
بسم الله الرحمن الرحيم

The Effect of Gut Microbiome in Healthy of Kidney

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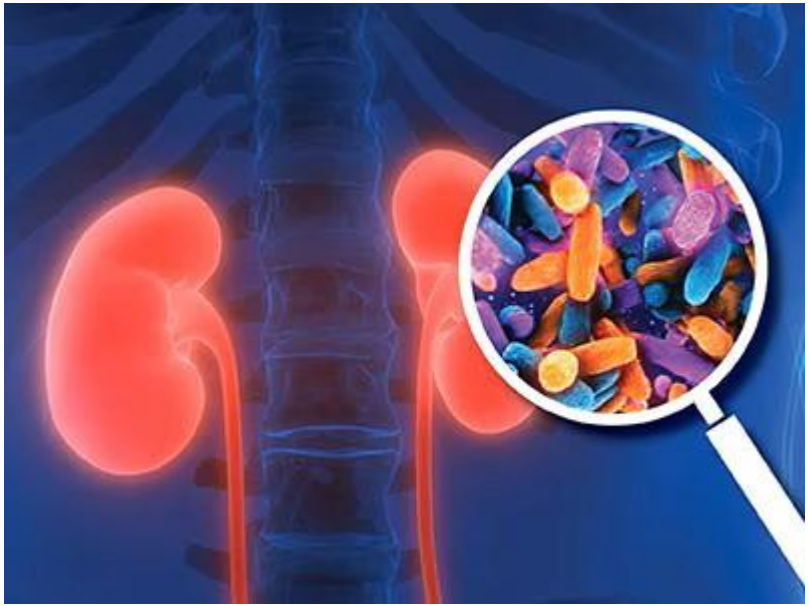
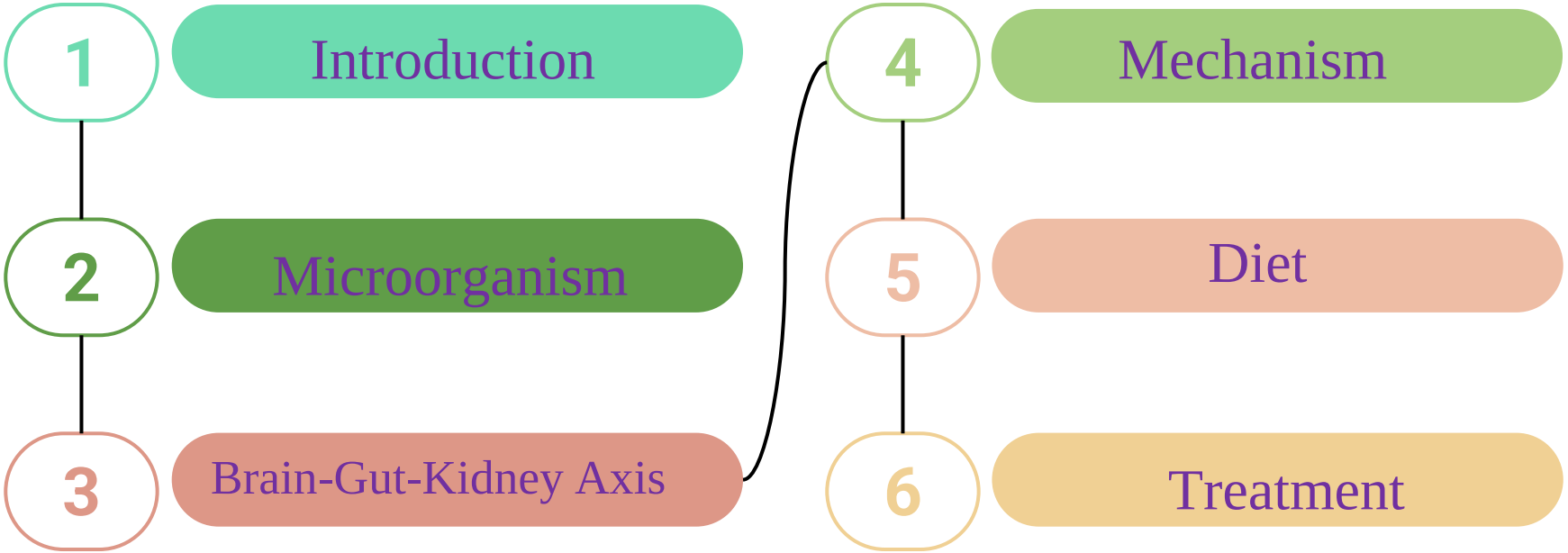
May 2025



Topics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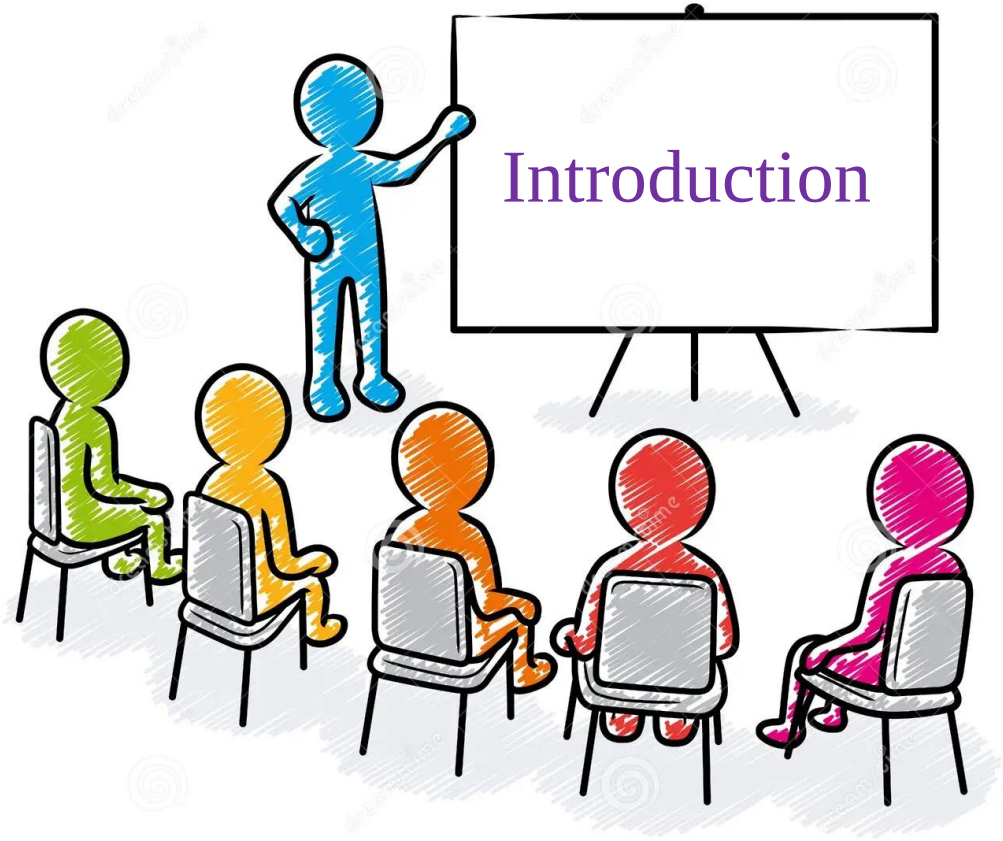
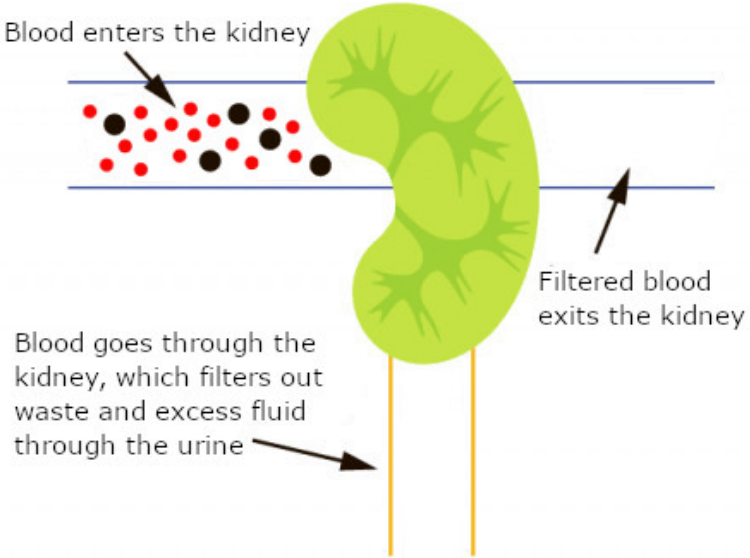
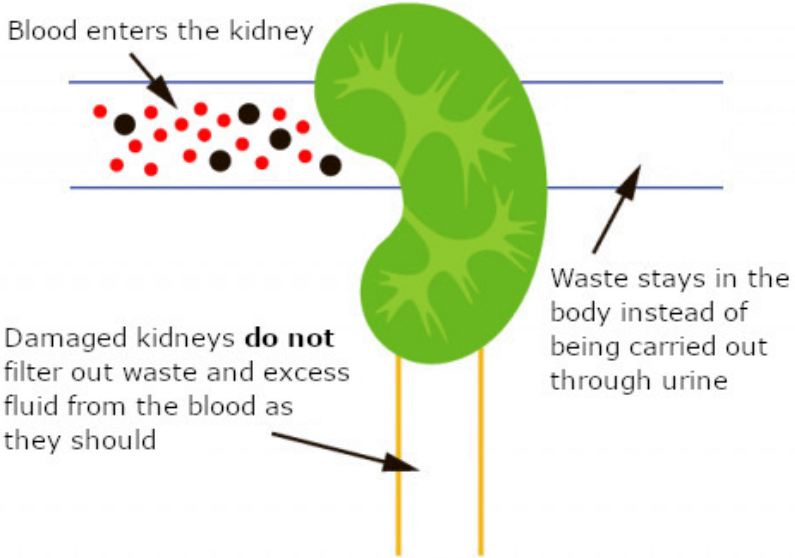

Introduction

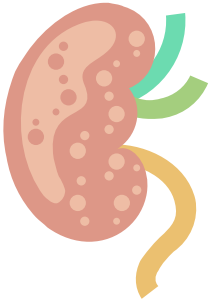
Healthy Kidney



Damaged Kidney

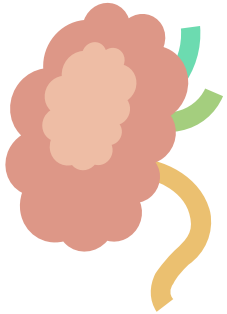


(Chronic Kidney Disease)CKD



Stage1

GFR > 90
ml/min/1.73m²



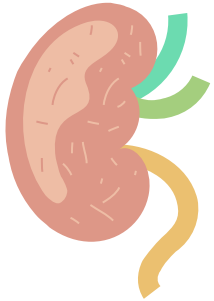
Stage2

GFR=60-89
ml/min/1/73m²

Stage3

GFR=30-59
ml/min/1.73m²

3a 3b



Stage4

GFR=15-29
ml/min/1.73m²

What is the microbiome?

The term **“microbiome“** encompasses a **microbial ecosystem** or community that inhabits a defined space with specific characteristics. Basically, the microbiome is understood as the totality of all **microorganisms**, **bacteria**, archaea, viruses, fungi and protozoa, that colonies a microorganism (such as humans, animals, plants).

Branches of Gut Microbiom

- Firmicutes
- Bacteroides
- Actinobacteria
- Proteobacteria

The Roles of Gut Microbiome

1. Protection against pathogenesis
2. Gut healthy maintenance
3. Nutrients metabolism
4. Synthesis of vitamins
5. Immune system regulation

microorganism

Tiny organisms living in all kinds of environments

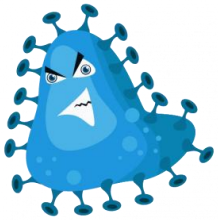
microbiota

A community of microorganisms in a specific environment

microbiome

A community of microorganisms & their role within a specific environment; considering environmental conditions interactions with each other

Microbiomes



The "bad" microbiome

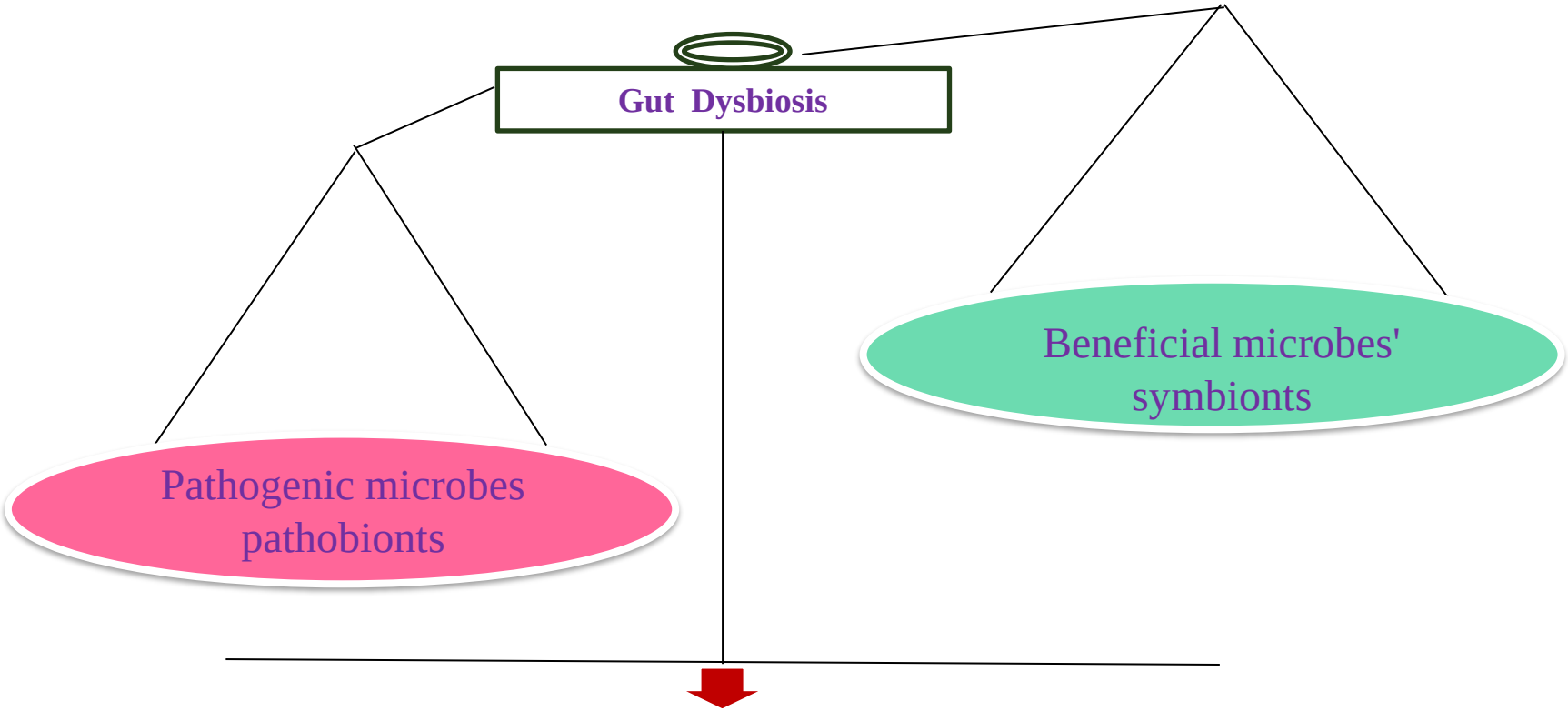
- ✓ Bacteroides
- ✓ Ruminococcus gnavus
- ✓ Enterobacteriaceae
- ✓ Pathogenic bacteria

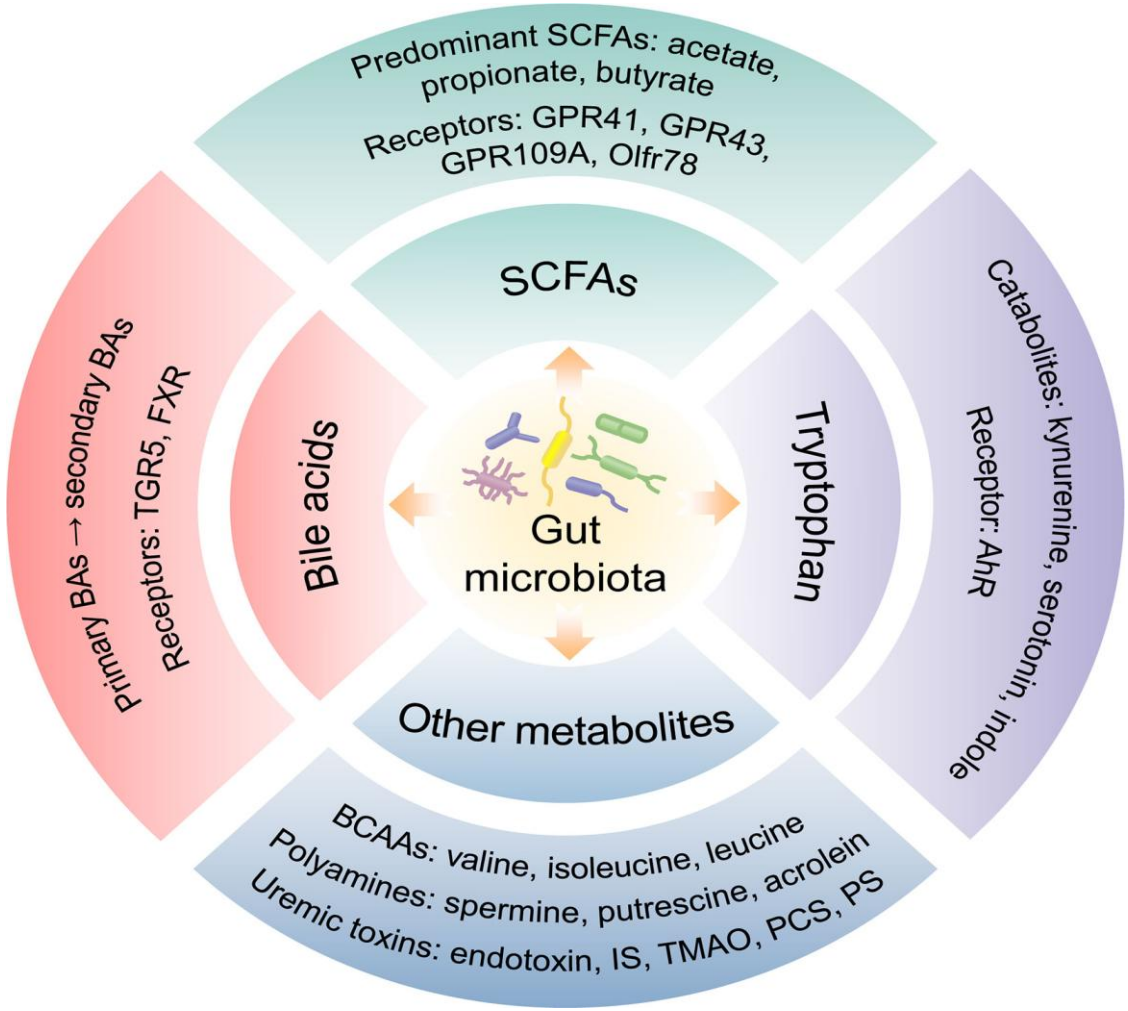
VS

The "good" microbiome

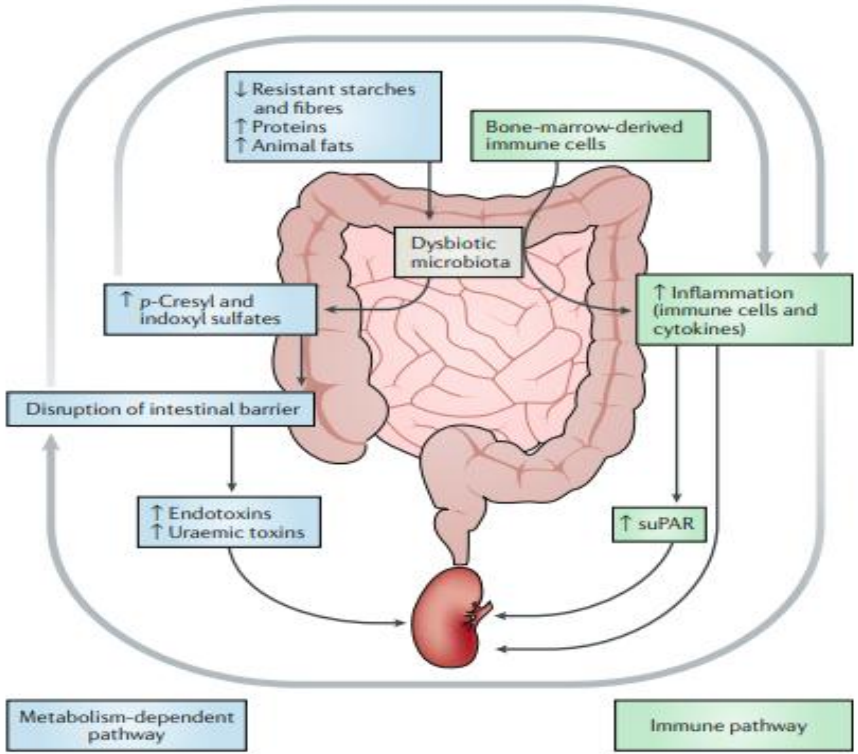
- ✓ Lactobacillus
- ✓ Bifidobacterium
- ✓ Eubacterium
- ✓ Faecalibacterium
- ✓ Akkermansia muciniphila
- ✓ Butyrate-producing bacteria(*Faecalibacterium* , *Roseburia*)

Gut- kidney axis

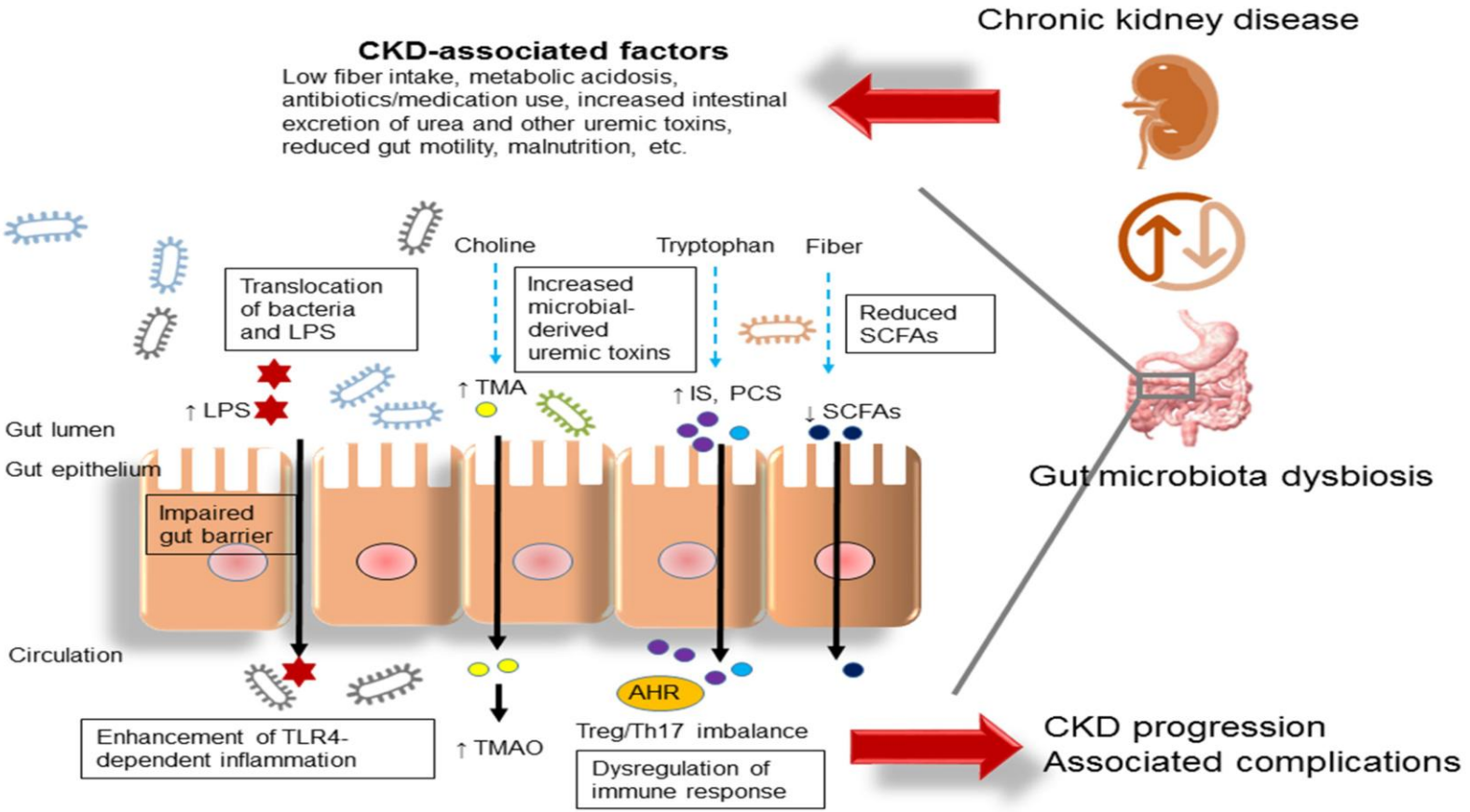



Predominant SCFAs: acetate, propionate, butyrate
Receptors: GPR41, GPR43, GPR109A, Olfr78
SCFAs
Primary BAs → secondary BAs
Receptors: TGR5, FXR
Bile acids
Gut microbiota
Tryptophan
Catabolites: kynurenine, serotonin, indole
Receptor: AhR
Other metabolites
BCAAs: valine, isoleucine, leucine
Polyamines: spermine, putrescine, acrolein
Uremic toxins: endotoxin, IS, TMAO, PCS, PS

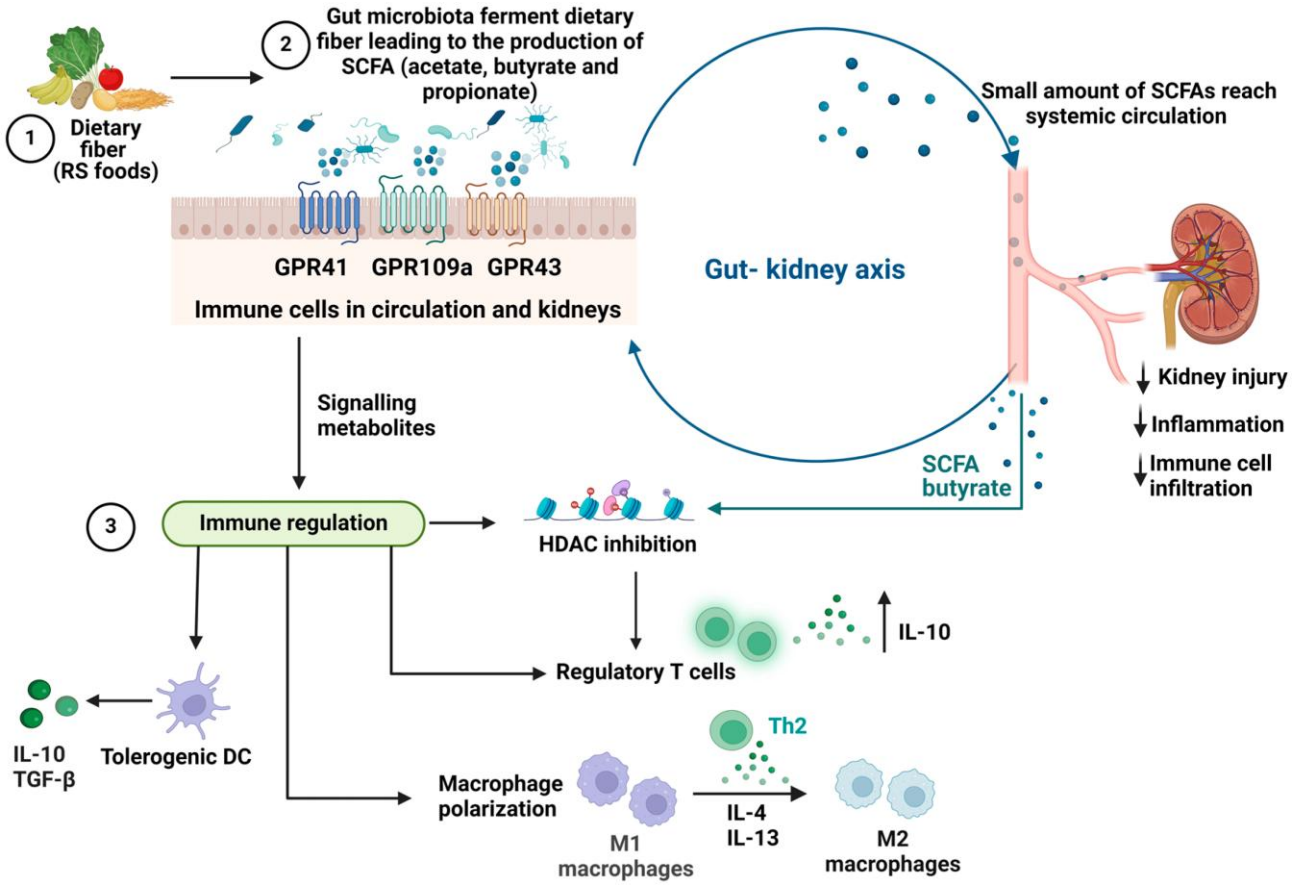
Gut- kidney axis



Mechanism of Gut Dysbiosis on Kidney Health



Signaling Pathway

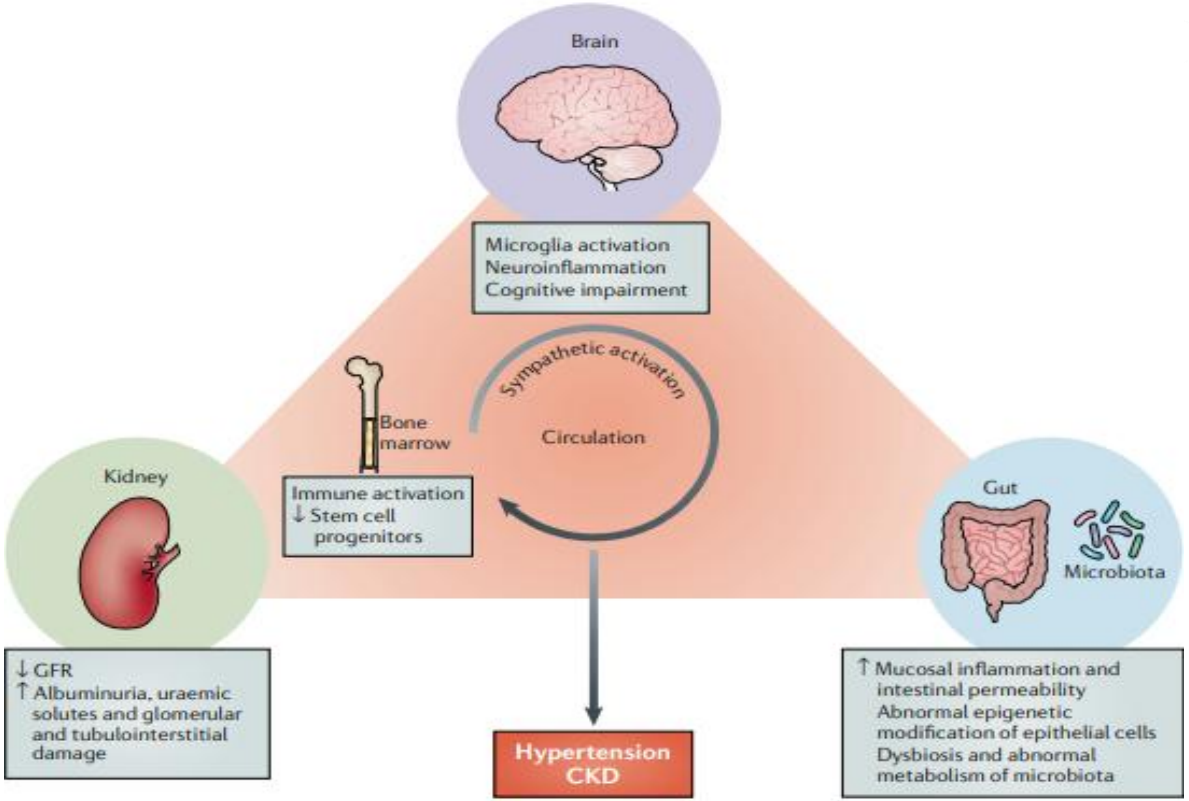


Gut Dysbiosis

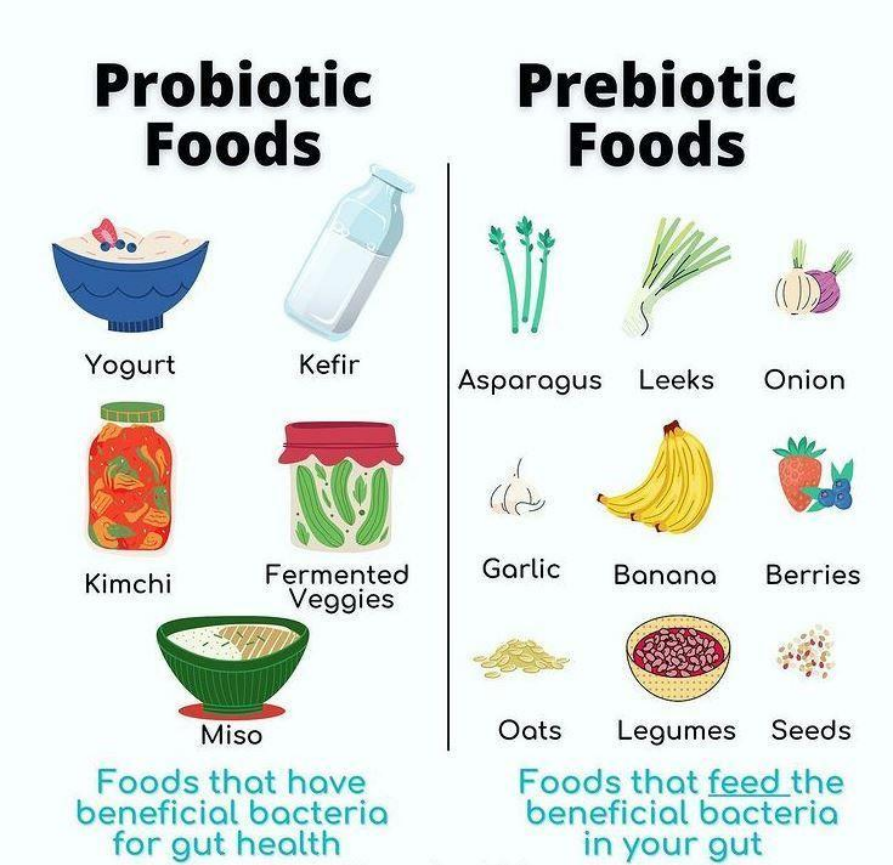
- SCFA Depletion → GPR41/43 ↓ → Inflammation ↑
- Uremic Toxins → AhR/NF-KB → Oxidative Stress
- Endotoxemia → TLR4/NLRP3 → Fibrosis
- Metabolic Dysregulation → AMPK/Mtor → Lipotoxicity

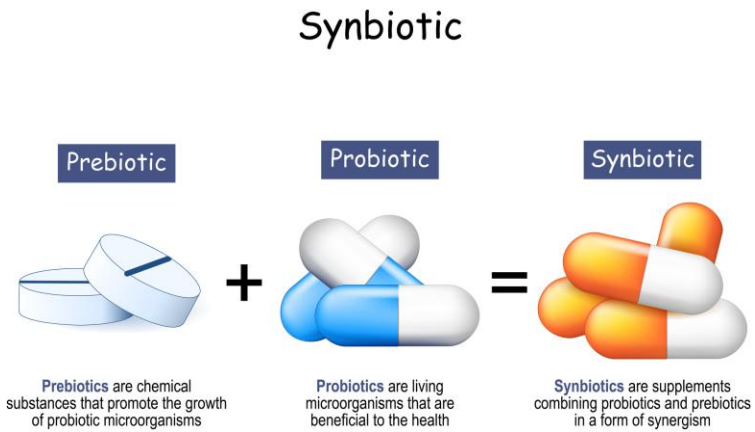
Kidney Injury (↓ GFR , ↑ Albuminuria)

Brain-Gut-Kidney Axis in Hypertension and CKD



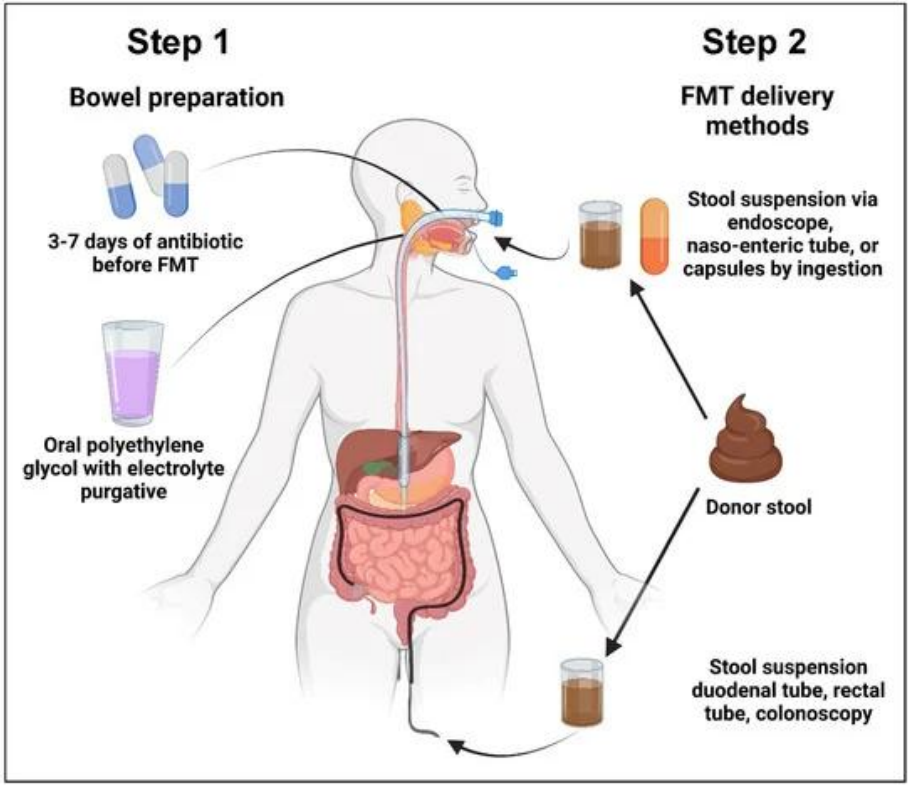
Diet


Probiotic Foods
Yogurt
Kefir
Kimchi
Fermented Veggies
Miso
Foods that have beneficial bacteria for gut health
Prebiotic Foods
Asparagus
Leeks
Onion
Garlic
Banana
Berries
Oats
Legumes
Seeds
Foods that feed the beneficial bacteria in your gut

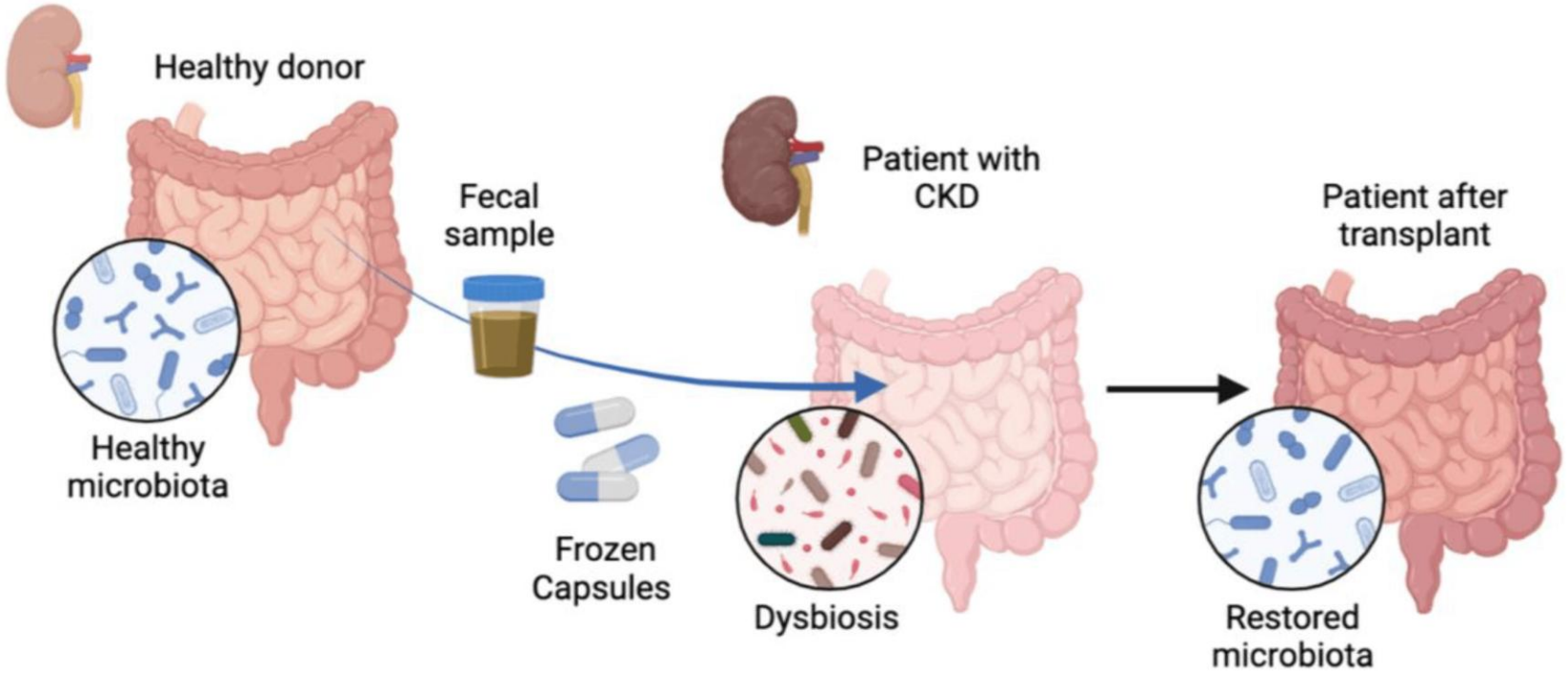

Synbiotic
Prebiotic
Probiotic
Synbiotic
Prebiotics are chemical substances that promote the growth of probiotic microorganisms
Probiotics are living microorganisms that are beneficial to the health
Synbiotics are supplements combining probiotics and prebiotics in a form of synergism

Intervention	Description	Mechanism of Action
Plant-based Diet	Diet rich in fruits, vegetables ,whole grains	-promotes saccharolytic fermentation -reduces uremic toxin producing (indoxyl sulfate) -increase SCFA production
Low-Protein Diet	Protein restriction (0/6-0/8g/kg/day)	-Limits substrate for proteolytic bacterial -Reduces generation of p-cresol &other nitrogenous toxins
High- fiber diet	>25-38g/day of dietary fiber	-Acts as probiotic for beneficial bacteria -Enhances intestinal barrier function -Lowers systemic inflammation
Probiotics	Microbial supplements(Lactobacillus, Bifidobacterium)	-competes with pathogenic bacteria -reduces endotoxemia -modulates T-regulatory cell response
Prebiotics	Non- digestible fibers (inulin,FOS,GOS)	-stimulates growth of commensal bacteria -increase fecal urea excretion -lowers serum IS levels
Synbiotics	Combined probiotics + prebiotics	-synergistic modulation of microbiota -enhances uremic toxin clearance -improves intestinal PH

Role of Fecal Microbiota Transplantation in Treating CKD



Fecal Microbiota Transplantation (FMT)



Conclusion :

- The gut microbiota has crucial roles in a variety of diseases, including hypertension and chronic kidney disease (CKD).
- The gut microbiota communicates with the endocrine, nervous and immune systems to regulate host homeostasis, including blood pressure and kidney functions.
- The brain-gut-kidney axis involves connections between these organs that are mediated by descending autonomic regulation from the brain and signals from the gut and the kidney, such as immune products and microbial metabolites
- Potential therapeutic strategies for CKD and hypertension that target the gut microbiota include dietary interventions, probiotics, prebiotics, synbiotics, faecal microbiota transplant and metabolome modulation.

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