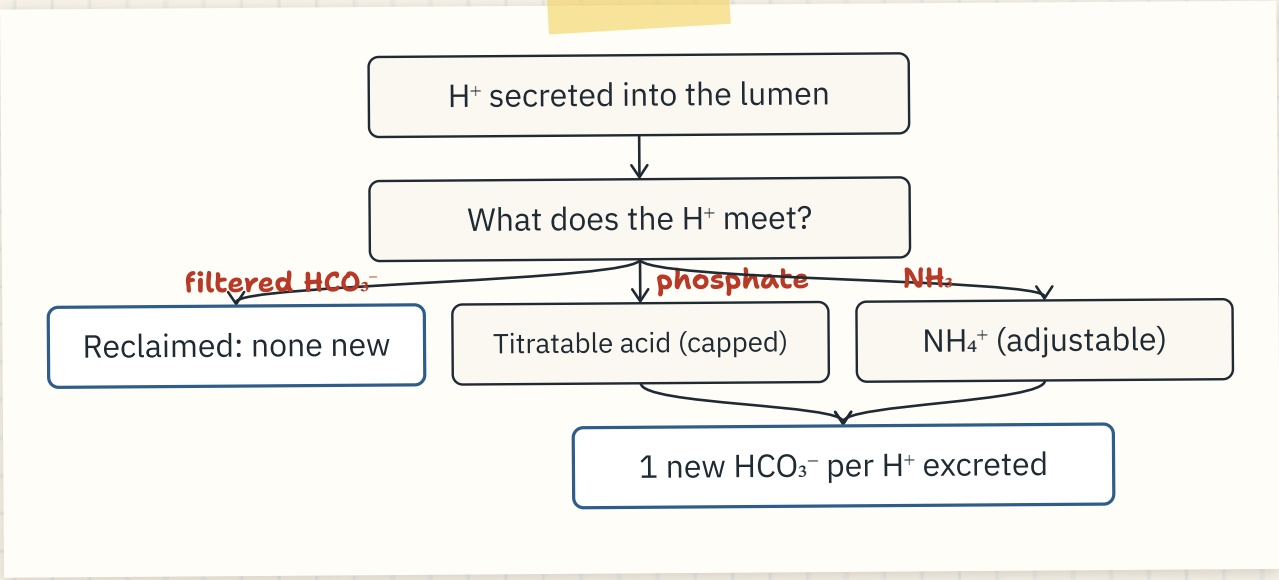
New bicarbonate

Reclaim vs make new: titratable acid and ammonium



Step by step

1. Proximal: NHE3 + carbonic anhydrase reclaim ~80% of filtered HCO_3^-; no acid leaves
2. Alpha-intercalated cell: H^+ pumped into urine, new HCO_3^- to blood (for Cl^-)
3. Each H^+ excreted on a buffer = 1 new HCO_3^-
4. Glutamine → 2 NH_4^+ + 2 HCO_3^-; counts only if NH_4^+ is excreted

	Normal	Chronic acidosis
Filtered HCO_3^-	180 L × 24 ≈ 4,300 mEq; ~80% proximal	Reclaimed, none new
Free H^+ in urine	Minimum pH 4.5 → 0.03 mEq/L	Still negligible
Titratable acid	10–40 mEq/day	Only ~2–3×, capped by phosphate
NH_4^+	30–40 mEq/day	> 200 mEq/day, over days

Daily numbers

NET ACID EXCRETION

NAE = titratable acid + NH_4^+ − urinary HCO_3^-

Steady state: NAE (new HCO_3^- made) = acid made each day (~70 mEq)

Rule of thumb

Reclaimed is not new: only excreting acid makes new HCO_3^-

Phosphate is capped; ammonium is the dial

Exam traps

- Proximal reabsorption reclaims bicarbonate but makes none new.
- NH_4^+ that returns to the blood is made into urea by the liver, which uses the new HCO_3^- up again.
- Ammonium takes days to ramp up (maximal renal adaptation ~3–5 days): one reason renal compensation is slow.
- Acetazolamide blocks carbonic anhydrase: HCO_3^- spills into the urine, a normal anion gap acidosis.

New bicarbonate: how the kidney excretes acid with ammonium

Video, written lesson, practice question and sources: medservatory.com/usmle-step-1/renal-acid-base/new-bicarbonate-ammonium-titratable-acid

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