Creatinine is a breakdown product of protein metabolism, mostly from muscle which is produced at a relatively constant rate, is filtered at the glomerulus of the kidney and is minimally reabsorbed along the tubule.

Creatinine clearance and serum creatinine levels are used as surrogate markers of glomerular filtration rate.

Glomerular filtration rate is a measure of the amount of plasma filtered at the glomerulus per unit time is a product of the filtration coefficient and the net Starling forces. The filtration coefficient is a marker of perm selectivity glomerular permselectivity. Net Starling forces are a balance between hydrostatic pressure which is elevated due to the capillary beds in series and oncotic pressure which is almost zero in Bowman's capsule due to the lack of filtered proteins.

Renal clearance is the volume of plasma completely cleared of a substance per unit time:

\[
C = \frac{UV}{P}
\]

GFR = clearance if the substance is not reabsorbed along the tubule. Inulin is a plant polysaccharide and is most accurate but problematic due to steady state requirements. Serum creatinine may be used as an alternative. Most accurate to collect urine and use the above formula to assess creatinine clearance. Because serum creatinine is at steady state, eGFR can be calculated by Cockroft-Gault.

Limitations of creatinine clearance as an estimate of GFR:

- General limitations:
  - Assumptions required to correct for age, weight and sex.
  - The relationship between creatinine clearance and serum creatinine is non-linear.
  - Filtration is only one component of a complex kidney, although GFR is used as a surrogate of function.

- Critically ill patients:
  - The amount of creatinine produced varies with muscle mass, nutrition, steroid use, muscle injury.
  - There can be a decline of almost 50% of function before serum creatinine levels rise.
  - They do not indicate dynamic changes in renal function.
  - Are modified by aggressive fluid resuscitation.