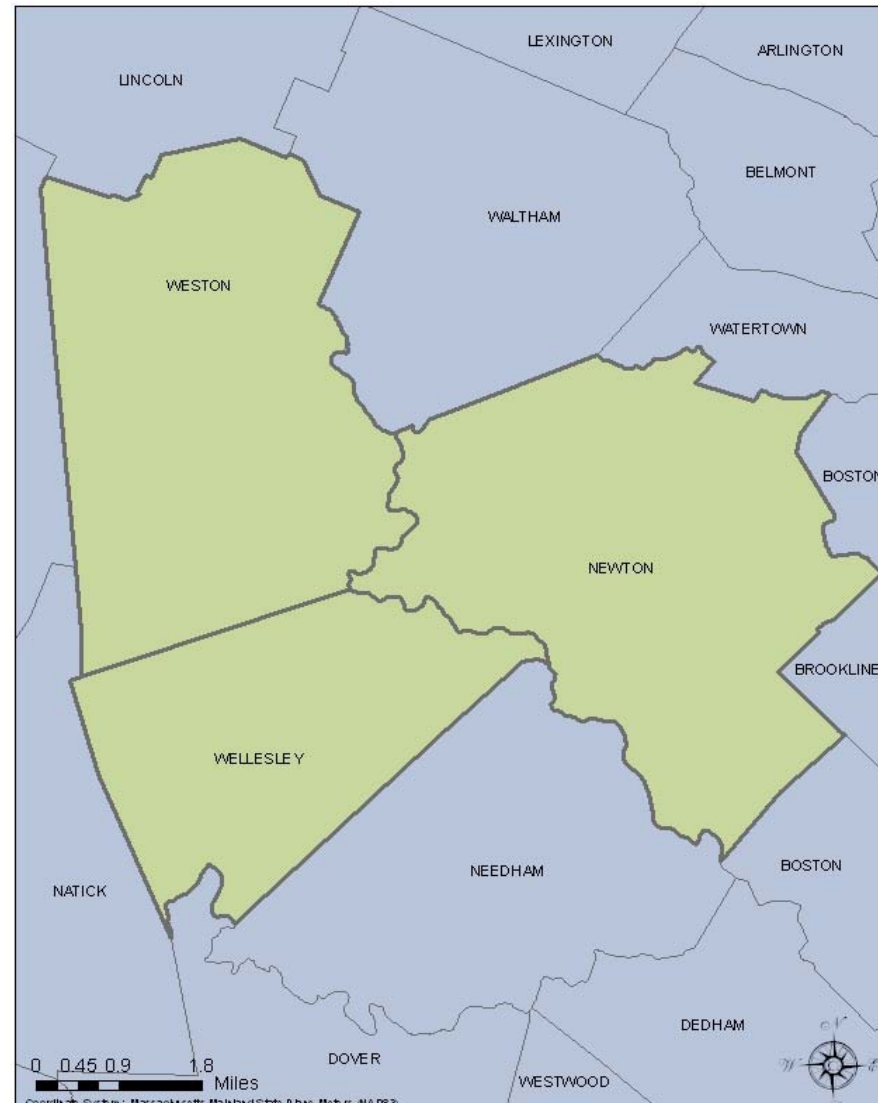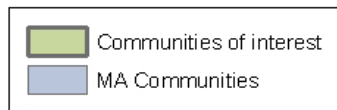* per 100,000 students

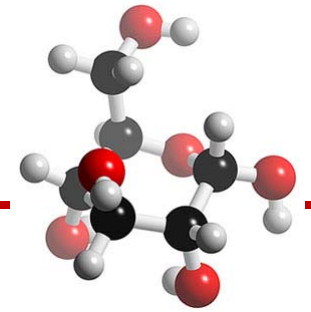NS--Data not shown due to small numbers

IV. MDPH Investigation of Type 1 Diabetes in Weston, Wellesley, and Newton

Selected Massachusetts Communities

Legend:
- Communities of interest
- MA Communities

IV. MDPH Investigation of Type 1 Diabetes in Weston, Wellesley, and Newton

Prevalence of Type 1 Diabetes in K-8 Students for the 2008-2009 School Year in Weston, Wellesley and Newton, Massachusetts

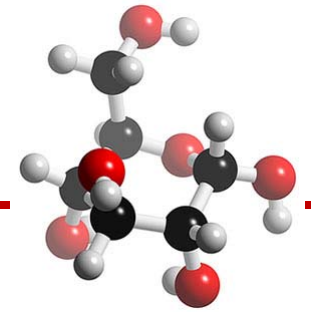| City/Town[†]	Number of Students with Type 1 Diabetes	Total Enrollment	Prevalence*	Lower 95% Confidence Interval	Upper 95% Confidence Interval	Statistical Significance
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† City/Town refers to the city/town of the child's residence

* per 100,000 students

NS--Data not shown due to small numbers

# IV. MDPH Investigation of Type 1 Diabetes in Weston, Wellesley, and Newton

Environmental Epidemiologic Questions

1. Does the prevalence of type 1 diabetes in these 3 communities or the census tracts of concern differ from the expected prevalence?
   - Compare to national SEARCH Study prevalence estimates*

2. Does family history play more of a role in the observed prevalence in the 3 communities or the census tracts of concern than would be expected?
   - Ten percent of individuals diagnosed with type 1 diabetes have a family history of diabetes (Source: Juvenile Diabetes Research Foundation)

3. Does residential history play a role in the observed prevalence?
   - Did children/adolescents reside in the 3 communities at diagnosis or within 1-2 years prior to diagnosis?

4. Does the geographic distribution of residence at diagnosis appear unusual?
   - Compare to population density patterns

5. Is there a grouping of diagnoses in space or time such that it is plausible that a common exposure might have contributed to diagnoses?

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IV. MDPH Investigation of Type 1 Diabetes in Weston, Wellesley, and Newton
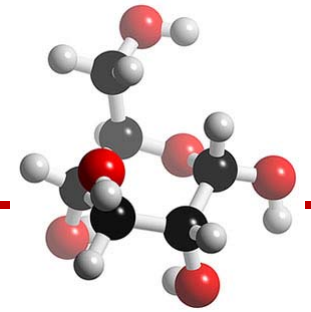
Data Sources

- In 2007-2008 MDPH began collecting diabetes data from school health records.
  - As with pediatric asthma, data are reported by school nurses and/or administrative staff at public and private schools in Massachusetts.
- Family Educational Rights and Privacy Act of 1974 (20 U.S.C. 1232g)
  - Protects students' privacy for educational records/Cannot be released w/o parental consent
  - Applies to all educational institutions that receive funds from U.S. Dept of Education
  - Applies to entire content of the student's record
- In 2009-2010, MDPH worked with school nurse leaders in the three communities to coordinate mailings to all parents of children diagnosed with diabetes
- In 2010, MDPH contacted health care providers to identify all children in the three communities with type 1 diabetes in an effort to capture information about:
  - pre-school age children
  - those attending private schools outside Weston, Wellesley, and Newton

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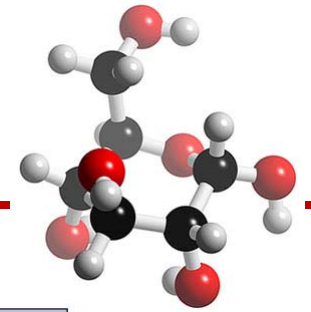# IV. MDPH Investigation of Type 1 Diabetes in Weston, Wellesley, and Newton
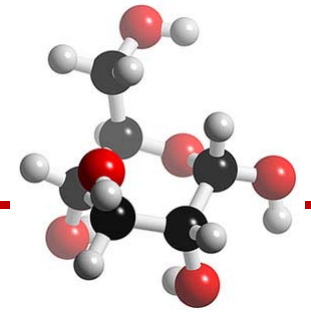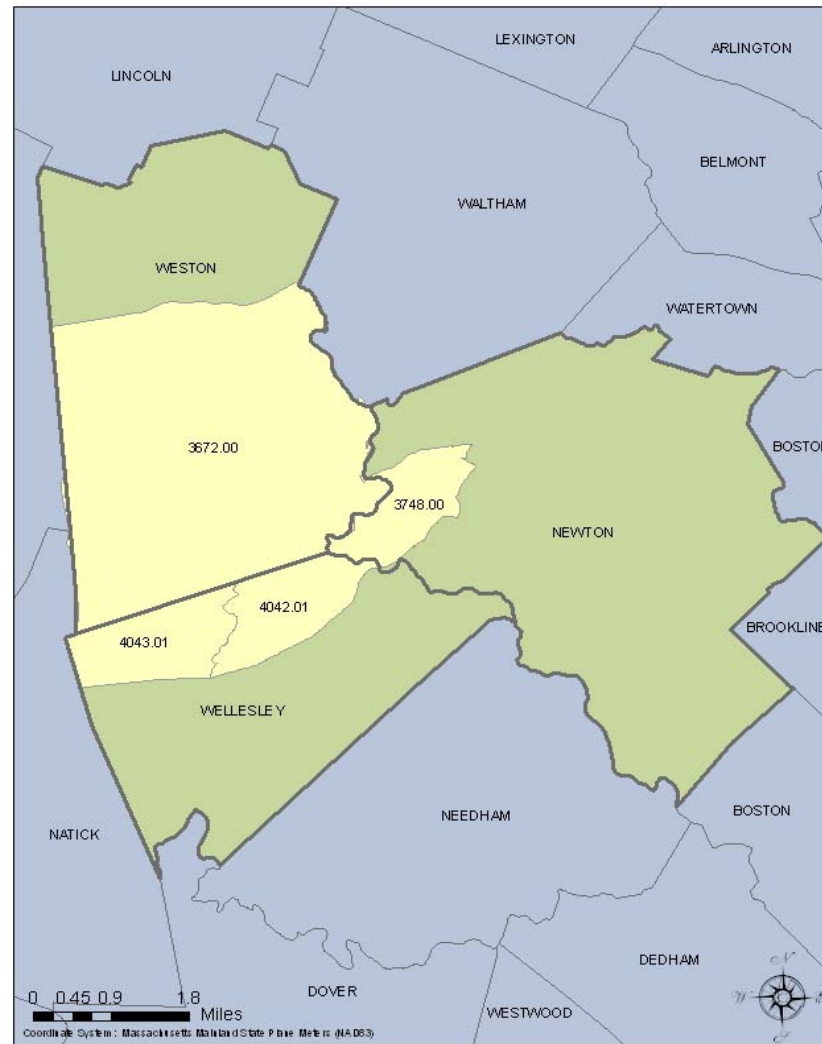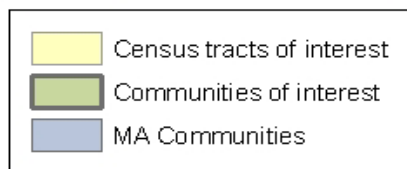
Consent Form

- Residential History

- Family History

- Insulin dependency

- Age at diagnosis

IV. MDPH Investigation of Type 1 Diabetes in Weston, Wellesley, and Newton

Selected Census Tracts in Weston, Wellesley and Newton Massachusetts

Legend:
- Census tracts of interest
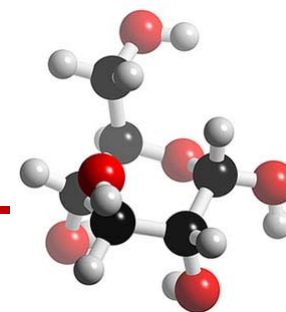- Communities of interest
- MA Communities

cg, October 20, 2011

Geographic data supplied by: Massachusetts Executive Office of Environmental Affairs, MassGIS; Geographic Data Technology, Inc.
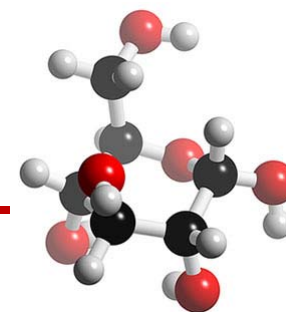
V. Risk Factors for Diabetes

- Type 1 diabetes is thought to be autoimmune in nature, for that reason environmental factors are also thought to play a role; genetic factors and a family history are also thought to play a role in the development of Type 1

- Type 2 diabetes also has some suggested environmental risk factors including persistent organic pollutants (e.g. PCBs)

- Recognized risk factors for Type 2 include family history, obesity, physical inactivity, race/ethnicity and others
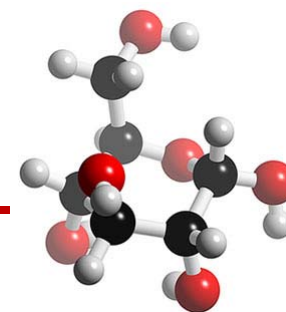
V. Risk Factors for Diabetes

Potential Environmental Risk Factors Associated with Type 1 Diabetes

Class	Specific agent
Viruses	Enteroviruses Rubella (congenital) Coxsackie B Rotaviruses
Nutritional	Cow's milk and cow's milk-based infant formula Gluten Exposure to Bafilomycin A1 Nitrates (N-nitroso compounds) Vitamin D Deficiency
Life-style / Other	Exposure to b-cell toxins (e.g. the rat poison, Vacor) Smoking (Family members, indoors) Older maternal age Birth order Infant Growth Birth weight Stressful life events

*Based on Table 2 from Zvi Laron's Interplay Between Heredity and Environment in the Recent Explosion of Type 1 Childhood Diabetes Mellitus
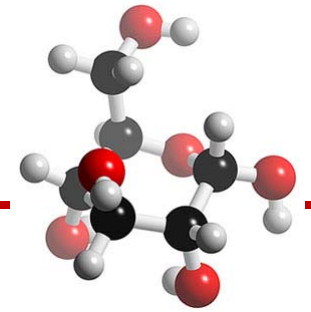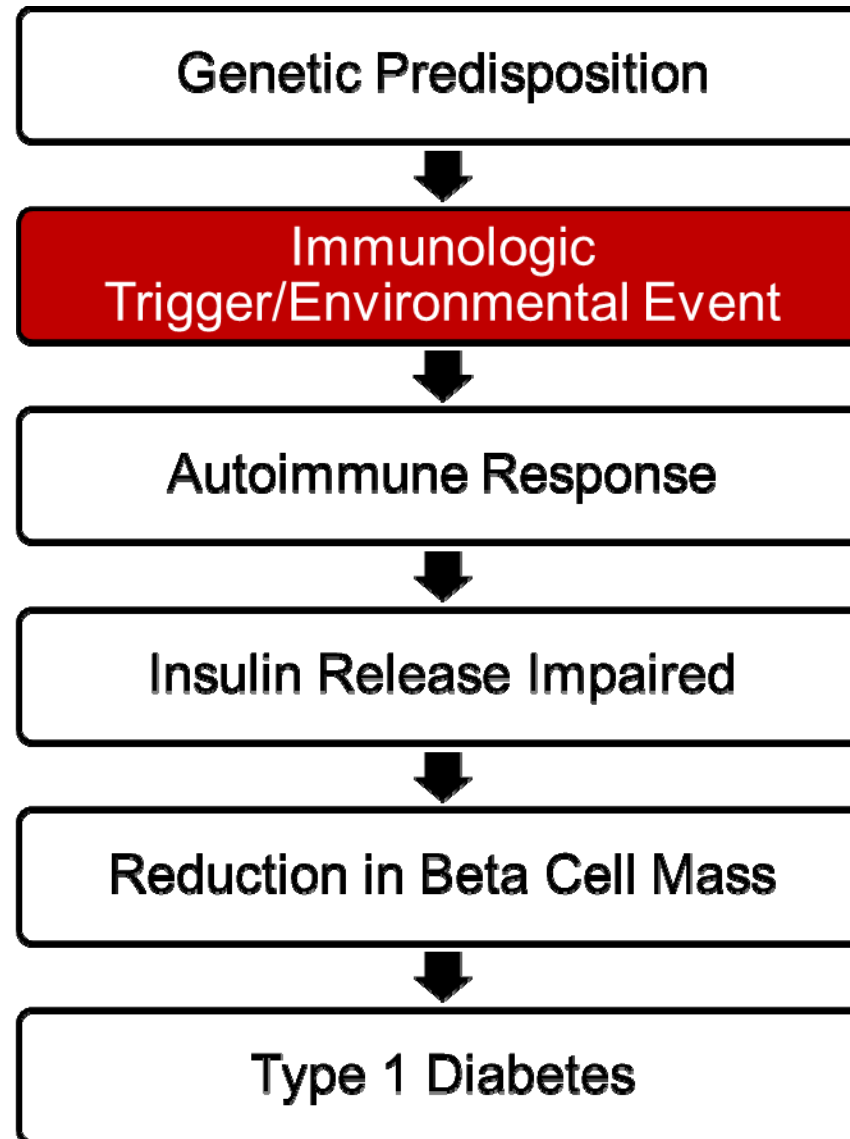
V. Risk Factors for Diabetes

Other Potential Risk Factors for
Type 1 Diabetes Requiring Further Study

- Exposure to ozone, sulfates, and particulate air pollution
  - One study in California has shown an association between estimates of exposure to air pollution and type 1 diabetes

- Exposure to persistent organic pollutants
  - Conflicting results in the few studies that have been conducted
  - Studies have major limitation (e.g. cross-sectional design ⟶ unable to report whether diabetes or higher PCB levels came first)

# VI. Autoimmune Diseases and Environmental Exposures

The Development of Type 1 Diabetes*

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┌─────────────────────────────────────────┐
│          Genetic Predisposition          │
└─────────────────────────────────────────┘
                     ↓
┌─────────────────────────────────────────┐
│              Immunologic                  │
│      Trigger/Environmental Event          │
└─────────────────────────────────────────┘
                     ↓
┌─────────────────────────────────────────┐
│            Autoimmune Response            │
└─────────────────────────────────────────┘
                     ↓
┌─────────────────────────────────────────┐
│          Insulin Release Impaired         │
└─────────────────────────────────────────┘
                     ↓
┌─────────────────────────────────────────┐
│        Reduction in Beta Cell Mass        │
└─────────────────────────────────────────┘
                     ↓
┌─────────────────────────────────────────┐
│              Type 1 Diabetes              │
└─────────────────────────────────────────┘
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*Adapted from Figure 338-6 in Diabetes Mellitus in Harrison's Principles of Internal Medicine, 17th Edition (2008)

# VI. Autoimmune Diseases and Environmental Exposures
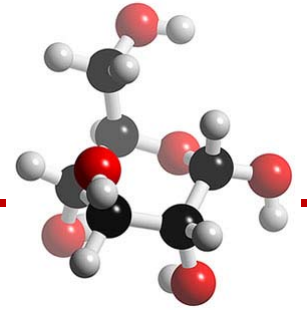
- Literature suggests that petroleum distillates (products, such as diesel fuel created from processing crude oil), mercury, silica and chlorinated hydrocarbons may be associated with lupus and other undifferentiated connective tissue diseases

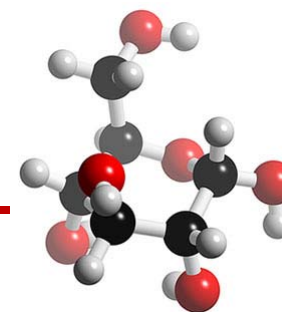# VI. Autoimmune Diseases and Environmental Exposures
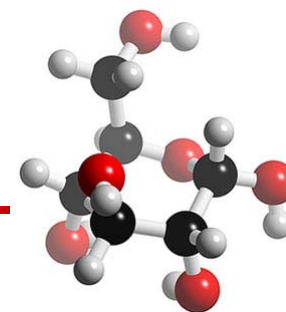
Density of Tier-Classified 21e Sites with Lupus-Suspected Chemicals and Neighborhoods with the Highest Rates of Lupus
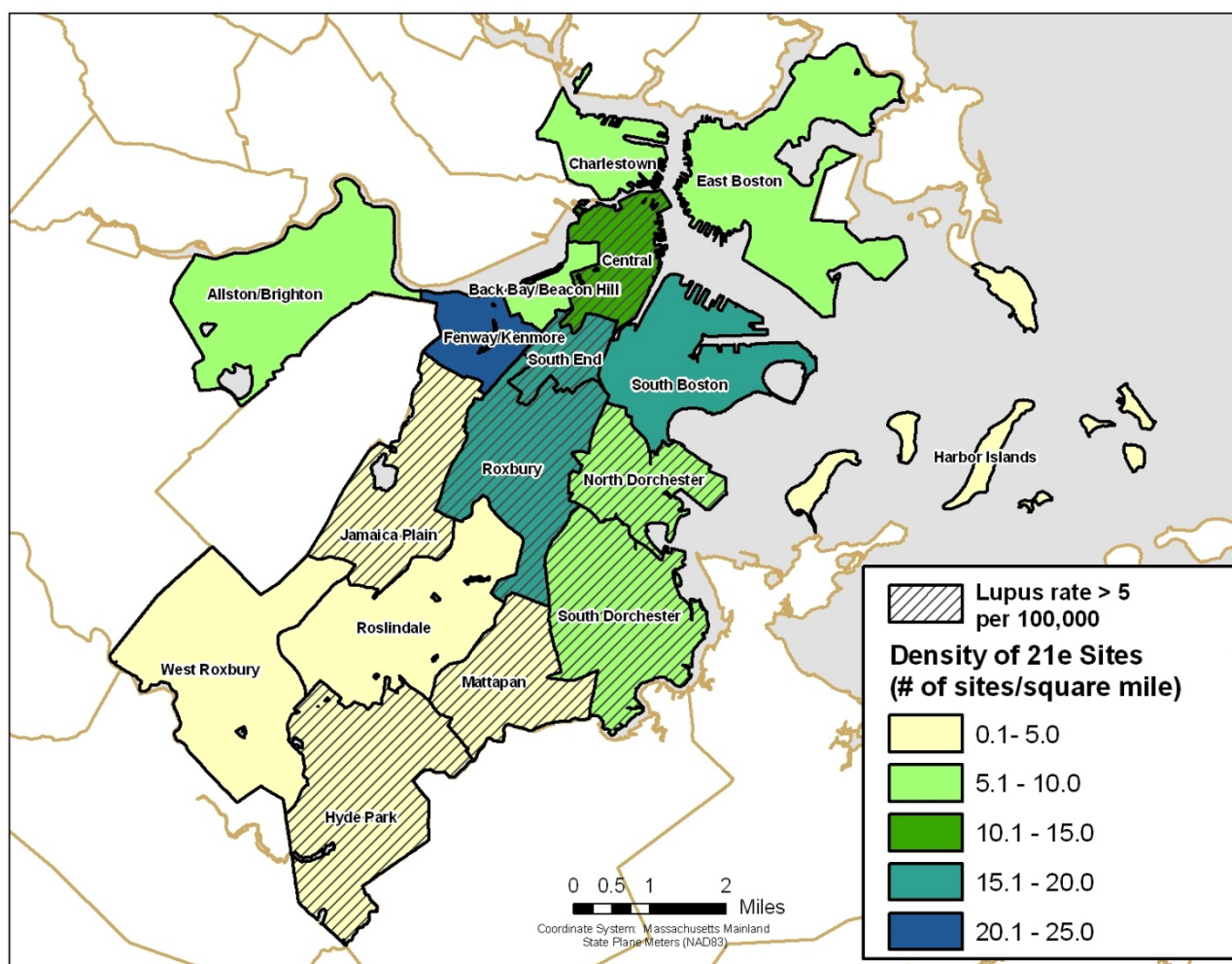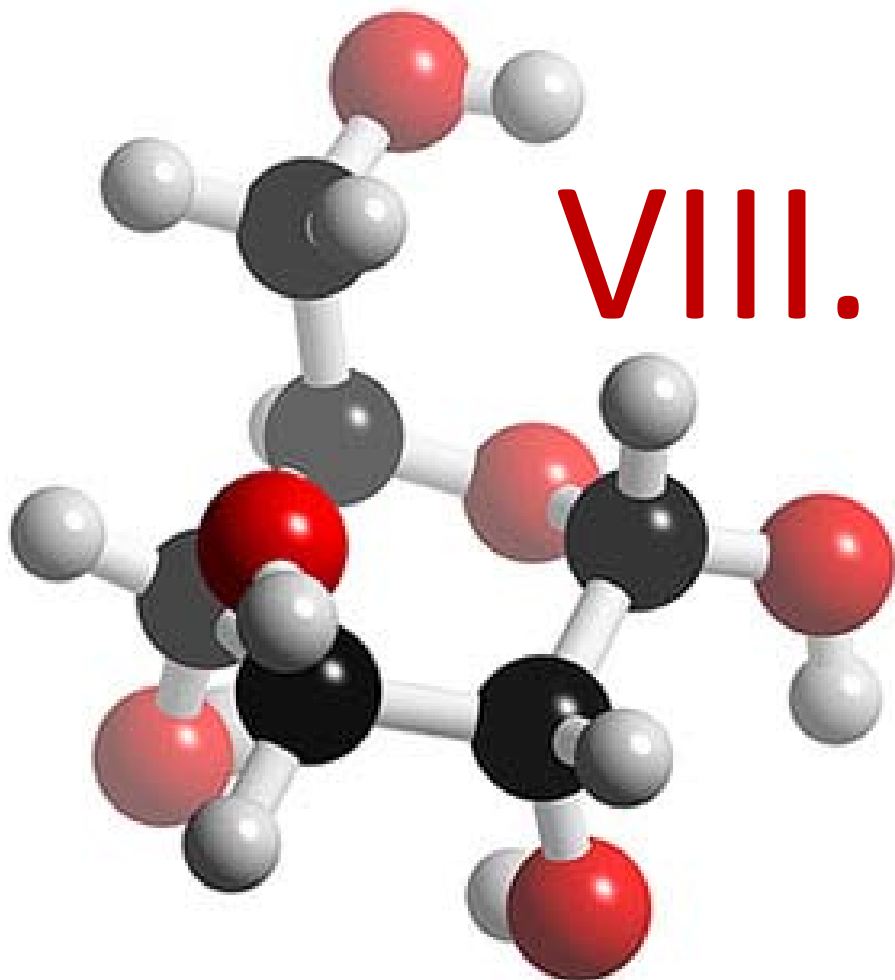
VII. Next Steps Related to Investigating Diabetes in Weston, Wellesley & Newton

- MDPH will soon release a report summarizing the 3-community prevalence estimates to residents of Weston, Wellesley, and Newton (expected in December 2011)

- The report will also review smaller geographic areas within the 3 communities to determine if prevalence is higher in certain areas

- MDPH will then complete review of environmental sites in the 4 census tracts to evaluate in relation to disease prevalence

- The findings of these reports will best direct follow-up investigative efforts

VIII. Questions?