

T. H. M.

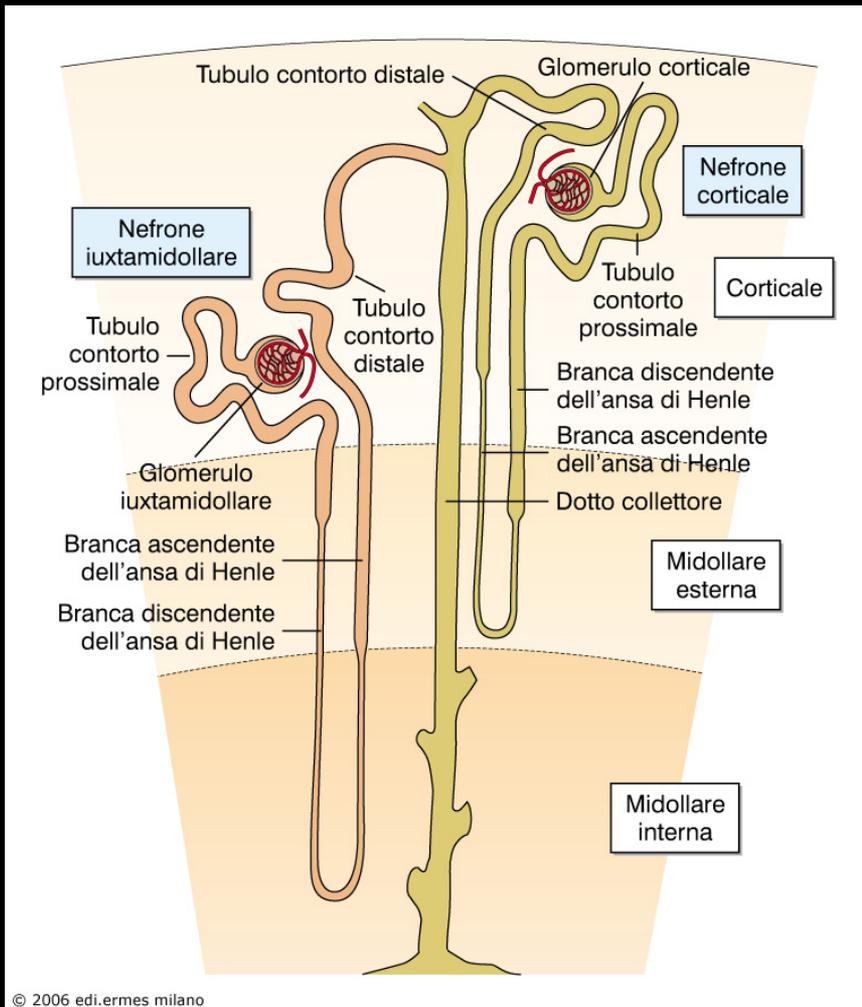
**RALLENTARE**

**ARRESTARE**

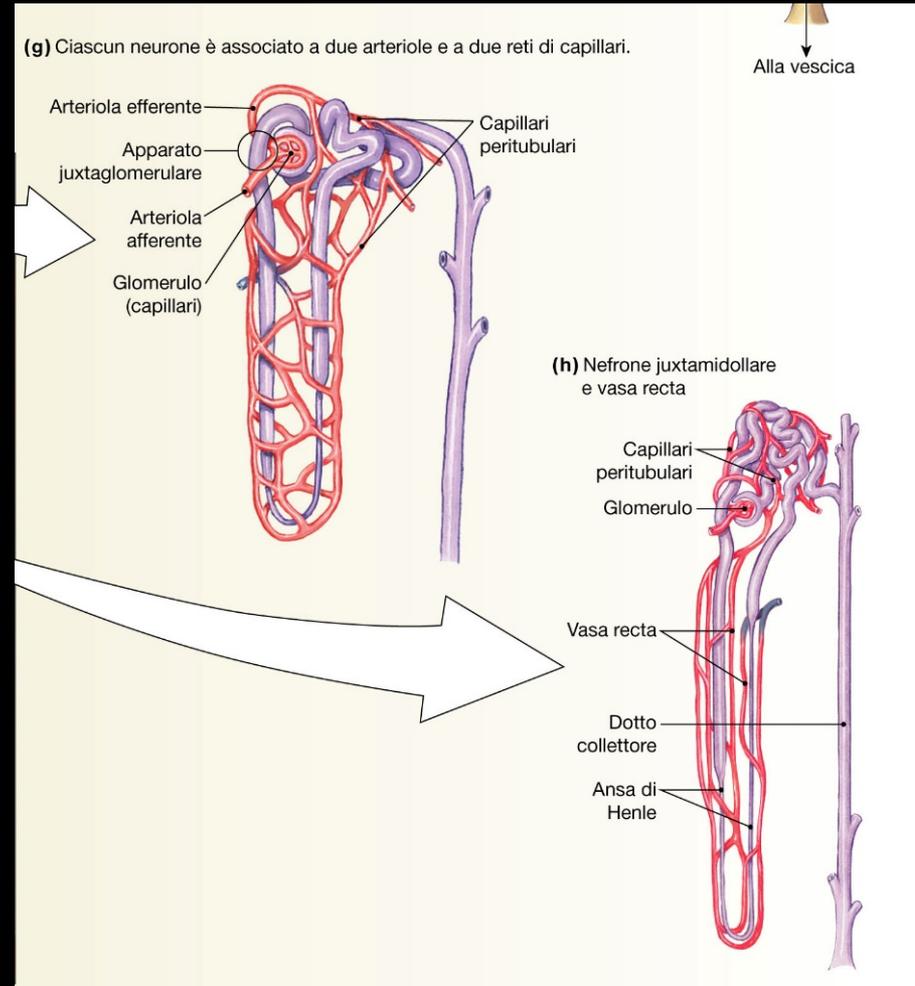
**REGREDIRE**

# Il nefrone: unità funzionale del rene

*N. nefroni nell'uomo: ≈ 1.2 milioni per rene*



20% dei nefroni sono juxta-midollari



Nei *vasa recta* scorre solo l'1-2% del flusso renale totale

Differenze fra nefroni superficiali e juxta-midollari: nei nefroni juxta-midollari il glomerulo renale è più grande ed è sito più in profondità, l'ansa di Henle è più lunga, e dall'a. efferente si originano i *vasa recta*.

Nel soggetto adulto a riposo il rene riceve circa il 20-25% della portata cardiaca (massa dei reni: circa lo 0.5% della massa corporea totale).

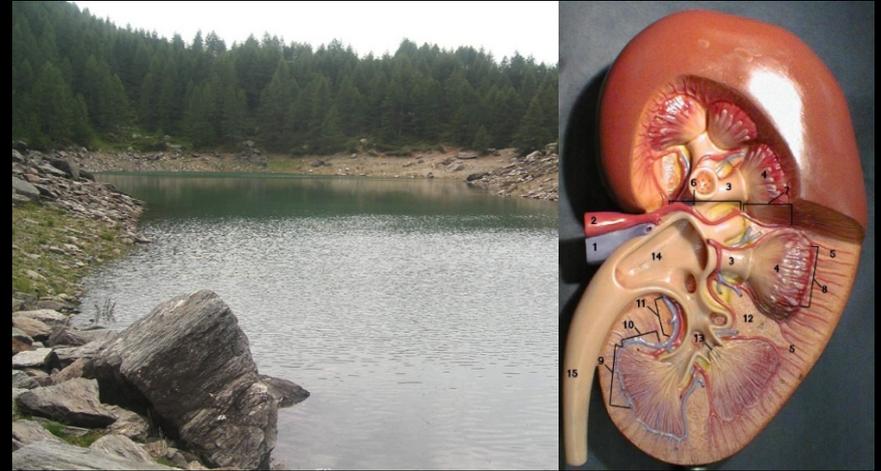
- $\approx 1200$  ml/min
- $\approx 1700$  litri al giorno
- $\approx 63000$  litri in un anno
- $\approx 44$  milioni litri in 70 anni

Il flusso plasmatico renale è circa il 55% del flusso ematico renale

Il volume del filtrato glomerulare è circa il 20% del flusso plasmatico renale ( $\approx 180$  litri al giorno;  $\approx 5$  milioni litri in 70 anni)

Il volume di urina prodotta è

- $\approx 1$  ml/min
- $\approx 1,5$  litri al giorno
- $\approx 550$  litri in un anno
- $\approx 38500$  litri in 70 anni

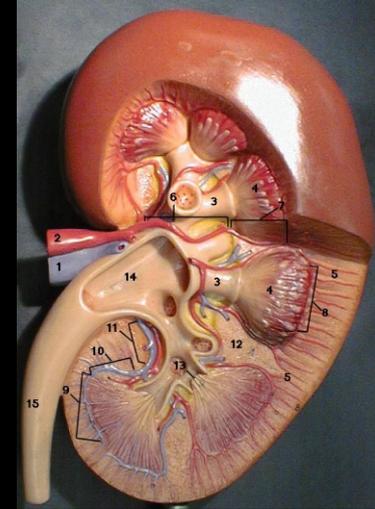


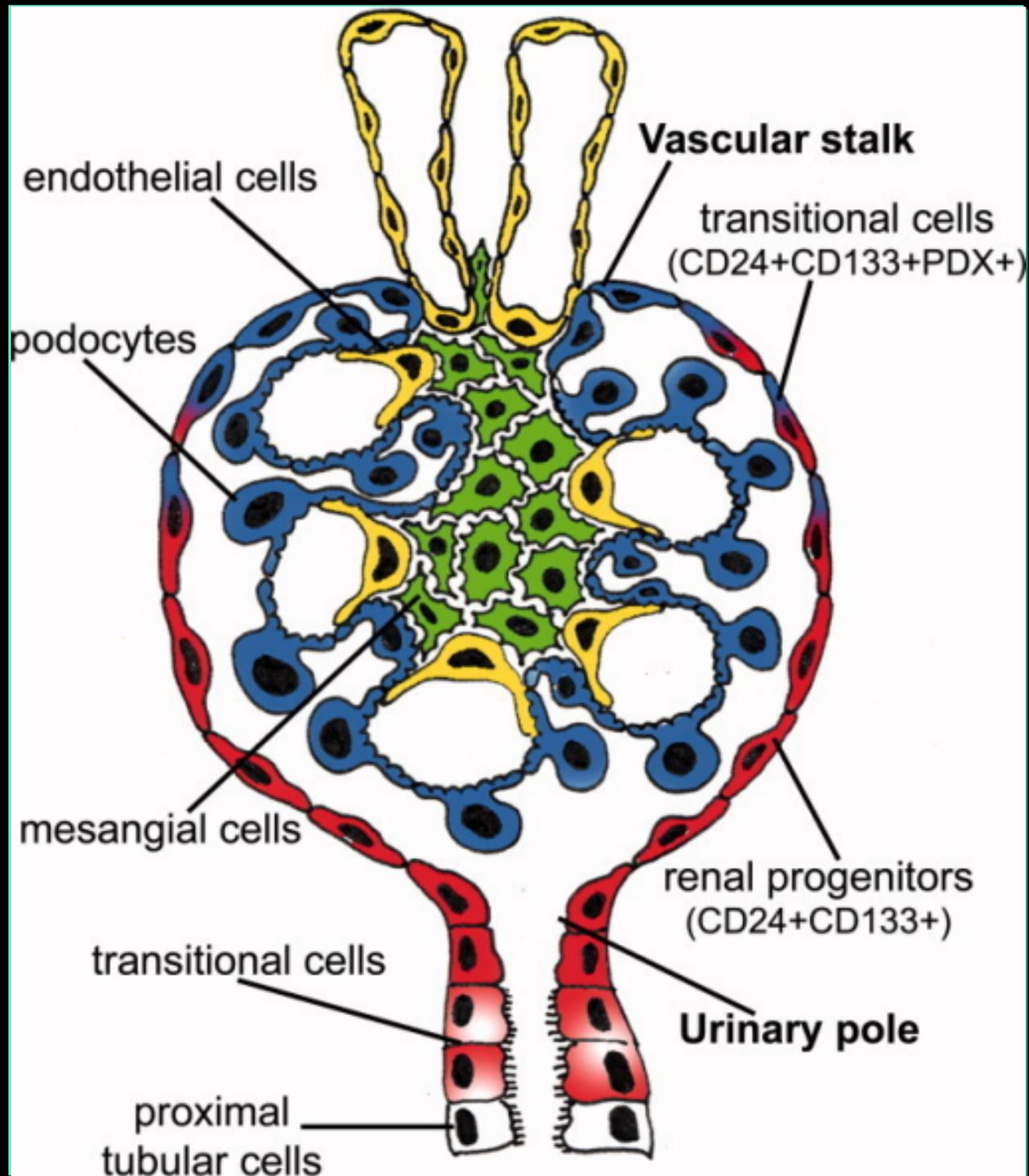
Più del 99% del liquido filtrato dai reni deve tornare nel sangue.

# Fisiologia del rene

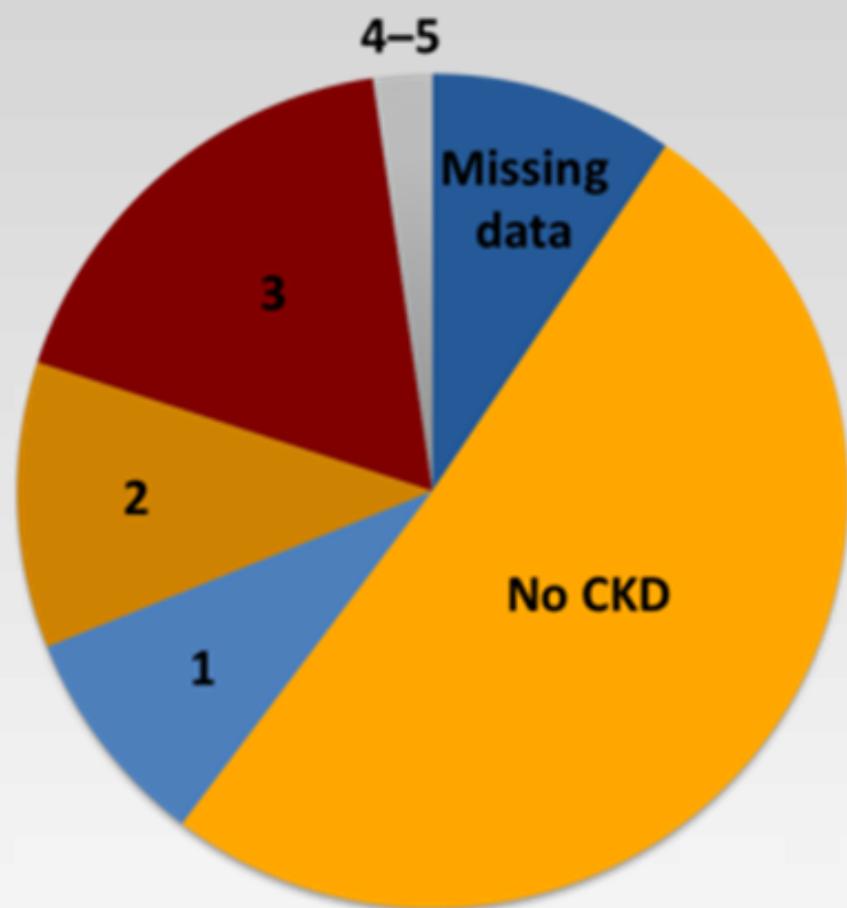
Le funzioni renali sono:

- **Mantenimento del bilancio idrico**
- **Regolazione dell'osmolarità del liquido extra-cellulare**
- **Mantenimento del bilancio elettrolitico**
- **Mantenimento dell'equilibrio acido-base**
- **Funzione emuntoria o escrezione di prodotti di scarto e di sostanze estranee**
- **Produzione e degradazione di ormoni e citochine**
- **Gluconeogenesi**





# Incidence of Renal Disease in People with T2DM



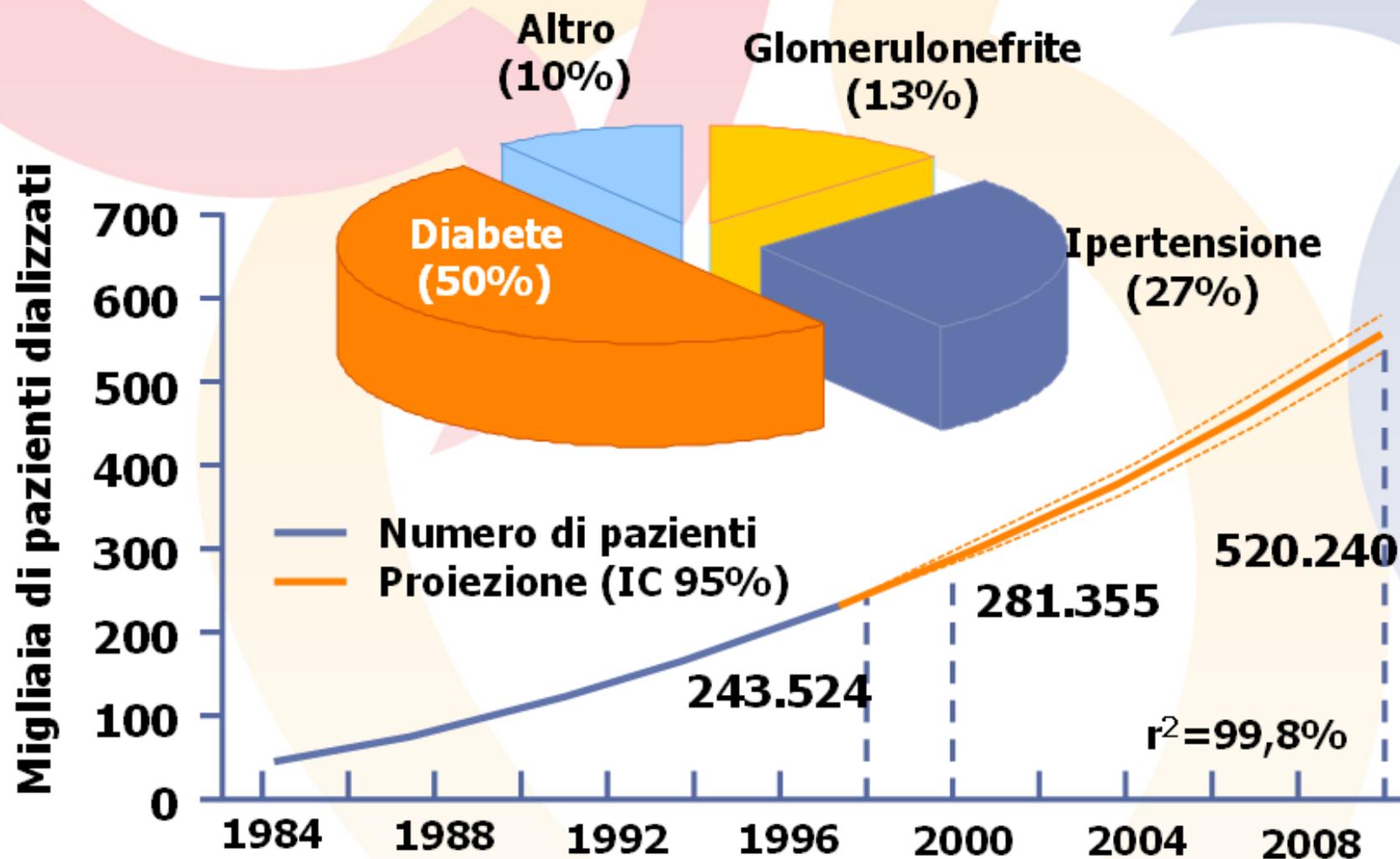
| CKD Stage    | eGFR (mL/min) | % of T2DM Patients* |
|--------------|---------------|---------------------|
| Missing data | –             | 9.5%                |
| No CKD       | ≥90           | 50.8%               |
| 1            | ≥90           | 8.6%                |
| 2            | 60-89         | 11.1%               |
| 3            | 30-59         | 17.7%               |
| 4-5          | <29           | 2.3%                |

\*Based on data from 1462 patients aged ≥20 years with T2DM who participated in the Fourth National Health and Nutrition Examination Survey in the years 1999 through 2004

CKD = chronic kidney disease; eGFR = estimated glomerular filtration rate

# Il diabete è la causa più comune di insufficienza renale terminale

## Diagnosi principale nei pazienti che vanno incontro a dialisi

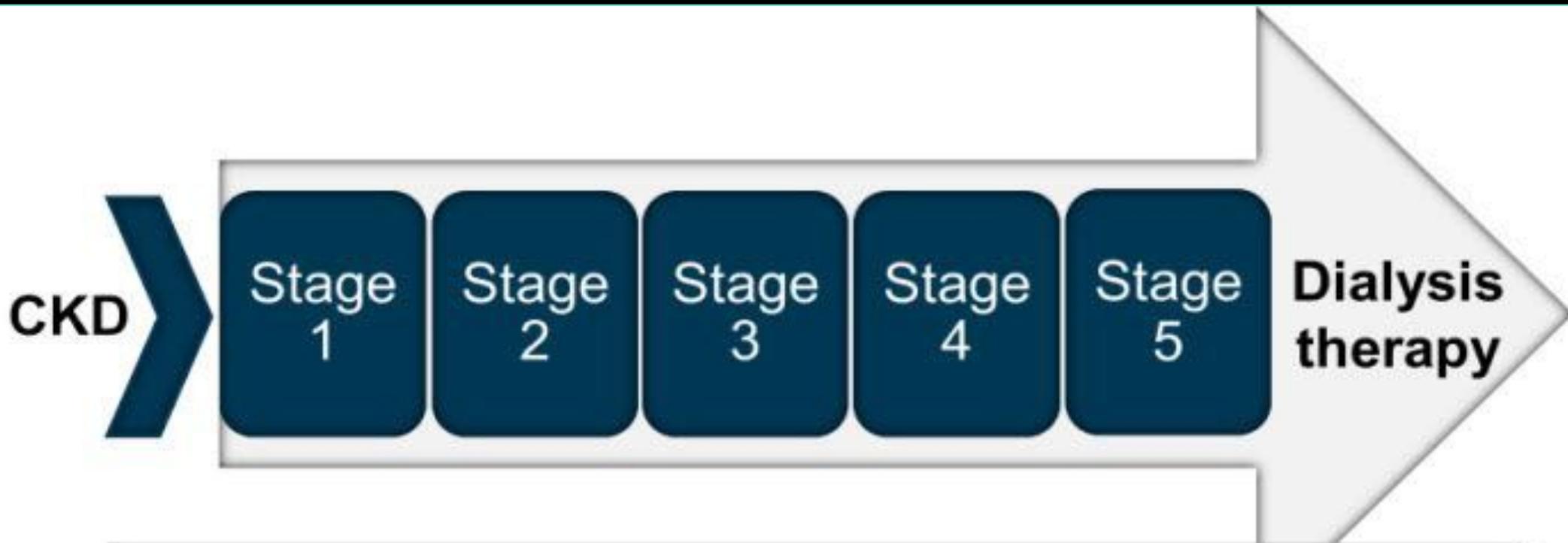


# Excess Mortality among Persons with Type 2 Diabetes

>400.000 pts from Swedish National Diabetes Register followed for a mean of 4.6 yrs

**The *excess risks* of all-cause and cardiovascular death *increased* with younger age, worse glycemic control, and *greater severity of renal complications*...**

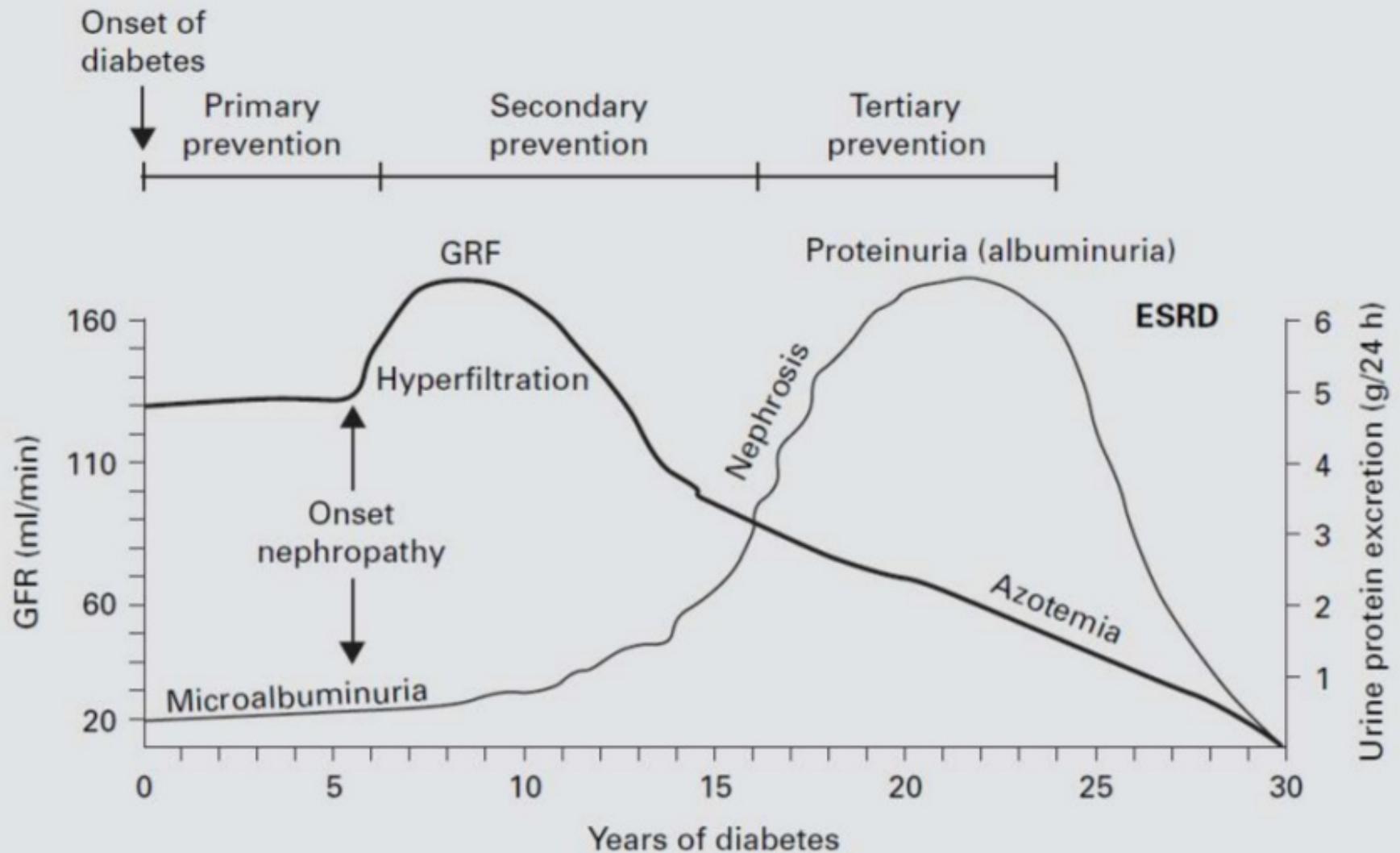
| Variable                       | Death from Any Cause |                  |                  |                  | Death from Cardiovascular Causes |                   |                  |                  |
|--------------------------------|----------------------|------------------|------------------|------------------|----------------------------------|-------------------|------------------|------------------|
|                                | <55 Yr               | 55–64 Yr         | 65–74 Yr         | ≥75 Yr           | <55 Yr                           | 55–64 Yr          | 65–74 Yr         | ≥75 Yr           |
| Reference                      | 1.00                 | 1.00             | 1.00             | 1.00             | 1.00                             | 1.00              | 1.00             | 1.00             |
| Normoalbuminuria               | 1.87 (1.70–2.04)     | 1.27 (1.22–1.32) | 0.96 (0.94–0.99) | 0.83 (0.82–0.84) | 2.19 (1.82–2.62)                 | 1.43 (1.33–1.55)  | 0.95 (0.91–1.00) | 0.79 (0.78–0.81) |
| Microalbuminuria               | 2.61 (2.19–3.10)     | 1.88 (1.75–2.02) | 1.44 (1.38–1.50) | 1.04 (1.02–1.07) | 4.26 (3.19–5.70)                 | 2.38 (2.11–2.69)  | 1.55 (1.44–1.66) | 1.01 (0.97–1.04) |
| Macroalbuminuria               | 3.78 (3.03–4.71)     | 2.88 (2.65–3.13) | 2.14 (2.04–2.24) | 1.40 (1.37–1.44) | 5.58 (3.79–8.20)                 | 3.81 (3.33–4.35)  | 2.62 (2.44–2.81) | 1.37 (1.32–1.42) |
| Stage 5 chronic kidney disease | 14.63 (9.53–22.48)   | 7.19 (5.75–8.98) | 5.97 (5.29–6.73) | 3.31 (3.02–3.62) | 30.03 (16.08–56.10)              | 9.22 (6.40–13.29) | 5.45 (4.43–6.70) | 2.45 (2.11–2.86) |
| Reference                      | 1.00                 | 1.00             | 1.00             | 1.00             | 1.00                             | 1.00              | 1.00             | 1.00             |
| >90 ml/min                     | 2.07 (1.90–2.26)     | 1.47 (1.41–1.54) | 1.17 (1.13–1.21) | 0.88 (0.86–0.91) | 2.47 (2.08–2.94)                 | 1.56 (1.43–1.69)  | 1.02 (0.96–1.09) | 0.72 (0.69–0.76) |
| >60–90 ml/min                  | 1.92 (1.69–2.17)     | 1.30 (1.24–1.36) | 0.96 (0.93–0.99) | 0.81 (0.80–0.82) | 2.59 (2.05–3.27)                 | 1.60 (1.47–1.74)  | 1.04 (1.00–1.10) | 0.77 (0.75–0.78) |
| >45–60 ml/min                  | 3.84 (2.68–5.50)     | 2.60 (2.35–2.88) | 1.48 (1.41–1.55) | 1.02 (1.00–1.04) | 5.56 (2.98–10.38)                | 3.83 (3.29–4.45)  | 1.75 (1.63–1.89) | 1.02 (1.00–1.05) |
| >30–45 ml/min                  | 5.52 (3.05–9.97)     | 4.00 (3.44–4.64) | 2.42 (2.26–2.58) | 1.37 (1.34–1.41) | 8.59 (3.21–22.97)                | 4.72 (3.69–6.04)  | 2.94 (2.68–3.24) | 1.39 (1.35–1.44) |
| 15–30 ml/min                   | 18.79 (11.50–30.72)  | 6.98 (5.75–8.48) | 4.21 (3.84–4.62) | 2.21 (2.12–2.30) | 35.03 (16.63–73.79)              | 8.96 (6.59–12.19) | 4.58 (3.97–5.28) | 2.13 (2.01–2.25) |
| Stage 5 chronic kidney disease | 14.70 (9.57–22.59)   | 7.23 (5.79–9.04) | 6.09 (5.40–6.87) | 3.33 (3.04–3.64) | 30.26 (16.20–56.52)              | 9.30 (6.45–13.40) | 5.57 (4.53–6.86) | 2.48 (2.13–2.89) |



**Traditional risk factors:** aging, hypertension, diabetes, obesity, dyslipidemia, smoking

**Renal disease/uremia-related risk factors:** uremic toxins, endothelial dysfunction, chronic inflammation, oxidative stress, sympathetic activation, volume overload, anemia, vascular calcification, CKD-MBD

# Natural history of DN



# Diabetes

Diagnosis



Hyperfiltration



Clinical Latency



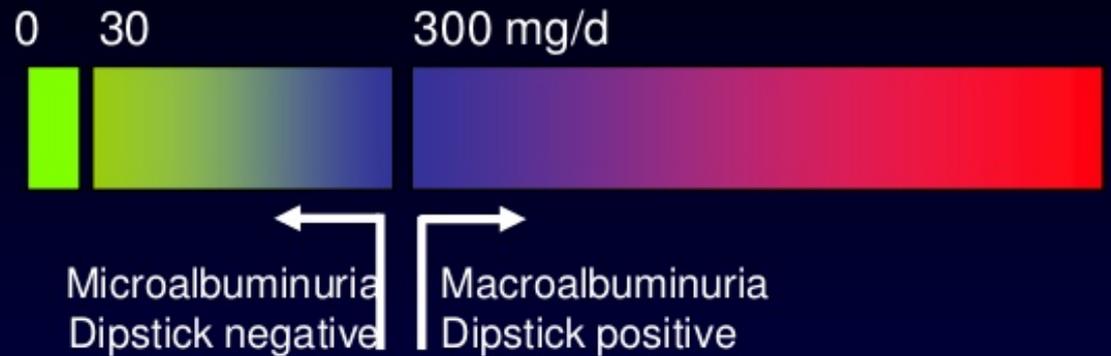
Microalbuminuria



Macroalbuminuria



Renal failure



## New Terminology

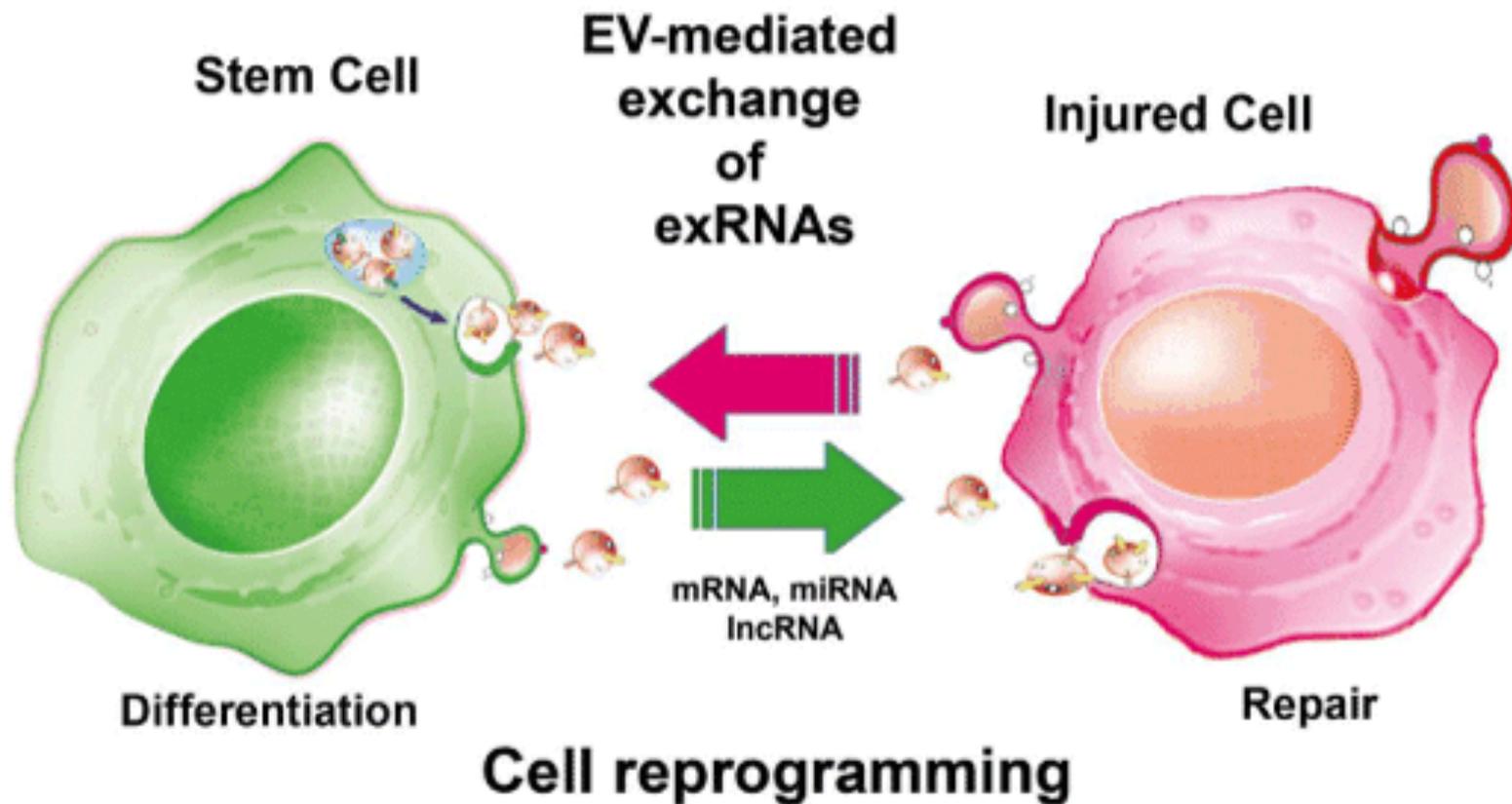
Micro-albuminuria = High Albuminuria

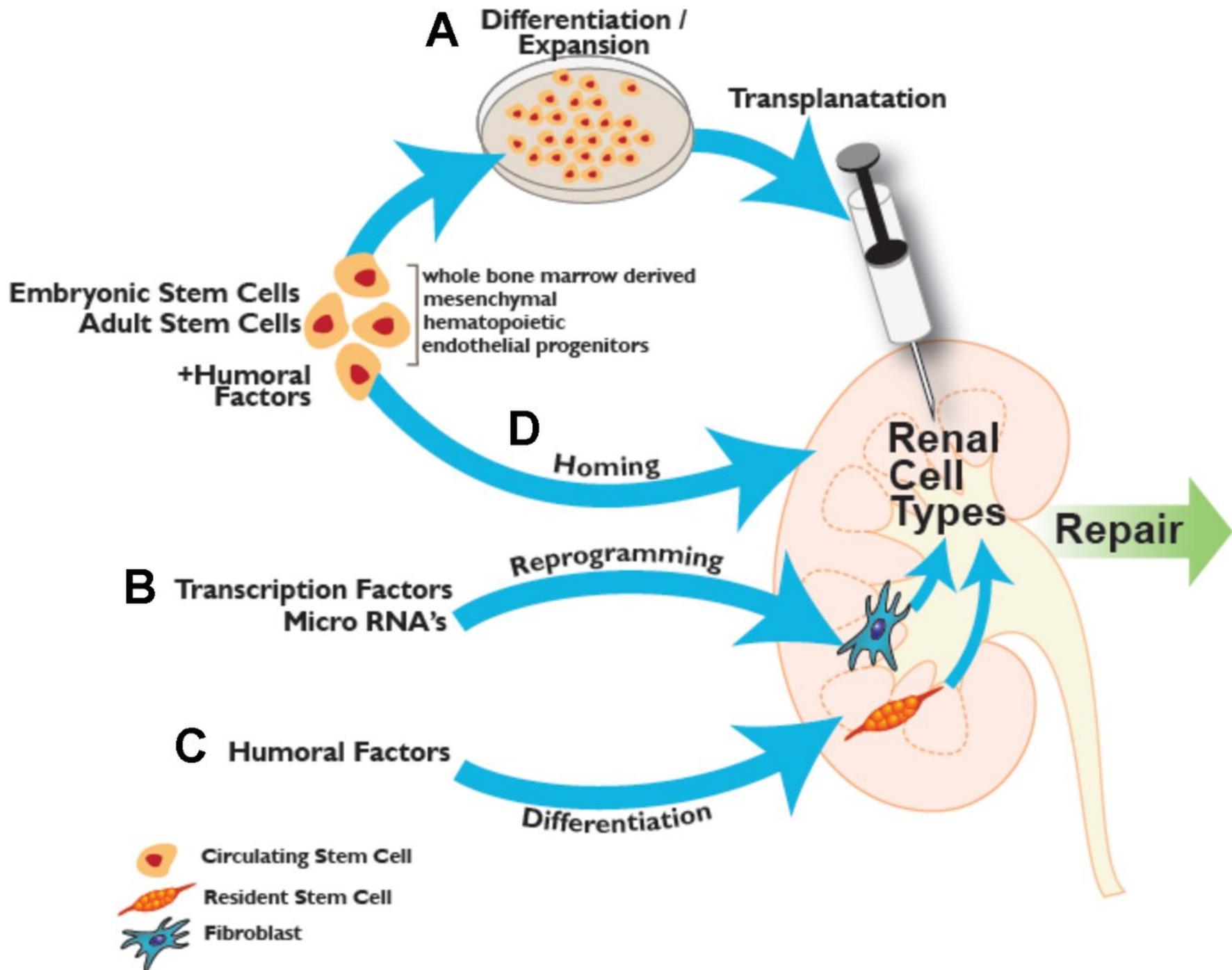
Macroalbuminurais = Very high  
Albuminuria

**ARRESTARE**

**REGREDIRE**

# Stem Cell Treatment For Kidney Disorder





ARRESTARE

**Grazie per la  
partecipazione e  
l'attenzione !**