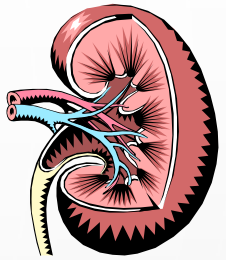
CHRONIC RENAL FAILURE

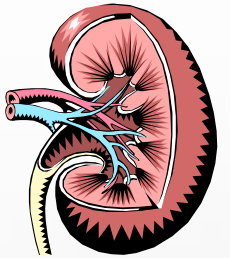
DR.M.AMERIAN

REVIEW



- RECALL FUNCTIONS OF THE KIDNEYS?
- RECALL NORMAL CREATININE & BUN; OTHER LAB TESTS?
- REVIEW DIAGNOSTIC TOOLS

FUNCTIONS OF THE KIDNEYS



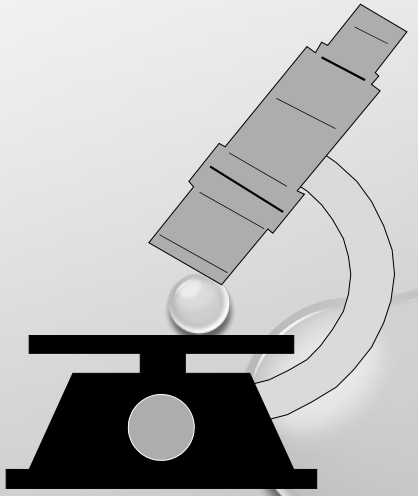
- REGULATES VOLUME AND COMPOSITION OF EXTRACELLULAR FLUID
- EXCRETION OF NITROGENOUS WASTE PRODUCTS
- BP CONTROL VIA RENIN-ANGIOTENSIN-ALDOSTERONE SYSTEM- ***RECALL RAAS***
- VITAMIN D ACTIVATION
- ACID-BASE BALANCE (HCO3 & H) REGULATION THROUGH PROCESS OF _____, ____ AND _____.

filtration, secretion, reabsorpton

- PROSTAGLANDIN SYNTHESIS
- ERYTHROPOIETIN PRODUCTION

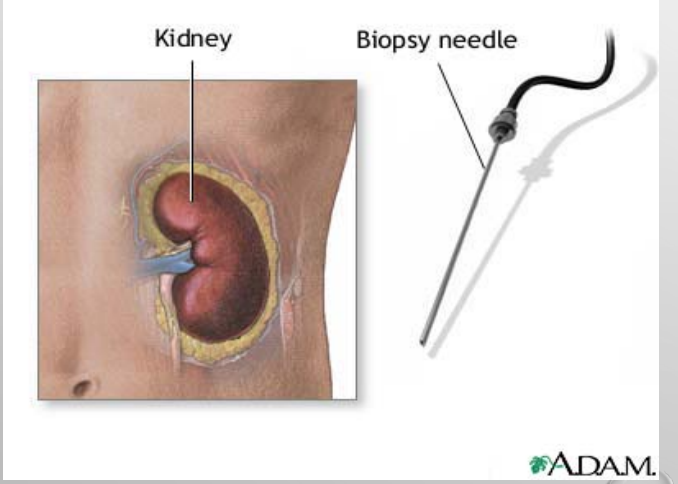
DIAGNOSTIC TOOLS FOR ASSESSING RENAL FAILURE

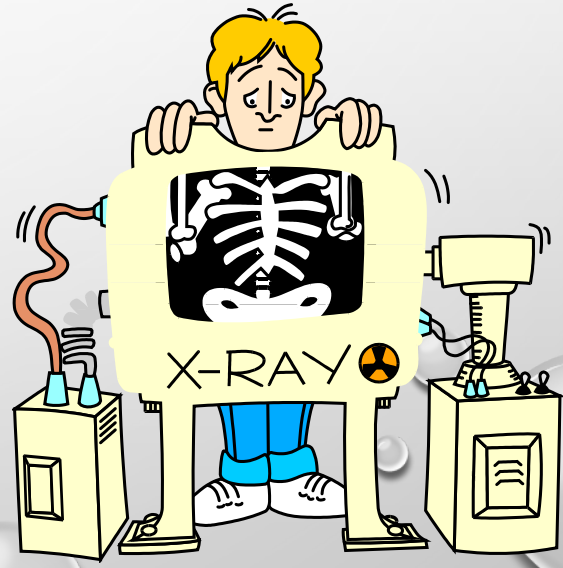
- BLOOD TESTS
  - BUN ELEVATED (NORM 10-20 MG/DL)
  - CREATININE ELEVATED (NORM 0.6 - 1.4 MG/DL)
  - K ELEVATED (TEXT NORM 3.5-5.0 MEQ/L)
  - PO_4 ELEVATED (TEXT NORM 2.8-4.5MG/DL)
  - CA DECREASED (TEXT NORM 8.5-10.5MG/DL)
- URINALYSIS
  - SPECIFIC GRAVITY (TEXT NORM 1.003-1.030
  - PROTEIN (TEXT NORM 0-TRACE)
  - CREATININE CLEARANCE (TEXT NORM 85-120ML/MIN)



DIAGNOSTIC TOOLS

- ULTRASOUND
- X-RAYS
- BIOPSY *MOST DEFINITIVE





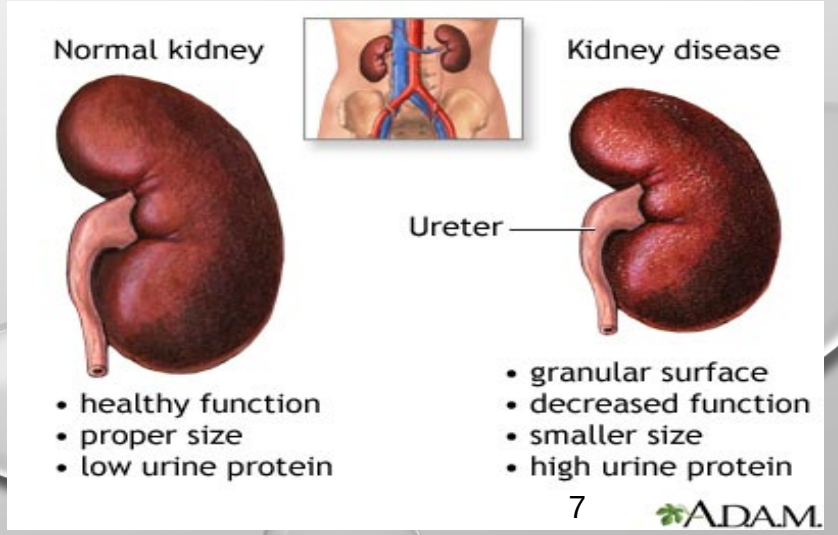
CHRONIC RENAL FAILURE/ CHRONIC KIDNEY DISEASE (CKD)

- SLOW PROGRESSIVE RENAL DISORDER RELATED TO NEPHRON LOSS, OCCURRING OVER MONTHS TO YEARS

- CULMINATES IN END STAGE RENAL DISEASE (ESRD)

CHARACTERISTICS OF CKD - ESRD

- CAUSE & ONSET OFTEN UNKNOWN
- LOSS OF FUNCTION PRECEDES LAB ABNORMALITIES
- LAB ABNORMALITIES PRECEDE SYMPTOMS
- SYMPTOMS (USUALLY) EVOLVE IN ORDERLY SEQUENCE
- RENAL SIZE IS USUALLY DECREASED



CAUSES OF CKD

- *DIABETES
- *HYPERTENSION
- GLOMERULONEPHRITIS
- CYSTIC DISORDERS
- DEVELOPMENTAL - CONGENITAL
- INFECTIOUS DISEASE

- Neoplasms
- Obstructive disorders
- Autoimmune diseases (lupus)
- Hepatorenal failure
- Scleroderma
- Amyloidosis
- Drug toxicity-(**overuse some common drugs, as aspirin, NSAID as ibuprofen, cocaine and acetaminophen)**

NSAIDs-…cause prerenal ARF by blocking prostaglandin production > also alters local glomerular arteriolar perfusion… (reduces renal blood flow)

GLOMERULAR FILTRATION RATE (GFR)-DETERMINE STAGE CKD (MOST ACCURATE EVALUATION)

- 24 HOUR URINE FOR CREATININE CLEARANCE
- FORMULA- URINE CREATININE X URINE VOLUME
- SERUM CREATININE
- CAN ESTIMATE CREATININE CLEARANCE BY:

$$140 - \{\text{AGE} \times \text{WEIGHT (KG)}\}$$
$$72 \times \text{SERUM CREATININE}$$

- WHAT IS NORMAL GFR? 90 - 120 mL/min


Kidney Failure is the Tip of the Iceberg…
Stage 5
Stage 4
Stage 3
Stage 2
Stage 1

Proteinuria is an important risk factor for the progression of CKD. Increased protein filtration results in excess reabsorption of filtered proteins by proximal tubular cells.

GFR categories (ml/min/ 1.73 m²) Description and range				Persistent albuminuria categories Description and range		
				A1 Normal to mildly increased	A2 Moderately increased	A3 Severely increased
				<30 mg/g <3 mg/mmol	30-300 mg/g 3-30 mg/mmol	>300 mg/g >30 mg/mmol
	G1	Normal or high	≥90			
	G2	Mildly decreased	60-89			
	G3a	Mildly to moderately decreased	45-59			
	G3b	Moderately to severely decreased	30-44			
	G4	Severely decreased	15-29			
	G5	Kidney failure	<15			

Green: low risk (if no other markers of kidney disease, no CKD); Yellow: moderately increased risk
Orange: high risk; Red: very high risk

STAGES OF CKD
NKF CLASSIFICATION SYSTEM

STAGE 1: GFR > 90 ML/MIN DESPITE KIDNEY DAMAGE

STAGE 2: MILD REDUCTION (GFR 60 – 89 ML/MIN)

GFR OF 60 MAY REPRESENT 50% LOSS IN FUNCTION.

DURING STAGE 1 - 2

- ***NO SYMPTOMS***

- SERUM CREATININE DOUBLES*
- (UP TO *50%* NEPHRON LOSS

STAGES OF CKD
NKF CLASSIFICATION SYSTEM

STAGE 3: MODERATE REDUCTION (GFR 30 – 59 ML/MIN)

1. CALCIUM ABSORPTION DECREASES
   (FROM THE GI TRACT)
2. MALNUTRITION ONSET
3. ANEMIA
4. LEFT VENTRICULAR HYPERTROPHY

STAGES OF CKD
NKF CLASSIFICATION SYSTEM

STAGE 4: SEVERE REDUCTION (GFR 15 – 29 ML/MIN)

1. SERUM TRIGLYCERIDES 
2. *HYPER*PHOSPHATEMIA
3. METABOLIC *ACIDOSIS*
4. *HYPER*KALEMIA

STAGES OF CKD-NKF CLASSIFICATION SYSTEM

STAGE 5: KIDNEY FAILURE (GFR < 15 ML/MIN) *ESRD!!!*

- AZOTEMIA
- RESIDUAL FUNCTION < *15% OF NORMAL*
- EXCRETORY, REGULATORY, HORMONAL FUNCTIONS SEVERELY IMPAIRED
- METABOLIC ***ACIDOSIS*** (KUSSMAUL BREATHING)
- MARKED ↑ : BUN, CREATININE, PHOSPHOROUS
- MARKED ↓ : HEMOGLOBIN, HEMATOCRIT, CALCIUM
- FLUID ***OVERLOAD***

TREATMENT OPTIONS

- *CONSERVATIVE* THERAPY * *(SEVERE RESTRICTIONS, DIETARY, FLUIDS MAINTAIN RENAL FUNCTION AS LONG AS POSSIBLE- IF GFR > 10ML/MIN)*
- HEMODIALYSIS
- PERITONEAL DIALYSIS
- TRANSPLANT
- ***NOTHING > DEATH***

CONSERVATIVE TREATMENT GOALS

- DETECT/TREAT POTENTIALLY REVERSIBLE CAUSES OF RENAL FAILURE
- PRESERVE EXISTING RENAL FUNCTION
- TREAT MANIFESTATIONS
- PREVENT COMPLICATIONS
- PROVIDE FOR COMFORT

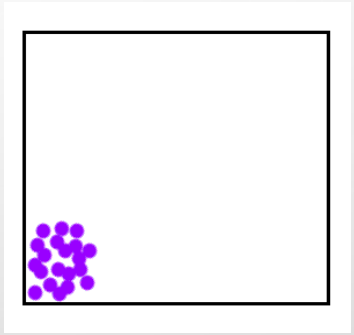
HEMODIALYSIS

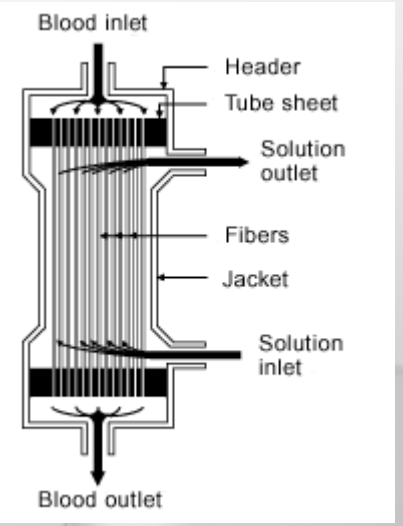
- REMOVAL OF SOLUBLE SUBSTANCES AND WATER FROM THE BLOOD BY ***DIFFUSION*** THROUGH A SEMI-PERMEABLE MEMBRANE.

- EARLY ANIMAL EXPERIMENTS BEGAN 1913
- 1ST HUMAN DIALYSIS 1940'S BY DUTCH PHYSICIAN WILLEM KOLFF (2 OF 17 PATIENTS SURVIVED)
- CONSIDERED EXPERIMENTAL THROUGH 1950'S, NO INTERMITTENT BLOOD ACCESS; FOR ACUTE RENAL FAILURE ONLY.
- 1960 DR. SCRIBNER DEVELOPED SCRIBNER SHUNT-1960'S MACHINES EXPENSIVE, SCARCE, NO FUNDING.
- "DEATH PANELS" PANELS WITHIN COMMUNITY DECIDED WHO GOT TO DIALYZE.

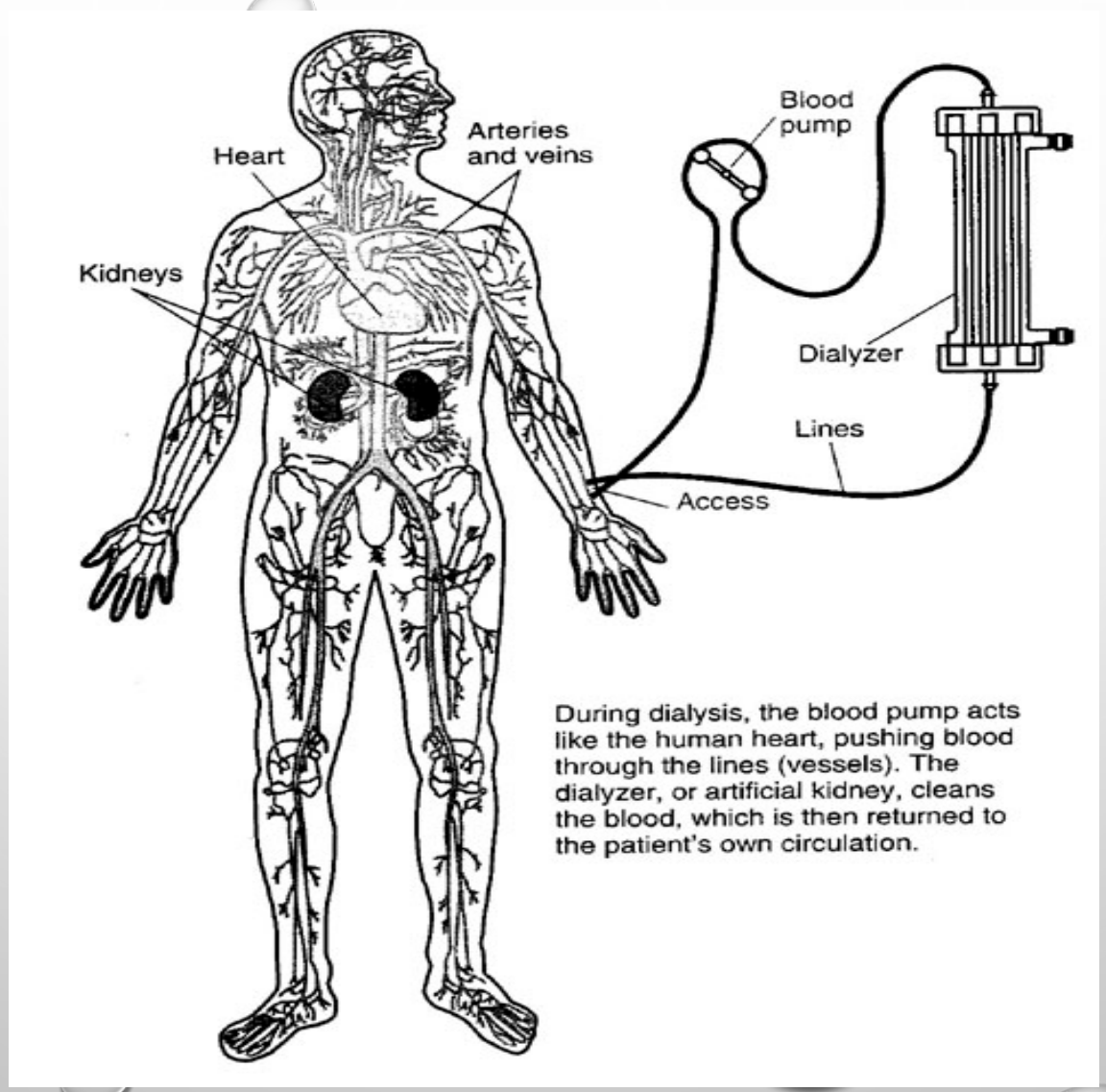
HEMODIALYSIS PROCESS

- BLOOD REMOVED FROM PATIENT INTO EXTRACORPOREAL CIRCUIT.
- DIFFUSION AND ULTRAFILTRATION TAKE PLACE IN DIALYZER.
- CLEANED BLOOD RETURNED TO PATIENT.

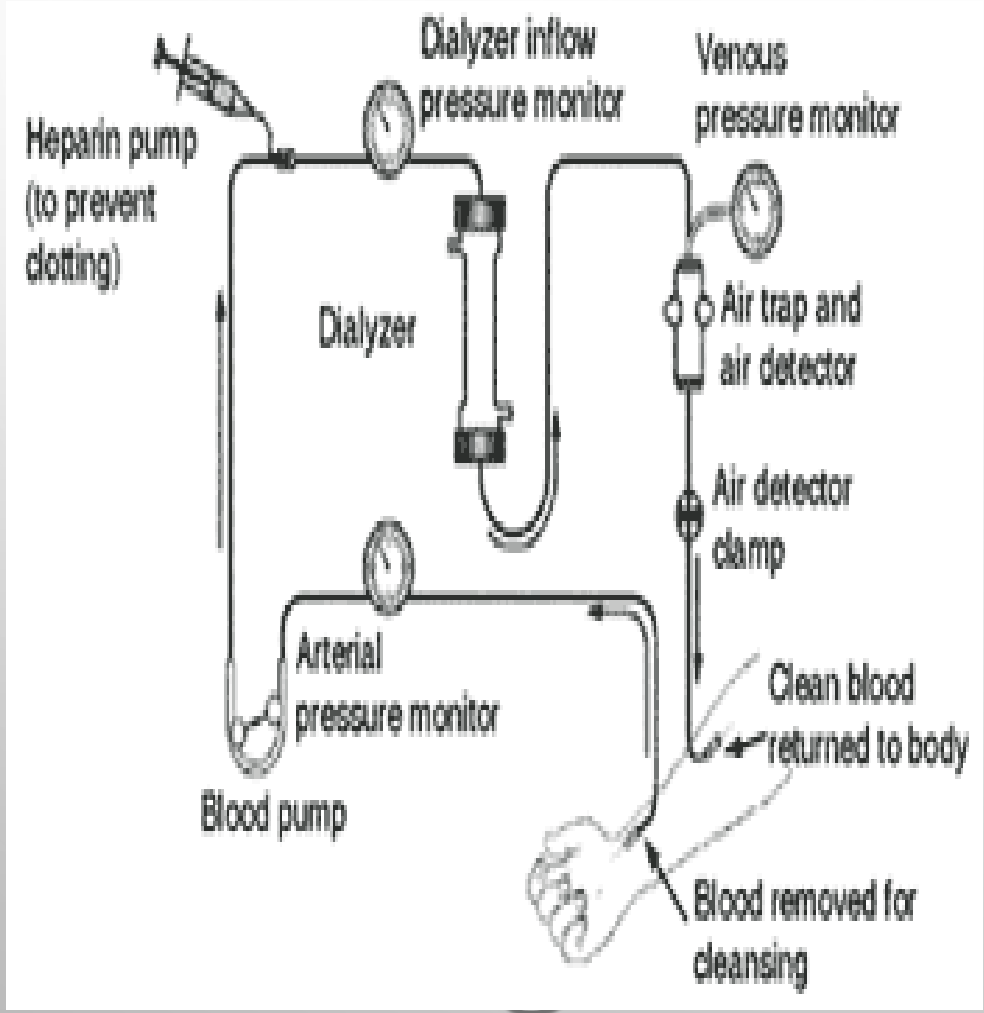


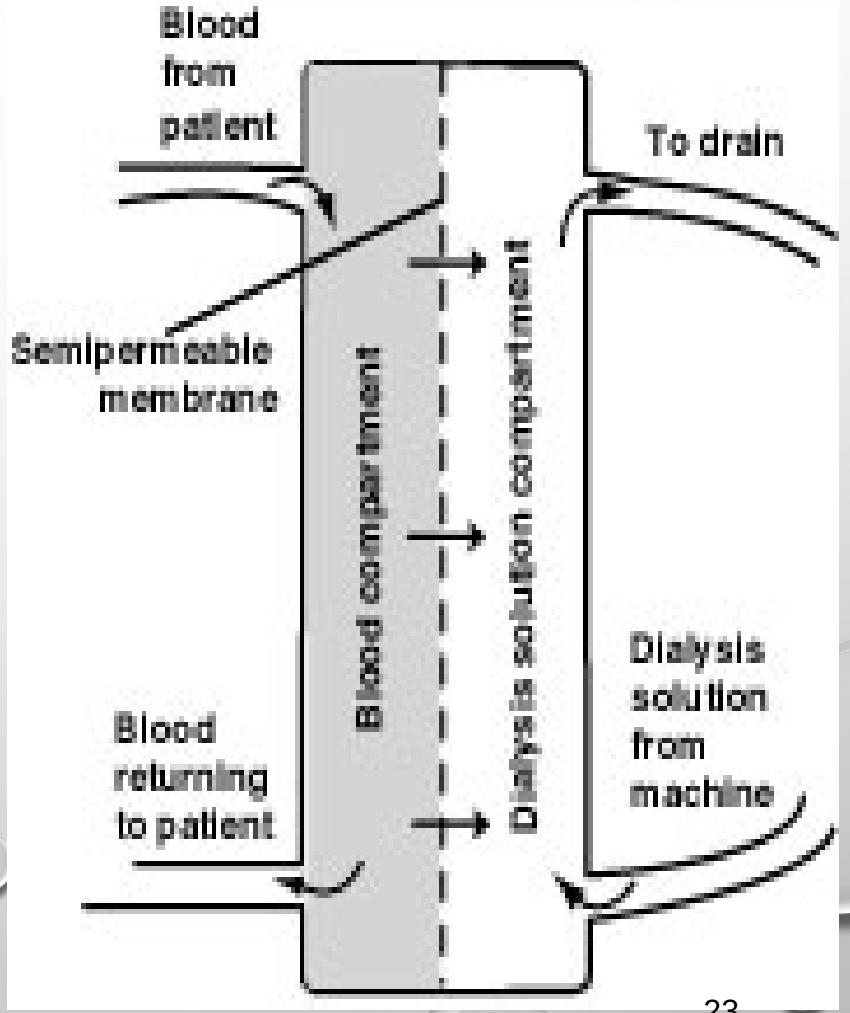


EXTRACORPOREAL CIRCUIT



HOW HEMODIALYSIS WORKS

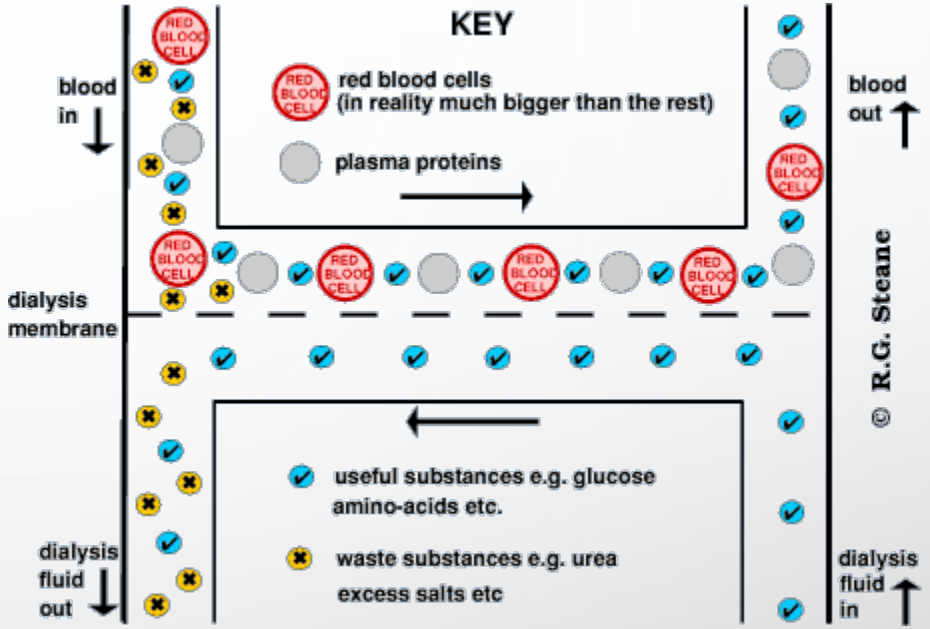


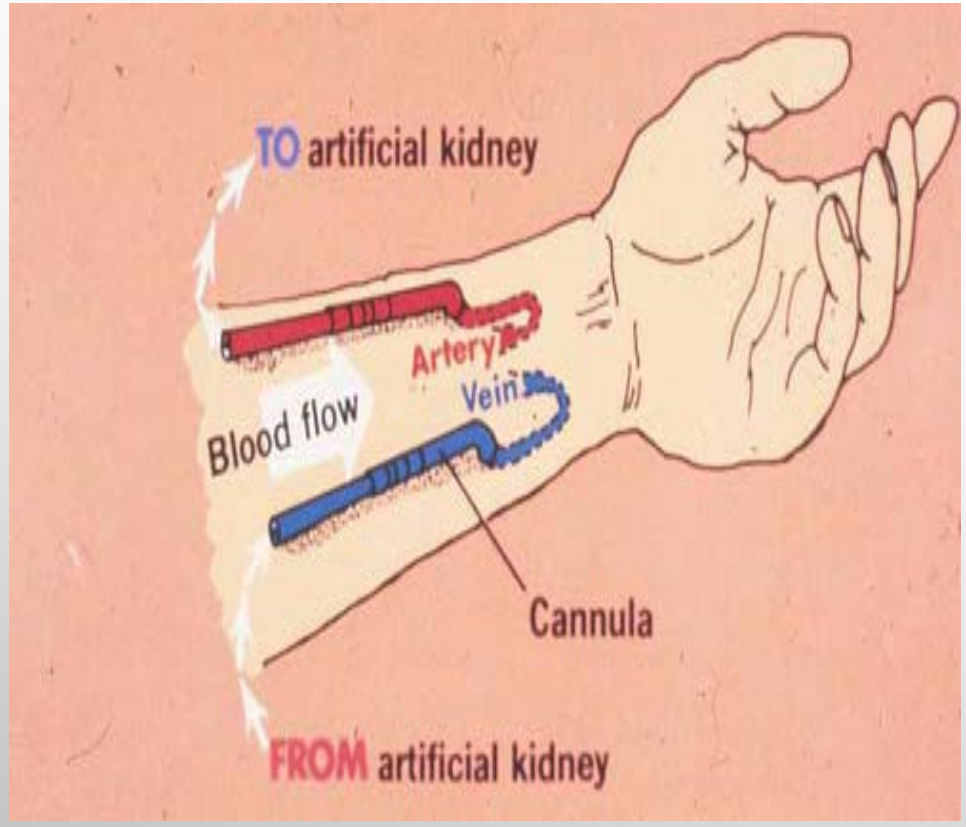


How Dialysis Works-Interactive!

An Introduction to Dialysis-How Stuff Works! (Step by Step)

YouTube- Hemodialysis! Great!




TO artificial kidney
Artery
Vein
Blood flow
Cannula
FROM artificial kidney