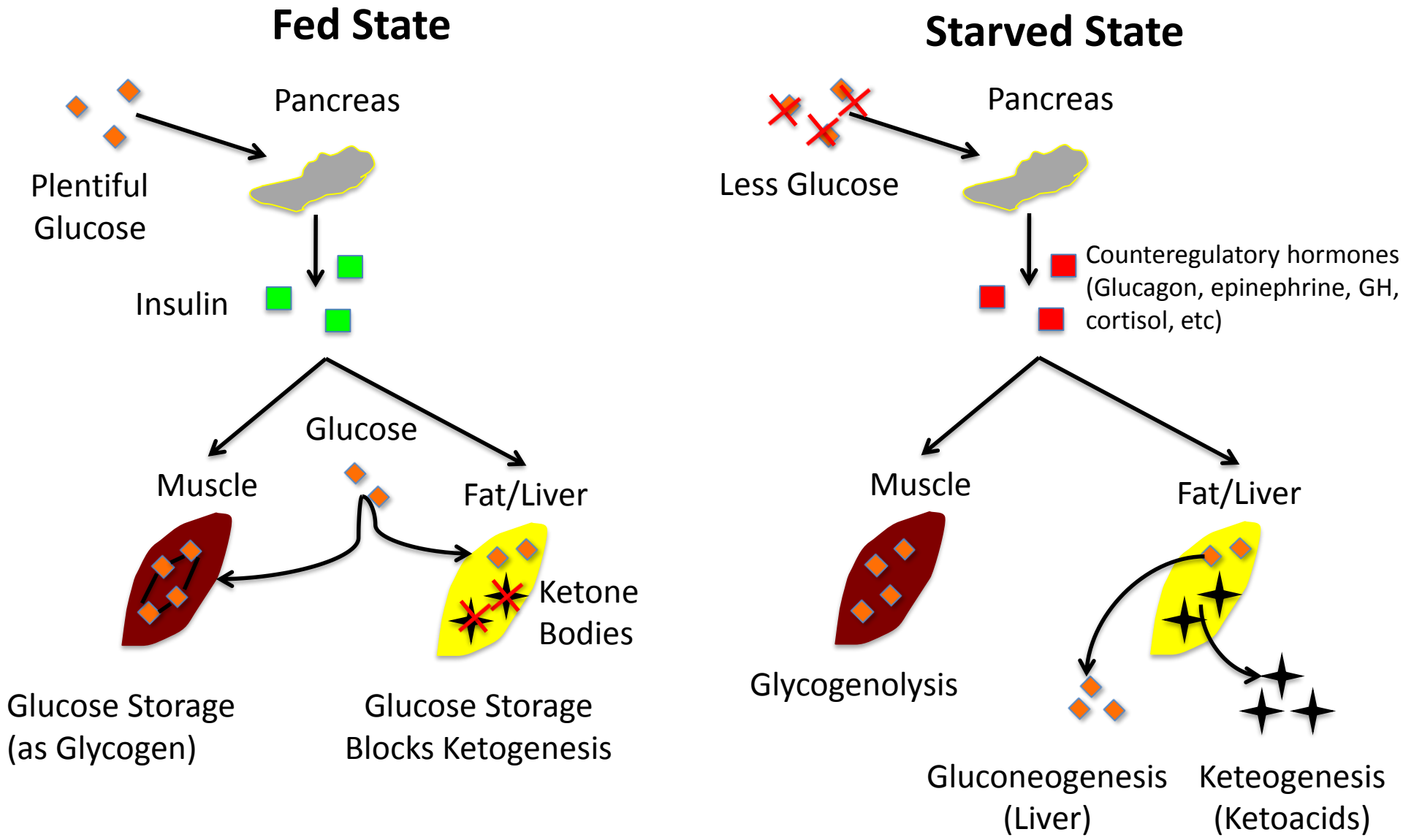
Diabetes and Anti-Hyperglycemic Agents

By Matt Vanneman, MD

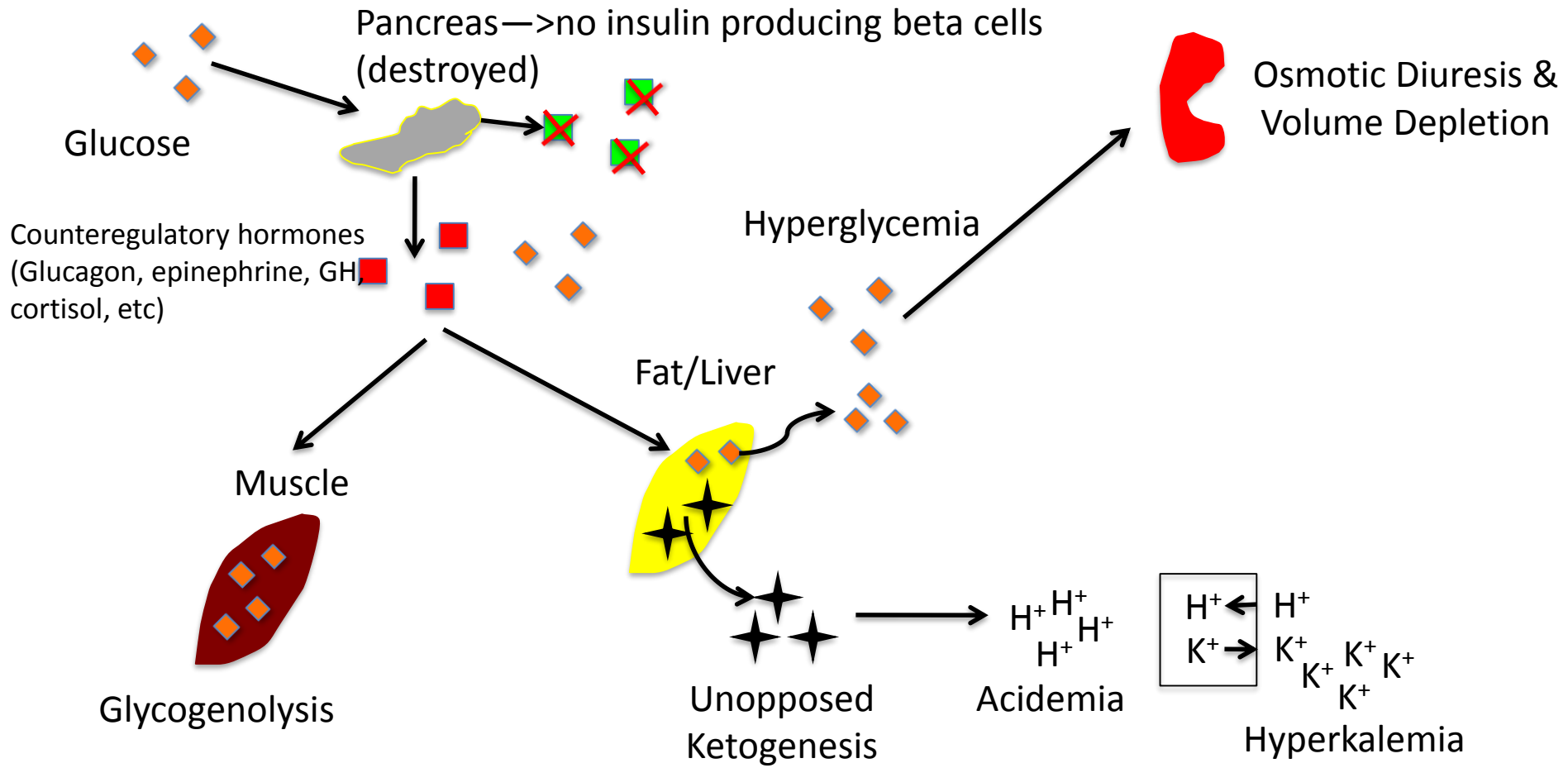
Goals of Talk

- Review physiology and pathophysiology of DM1 and DM2
- Review currently available therapies for diabetes
- Discuss perioperative diabetes management
- Discuss board review questions

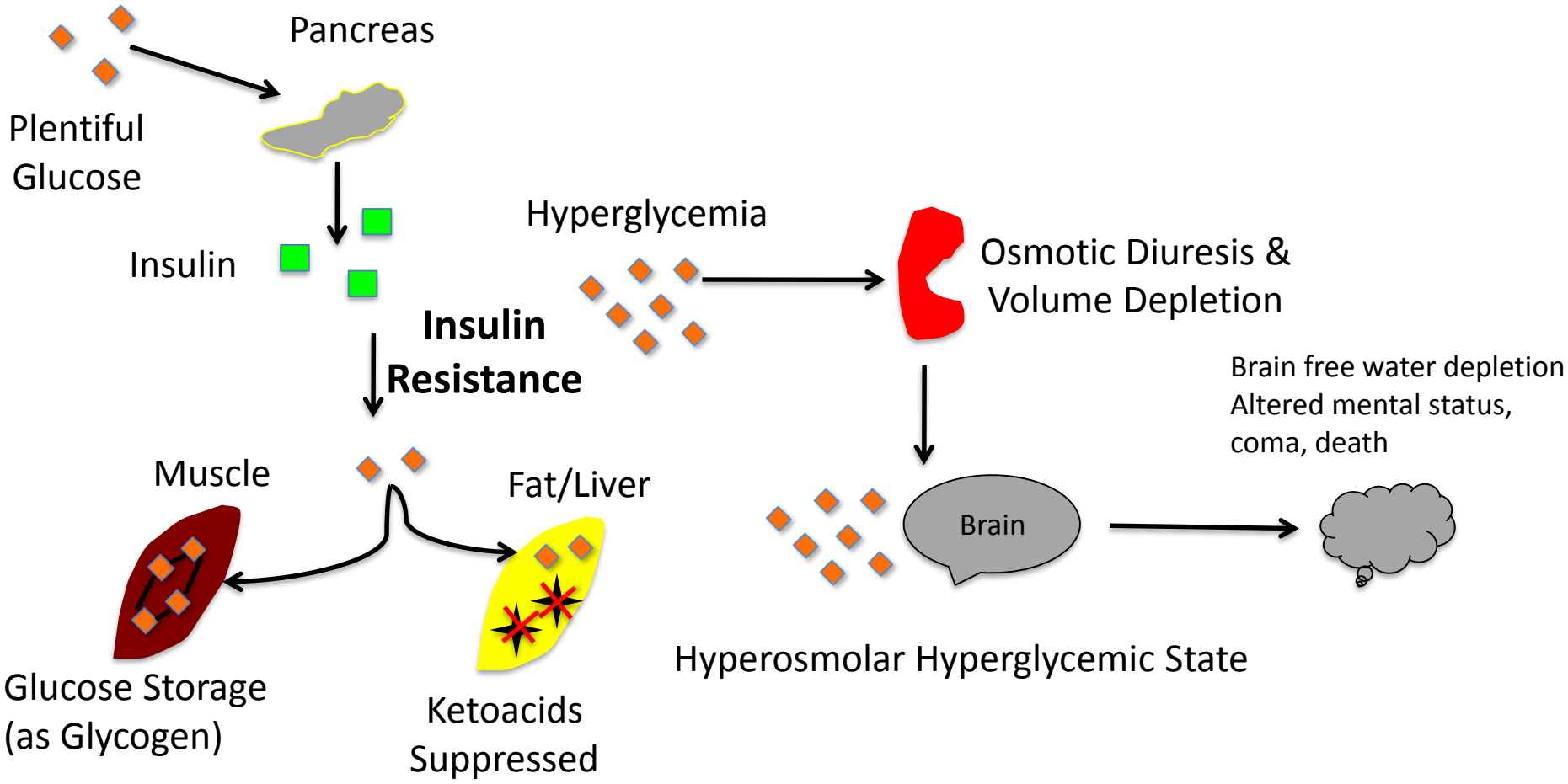
Normal Physiology of Glucose Control



Pathophysiology of Type 1 DM and Diabetic Ketoacidosis (DKA)



Pathophysiology of Type 2 DM and Hyperosmolar Hyperglycemic State (HHS)



Distinguishing DKA and HHS in laboratory studies

Lab Parameters	DKA	HHS	Alcoholic Ketoacidosis
pH (Increased/Decreased/ Normal)			
Blood Glucose (Increased/Decreased/ Normal)			
Serum Osmolality (Increased/Decreased/ Normal)			
Ketone Bodies (Present/Absent)			
Anion Gap (Present/Absent)			
Potassium			

Conventional Non-Insulin Anti-Hyperglycemic Agents

Drugs	Mechanism of action	Side effects
Metformin		
Glipizide, **gl**yburide, **gl**imeperide		
Repa**glinide**, Nate**glinide**, Miti**glinide**		
Rosi**glitazone**, pio**glitazone**		
Acarbose, miglitol		

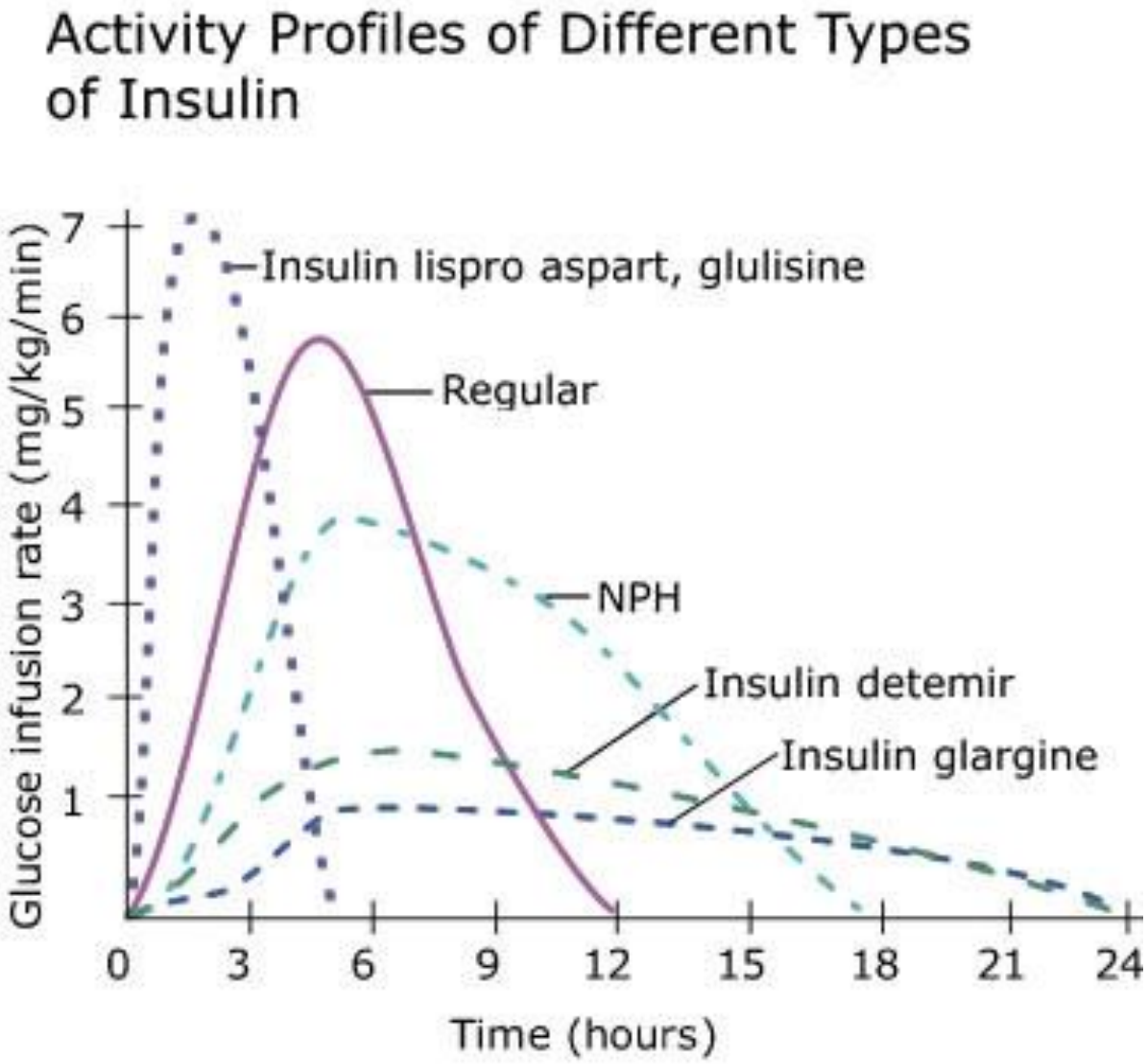
Adapted from Longnecker's *Anesthesiology*, 2nd edition

Novel Anti-Hyperglycemic Agents

Class (drugs)	Mechanism of action	Side effects
Exena**tide**, Liraglu**tide**		
Sitag**lipitin**, saxag**liptin**		
Pramlin**tide**		

Adapted from Longnecker's *Anesthesiology*, 2nd edition

Kinetics of Insulin Activity



http://dtc.ucsf.edu/types-of-diabetes/type2/treatment-of-type-2-diabetes/medications-and-therapies/type-2-insulin-rx/types-of-insulin/

Insulin Therapies in Diabetes

Drugs	Type	Time to onset	Duration of action	Usage	Perioperative management
Lispro, aspart, glusiline	Short acting	20 min	3 hours	**Prandial** insulin (with meals)	**HOLD** insulin given with meals, as pt NPO
Regular	Intermediate	30-45 min	4-8 hours	IV infusions	**Use as infusion**
NPH	Intermediate	1-3 hours	10-18 hours	"Basal" insulin*	Give 50-80% dose*
Glargine, detemir	Long acting	3 hours	24 hours	**Basal** insulin	Give 50-80% dose*

SHORT L-I-S-P-R-O (6) < G-L-A-R-G-I-N-E (8) **LONG**
SHORT A-S-P-A-R-T (6) < D-E-T-E-M-I-R (7) **LONG**

Adapted from Longnecker's *Anesthesiology*, 2nd edition

Hypoglycemia

Typical symptoms manifest as sympathetic activation:
Early symptoms may include: Tachycardia, nervousness, diaphoresis, nausea/vomiting, altered mental status, fatigue
Prolonged hypoglycemia may cause seizures, coma, or death

General anesthesia may mask normal physiologic responses to hypoglycemia:
AUTONOMIC SYMPATHETIC ACTIVATION

Signs of sympathetic activation ABSENT or wrongly attributed to other causes during General Anesthesia—clinical index of suspicion must remain high and glucose monitoring is essential!

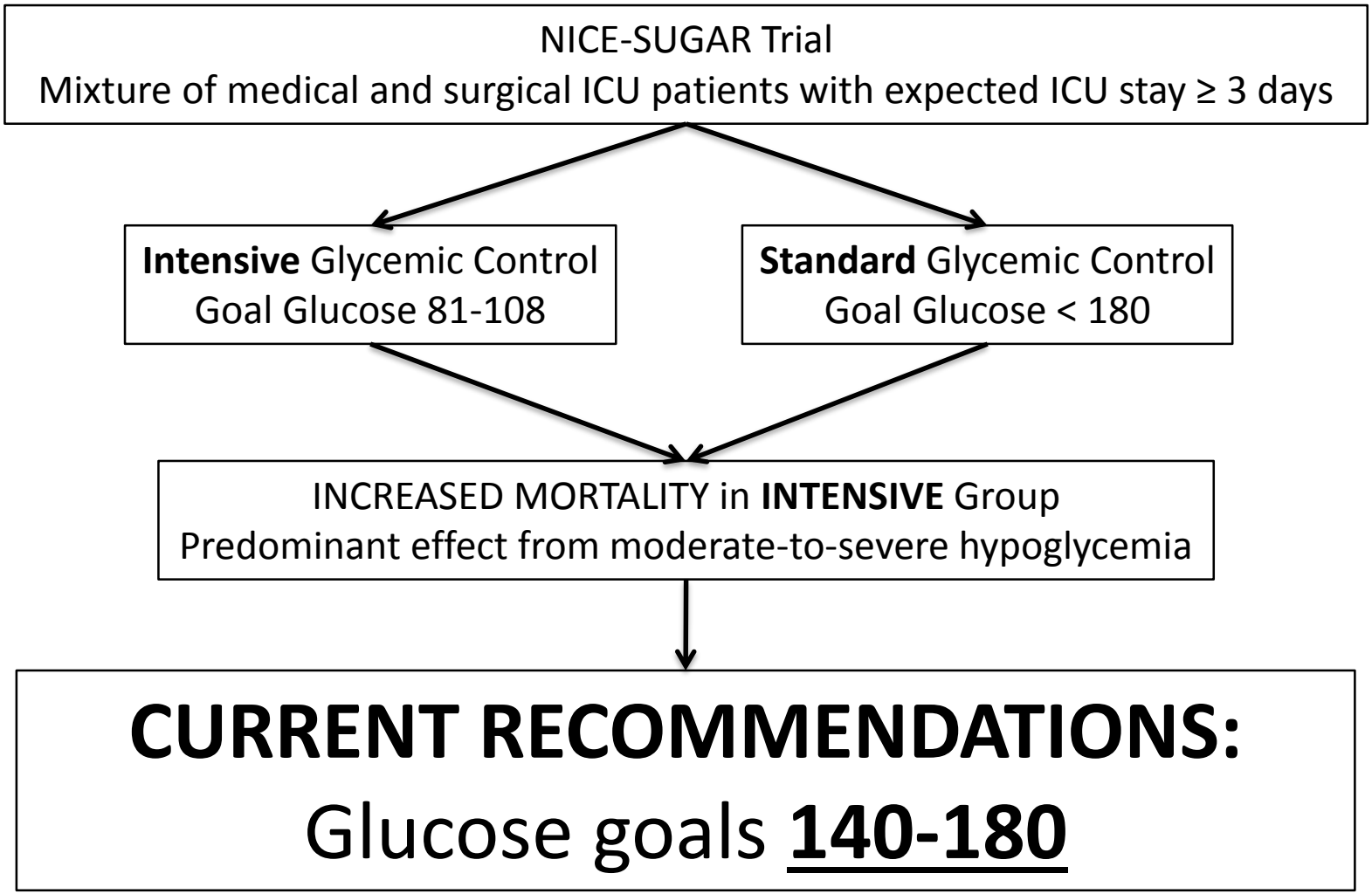
Slide adapted from Dr. Robert Peterfreund

Glucose pump management

Duration of procedure	Management (if pt is in personal glucose target range in pre-op)
Short (< 1 hour)	
Intermediate (1-3 hours)	
Long (> 3 hours)	

Current Pharmaceutical Design 2012, 18, 6204-6214

Management of Hyperglycemia in Critically Ill Patients



Spare slides

Diabetes Mellitus:
Definition & Classifications

- DM Type 1
  - **Absolute** insulin deficiency
  - Insulin sensitive
  - Insulin therapy *required* to control glucose levels
  - *Diabetic Ketoacidosis* (DKA) without insulin therapy
  - **Patients must always receive insulin therapy to prevent ketogenesis, even if concurrent glucose administration is required!**

- DM Type 2
  - **Relative** insulin deficiency
  - Insulin resistance
  - Multiple methods to control glucose levels
  - DKA unlikely, even without exogenous insulin
  - Hyperosmolar, nonketotic, Hyperglycemic state possible

Slide courtesy Dr. Robert Peterfreund

Treatment of Diabetic Ketoacidosis and Hyperosmolar Hyperglycemic State

Treatment	Purpose in DKA	Purpose in HHS
IV Fluids	Restore lost volume from diuresis	Restore lost volume from diuresis (requires significant fluid resuscitation)
Insulin	Control hyperglycemia	Control hyperglycemia
Potassium	Replete potassium lost from osmotic diuresis	Replete potassium lost from osmotic diuresis
Bicarbonate	Generally not recommended	Generally not recommended