Type 1 diabetes (T1DM)

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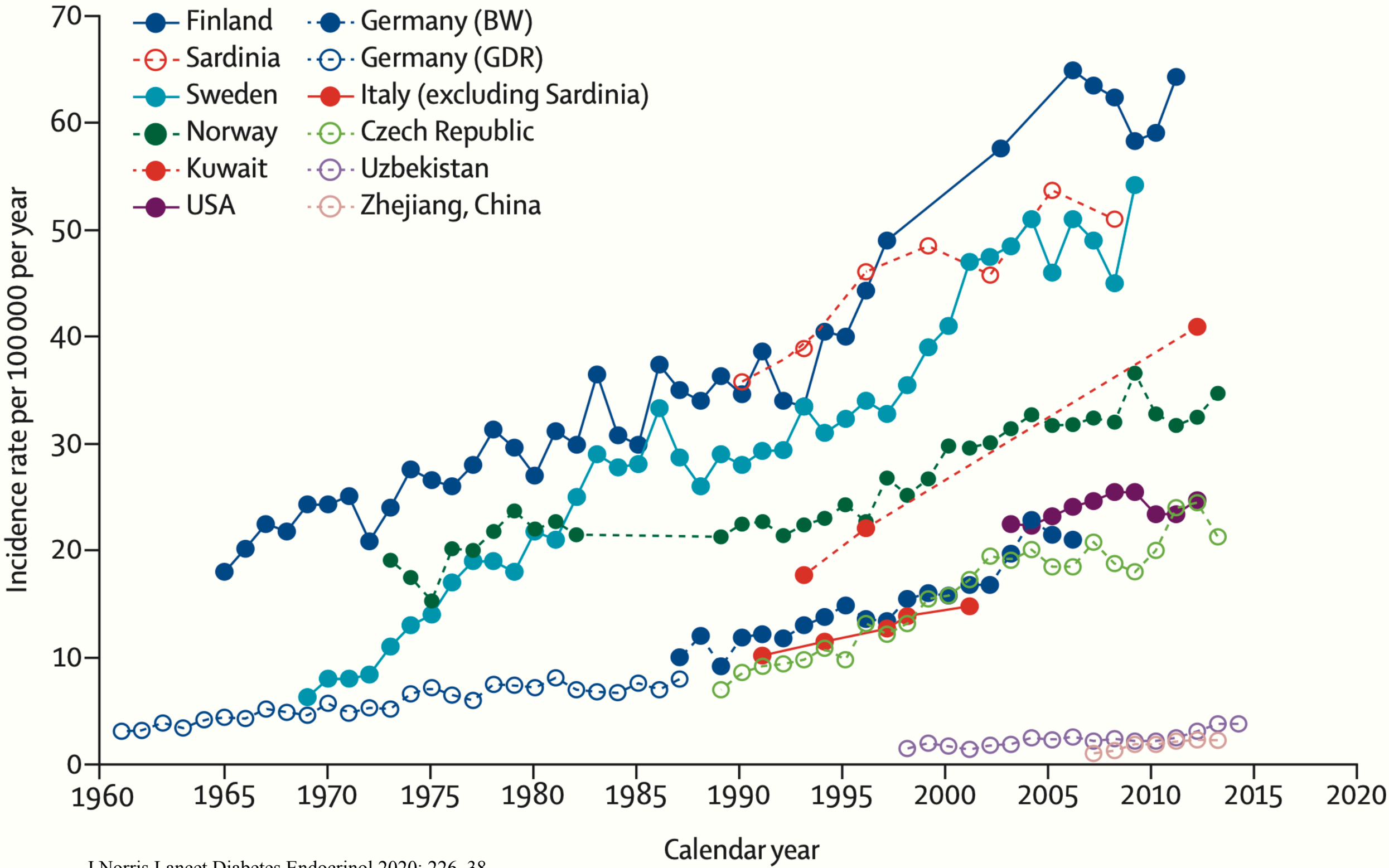
Objectives

- Increase awareness of diabetes epidemiology in Saudi Arabia
- Understand Classification of Diabetes
- Understand pathophysiology of T1DM
- Be more familiar with treatment option of T1DM

- The following is selected slides to remind student of the lecture content and not meant to be study reference.
- Suggested studying reference: Kumar & Clark’s Clinical Medicine.

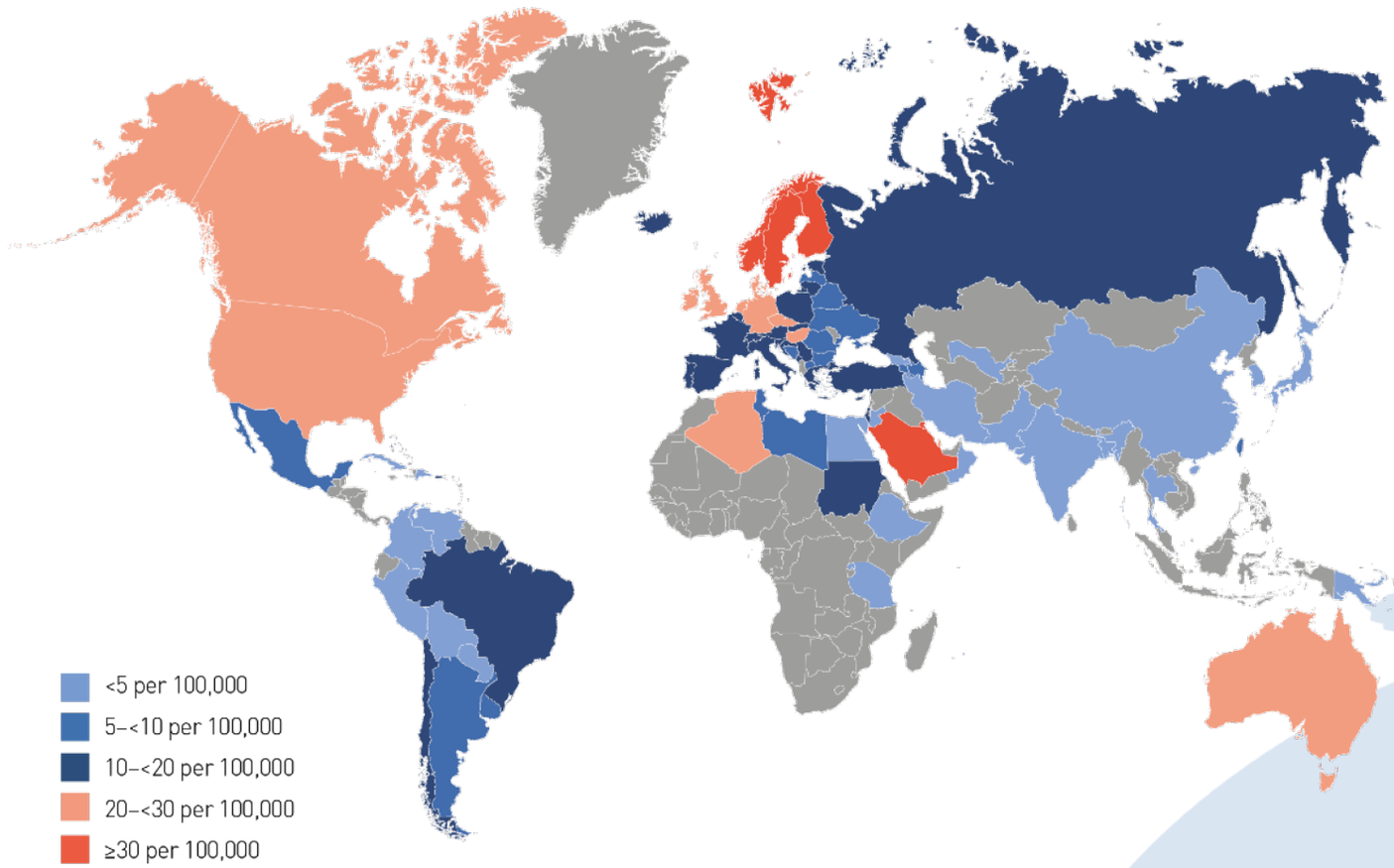
DM Epidemiology and Burden



J Norris.Lancet Diabetes Endocrinol 2020; 226–38

CHILDREN AND ADOLESCENTS

Age-sex standardised incidence rates (per 100,000 population per annum) of type 1 diabetes in children and adolescents aged 0–14 years, 2019



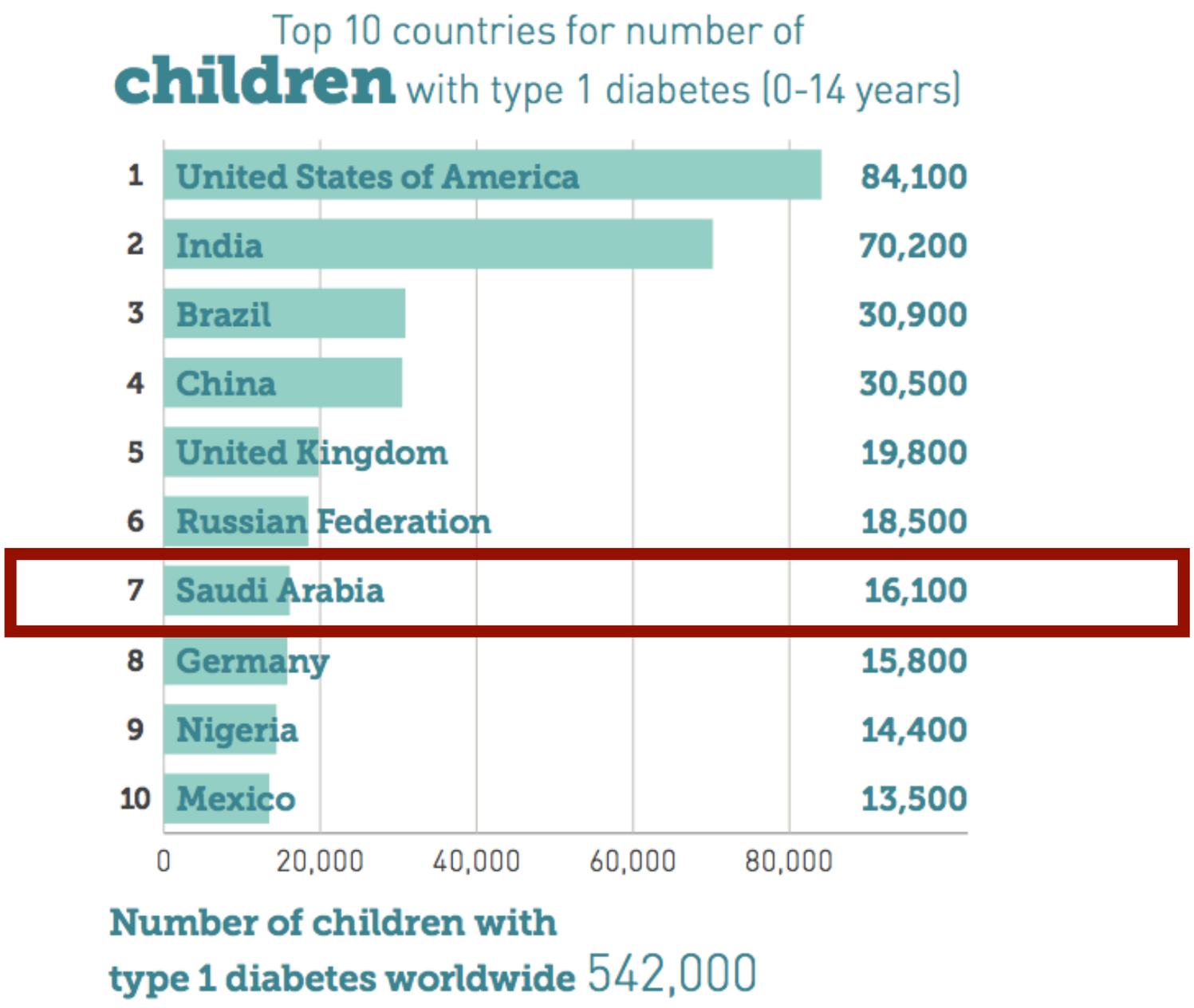
International Diabetes Federation

Table 3.16 **Top 10 countries or territories for the incidence rates (per 100,000 population per annum) of type 1 diabetes in children (aged 0–14 years)**

Rank	Country or territory	Incidence rates (per 100,000 population per year) 0–14 years
1	Finland	62.3
2	Sweden	43.2
3	Kuwait	41.7
4	Norway	33.6
5	Saudi Arabia	31.4
6	Canada	29.9
7	United Kingdom	29.4
8	Qatar	28.4
9	Ireland	27.5
10	Denmark	27.0

IDF Diabetes Atlas | 9th edition

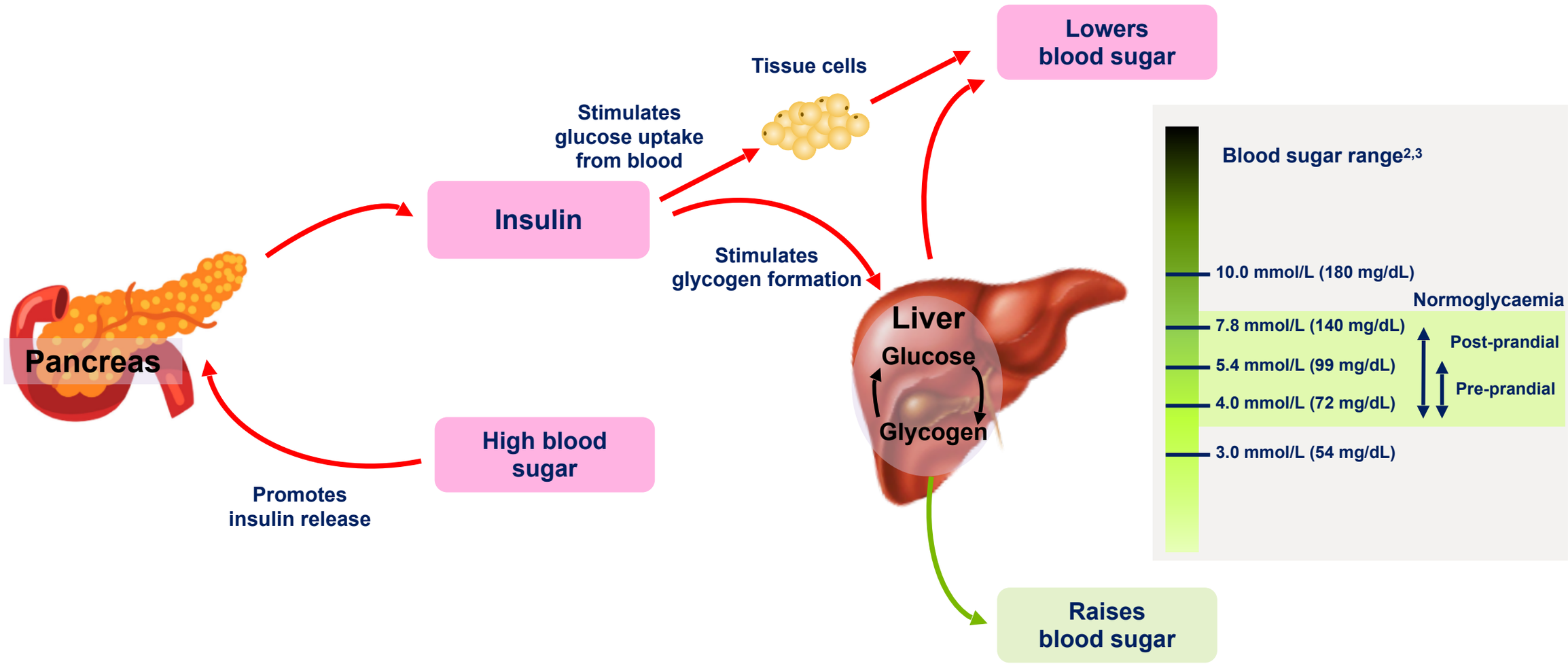
Children with diabetes



International Diabetes Federation. IDF Diabetes Atlas, 7th edn. Brussels, Belgium: International Diabetes Federation, 2015. http://www.diabetesatlas.org

Insulin Action and Glucose Homeostasis

Regulation of insulin and glucose in normal physiology[1,2]

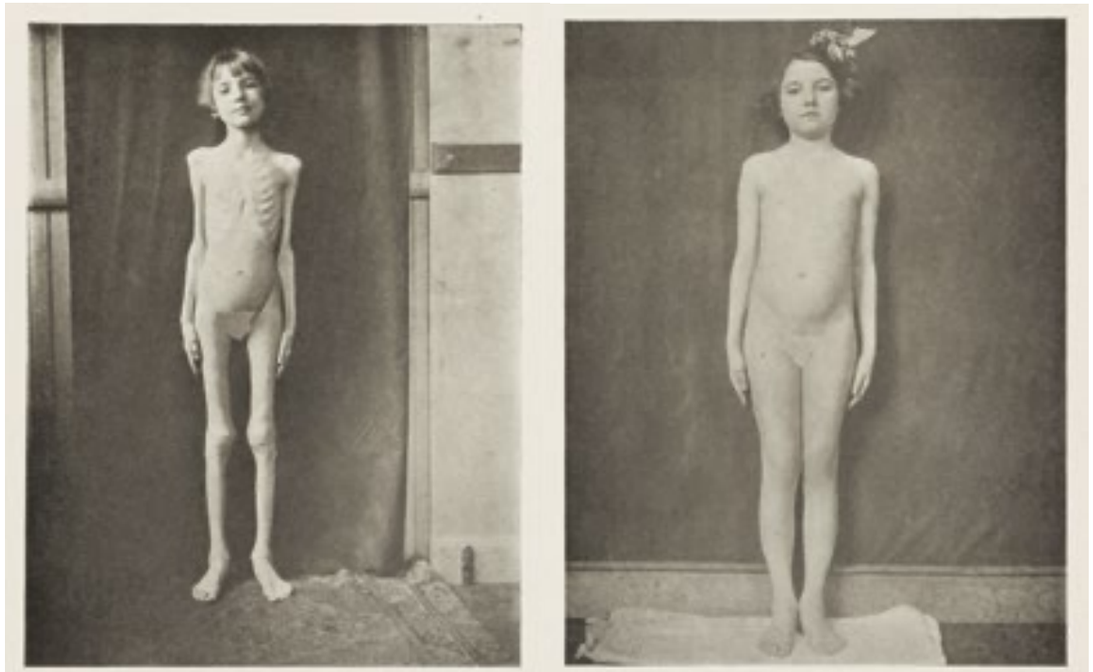


1. Adapted from Roder PV, et al. *Exp Mol Med* 2016;48:e129; 2. Diabetes.co.uk. Blood Sugar Level Ranges. Available at: https://www.diabetes.co.uk/diabetes_care/blood-sugar-level-ranges.html (Accessed March 2019); 3. International Hypoglycaemia Study Group. *Diabetes Care* 2017;40:155–157

Insulin is necessary for survival

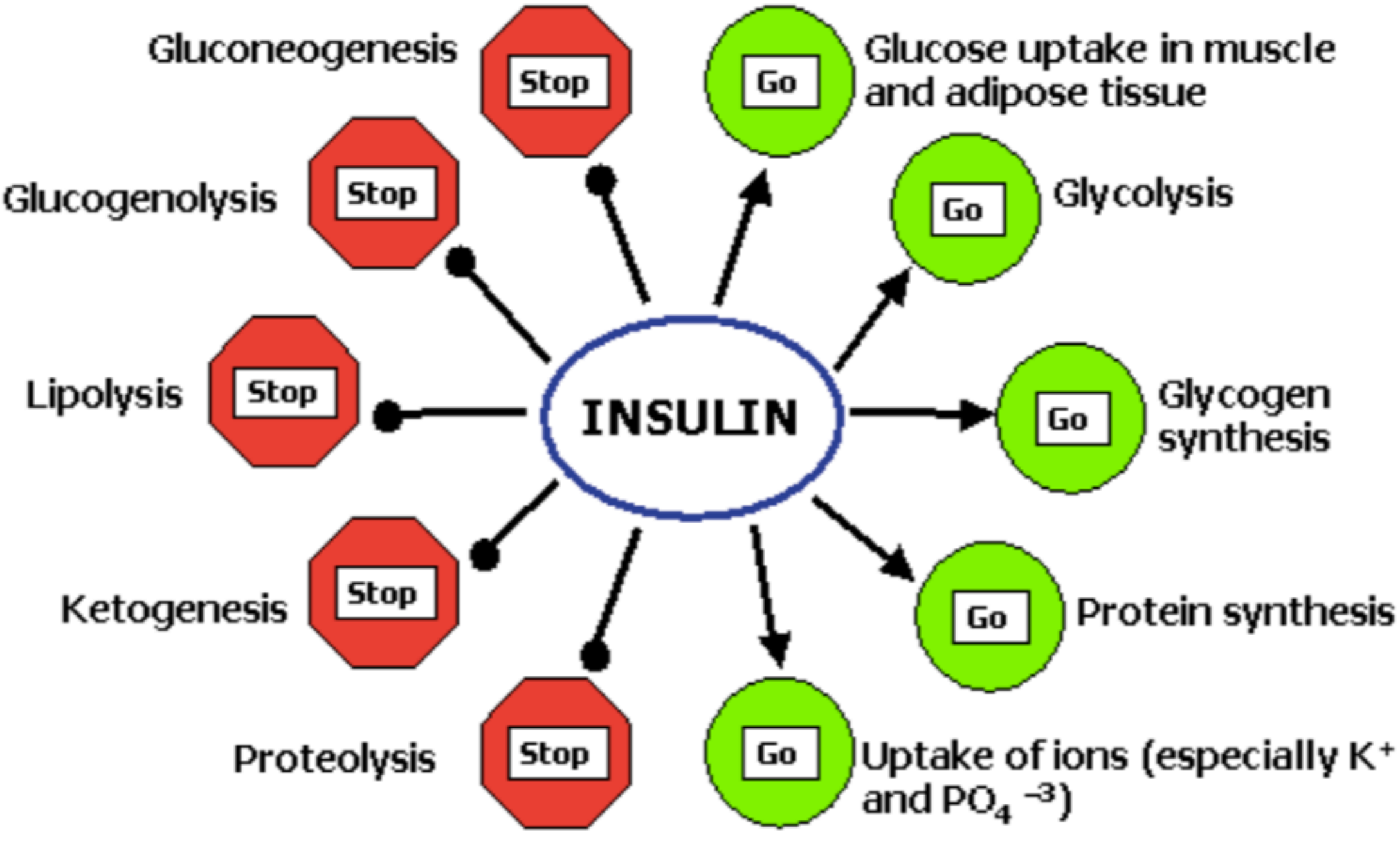
- Type 1 diabetes is an autoimmune disease leading to β-cell destruction, lack of insulin production and a need for life-long insulin therapy[1]
- Until 1922, the treatment for Type 1 diabetes was a ‘starvation diet’ – reducing patients to emaciation and subjecting them to a life of misery[2]
- The work of John Macleod, Frederik Banting and Charles Best with their patient, Elizabeth Hughes (right), led to the widespread use of insulin injections as a treatment for Type 1 diabetes[2]

Insulin treatment allows for a dramatic recovery in patients with Type 1 diabetes[2]



1. Atkinson MA, et al. *Lancet* 2014;383:69–82; 2. Botting JH. *Animal and Medicine.* Cambridge, Open Book Publishers; 2015:143–154

Actions of Insulin



Classification of Diabetes and Diagnosis criteria

Classification of Diabetes

- **Type 1 diabetes** (due to b-cell destruction, leading to absolute insulin deficiency)

- **Type 2 diabetes** (due to a progressive insulin secretory defect on the background of insulin resistance)

- **Gestational diabetes mellitus** (GDM) (diabetes diagnosed in the second or third trimester of pregnancy that is not clearly overt diabetes)

- **Specific types of diabetes** due to other causes, e.g., monogenic diabetes syndromes (such as neonatal diabetes and maturity-onset diabetes of the young [MODY]), diseases of the exocrine pancreas (such as cystic fibrosis), and drug or chemical induced diabetes (such as in the treatment of HIV/AIDS or after organ transplantation)

American diabetes Association. Standards of medical care in diabetes--2015

Type of Diabetes	Normal glucose tolerance	Hyperglycemia		
		Pre-diabetes*	Diabetes Mellitus	
		Impaired fasting glucose or impaired glucose tolerance	Not insulin requiring	Insulin required for control / Insulin required for survival
Type 1				
Type 2				
Other specific types				
Gestational Diabetes				
Time (years)				
FPG	<5.6 mmol/L (100 mg/dL)	5.6–6.9 mmol/L (100–125 mg/dL)	≥7.0 mmol/L (126 mg/dL)	
2-h PG	<7.8 mmol/L (140 mg/dL)	7.8–11.0 mmol/L (140–199 mg/dL)	≥11.1 mmol/L (200 mg/dL)	
HbA1C	<5.6%	5.7–6.4%	≥6.5%	

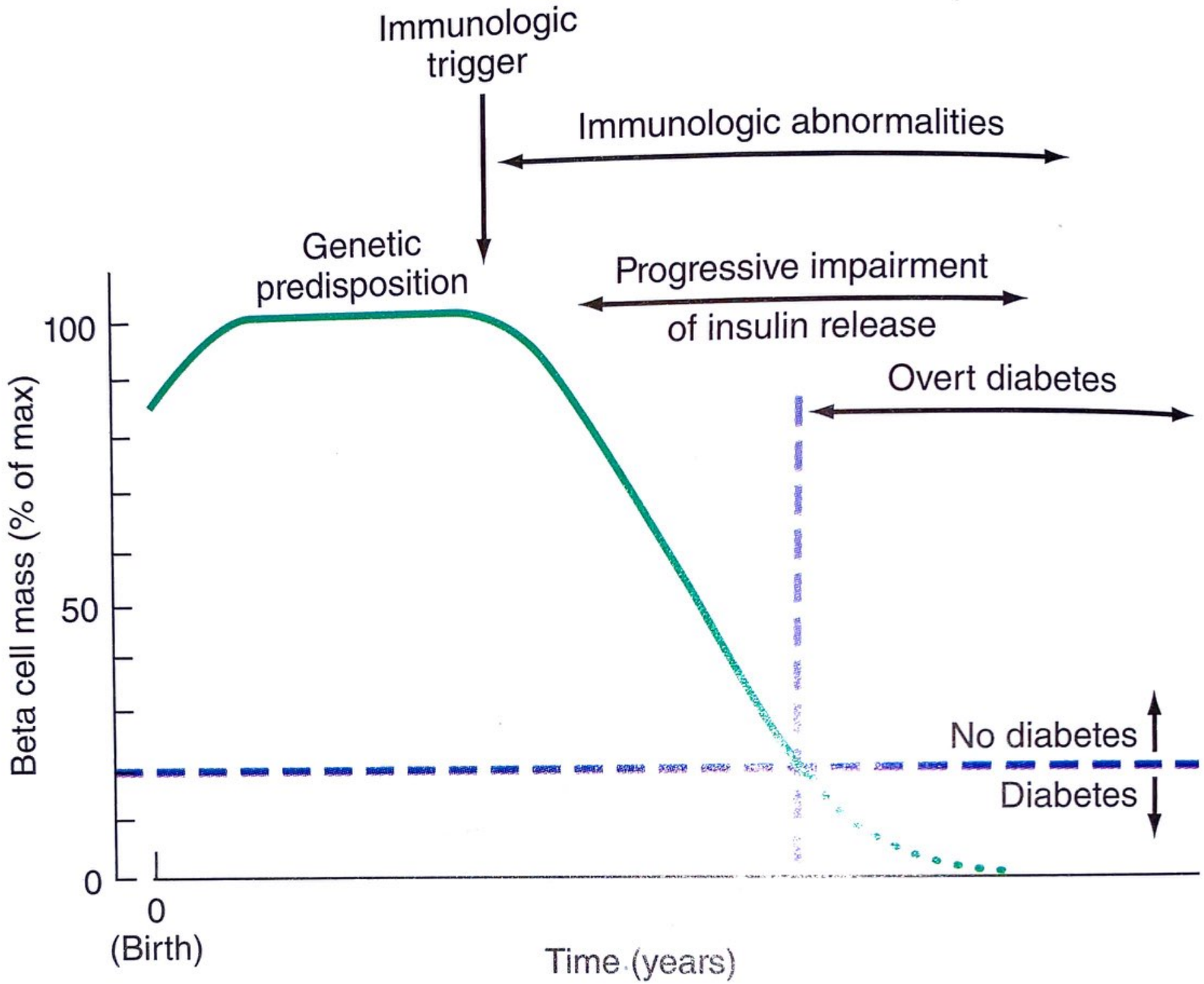
Diagnostic Criteria

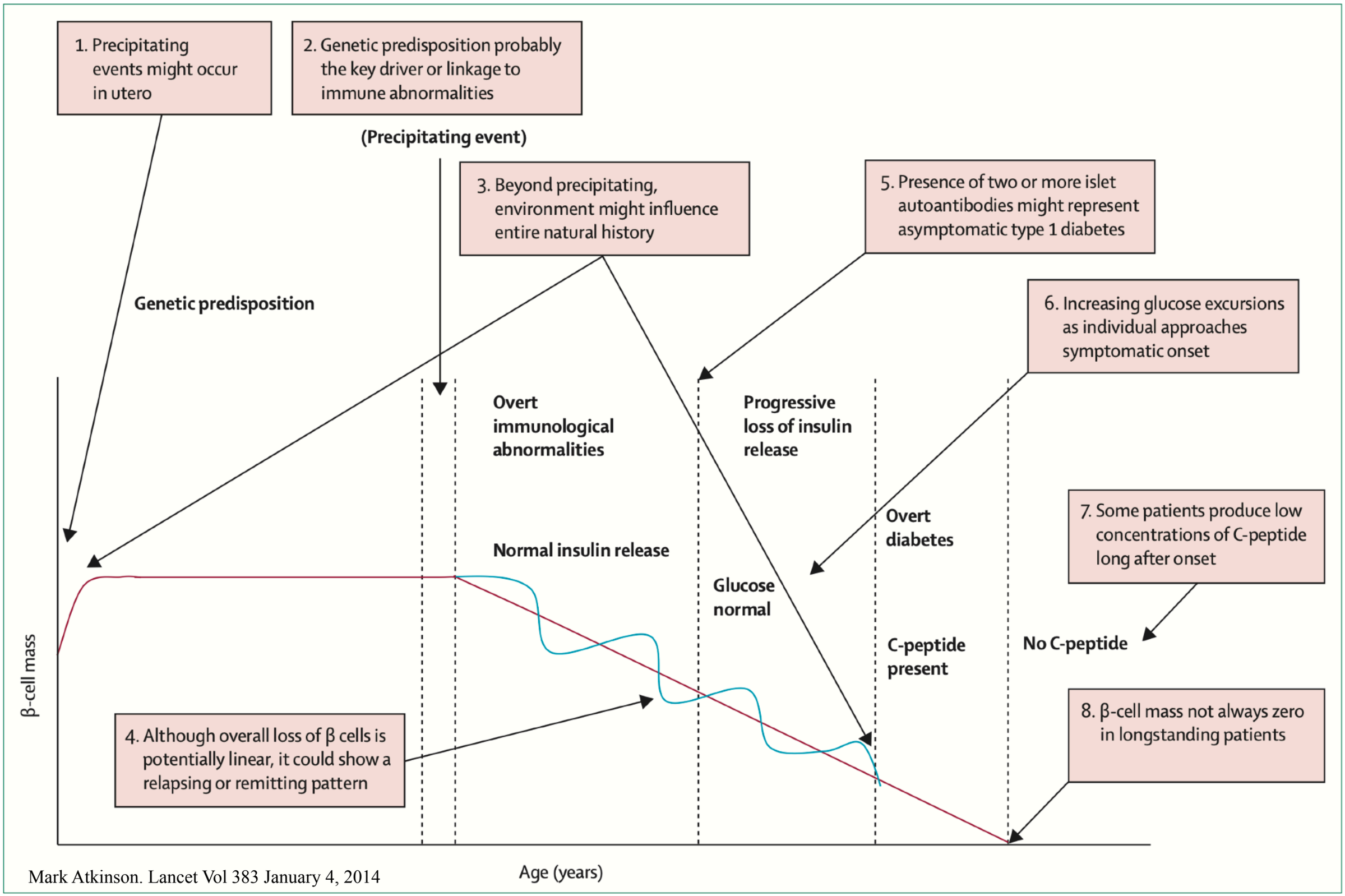
Table 2.1—Criteria for the diagnosis of diabetes

FPG ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.*
OR
2-h PG ≥200 mg/dL (11.1 mmol/L) during an OGTT. The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.*
OR
A1C ≥6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.*
OR
In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dL (11.1 mmol/L).

*In the absence of unequivocal hyperglycemia, results should be confirmed by repeat testing.

Pathogenesis of T1DM


Immunologic trigger
Immunologic abnormalities
Genetic predisposition
Progressive impairment of insulin release
Overt diabetes
100
50
0
Beta cell mass (% of max)
No diabetes
Diabetes
0 (Birth)
Time (years)



Mark Atkinson. Lancet Vol 383 January 4, 2014

Presentation of T1DM

Figure 1.2 **The typical symptoms of type 1 diabetes**

Management

- **Goals of Therapy**
  - Eliminate symptoms related to hyperglycaemia
  - Reduce risk or eliminate diabetes complications
  - Allow patient to achieve as normal a lifestyle as possible

- **Basal insulin**

  - Basal insulin refers to long- or intermediate-acting insulin, which provides control of glucose in the fasting state and between meals.

  - Basal insulin is given once or twice a day and includes long-acting insulin analogues and intermediate-acting insulin neutral protamine Hagedorn (NPH)

- **Bolus Insulin**

  - Bolus insulin refers to rapid- or short-acting insulin given to control the glycemic rise at meals and to correct hyperglycemia.

  - The prandial injection dose is decided based on carbohydrate content, carbohydrate-to-insulin ratio for each meal, planned exercise, time since last insulin dose and blood glucose level