

# Anti-inflammatory Drugs

NSAIDs & Anti-arthritis  
Drugs



# anti-inflammatory drugs

- **steroids**
- **NSAIDs**
- **anti-arthritic drugs**
- **odds & ends**



# anti-inflammatory drugs

- **steroids**
- **NSAIDs**
- **anti-arthritic drugs**
- **odds & ends**



# NSAID effects

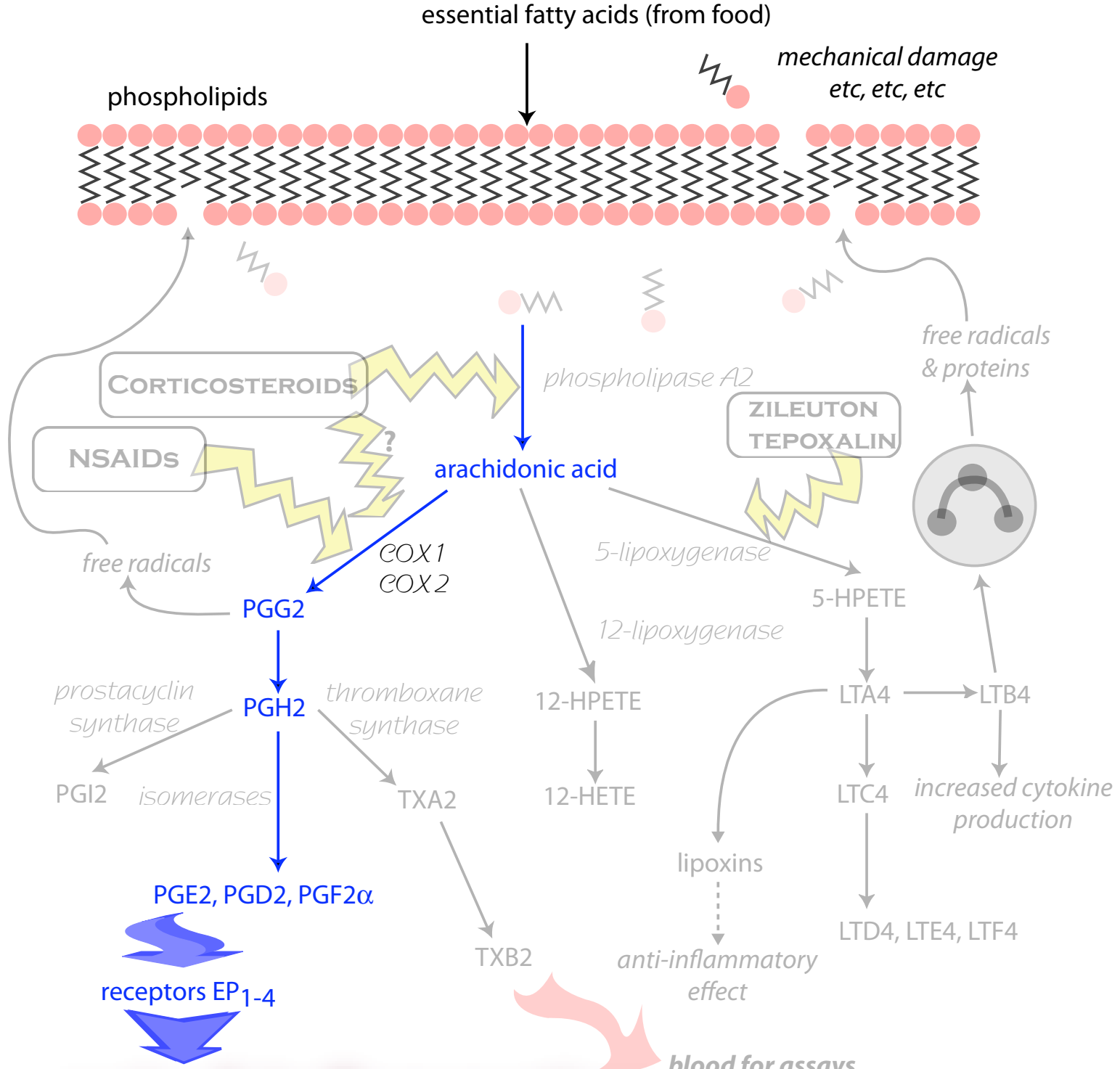
- analgesic
- anti-inflammatory
- anti-pyretic
- anti-thrombotic
- anti-endotoxaemic?



# mechanisms

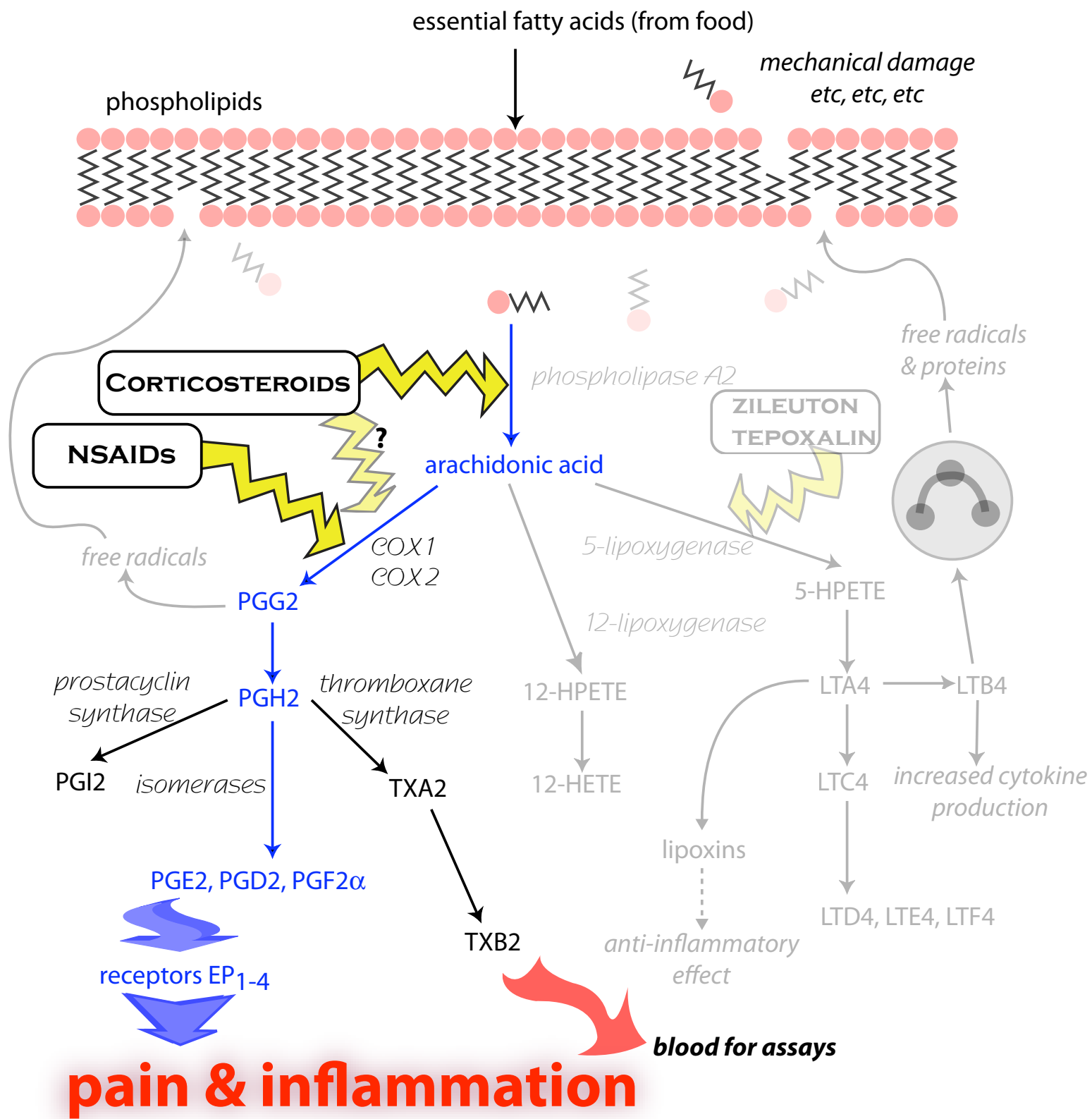
- block PG production
- scavenge free radicals
- PG receptor antagonism
- interfere with neuropeptide signalling

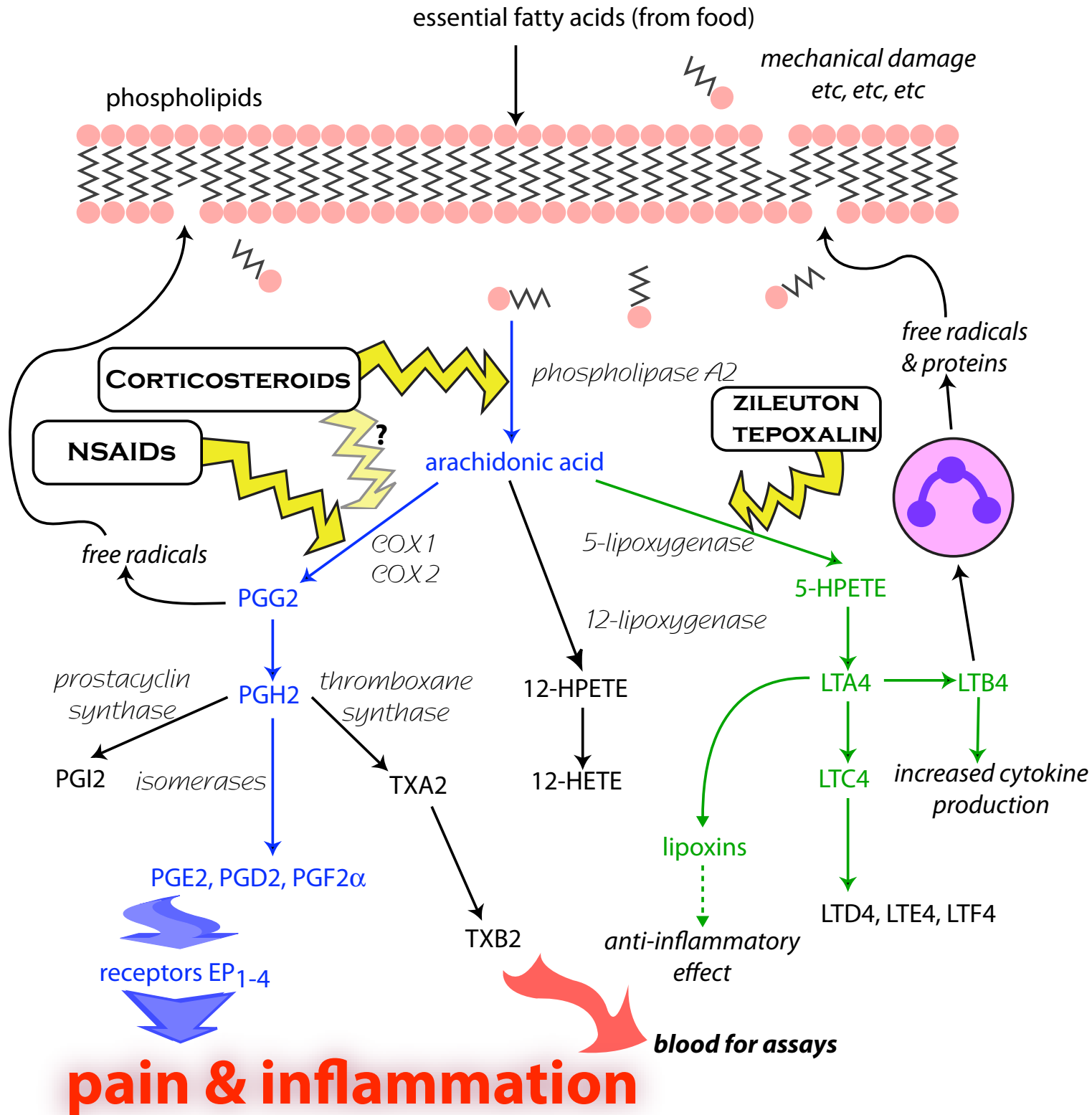




**pain & inflammation**

blood for assays





**pain & inflammation**



# cyclo-oxygenase

- **COX 1 constitutive**
  - physiological
- **COX 2 inducible**
  - mainly in response to inflammation
- **COX 3 neuronal???**



# analgesic NSAIDs

- **carprofen**
- **ketoprofen**
- **flunixin**



# anti-inflammatory NSAIDs

- **horses**
  - phenylbutazone
  - flunixin
  - ketoprofen
  - fenamates
  - (dipyrone)



# colic

- ketoprofen
- flunixin



# anti-inflammatory NSAIDs

- **cattle**
  - flunixin
  - ketoprofen
  - tolfenamate



# anti-arthritis NSAIDs

- dogs
  - meloxicam
  - carprofen
  - flunixin
  - ketoprofen
  - fenamates etc



# anti-thrombotic

- aspirin



# COX 2 inhibitors

- celecoxib
- rofecoxib
- etoricoxib
- valdecoxib
- parecoxib
- firocoxib
- (deracoxib)





# pharmacokinetics

- extreme variation between species
- eg, aspirin half life
  - cat 22 hours
  - cattle 25 minutes



# pharmacokinetics

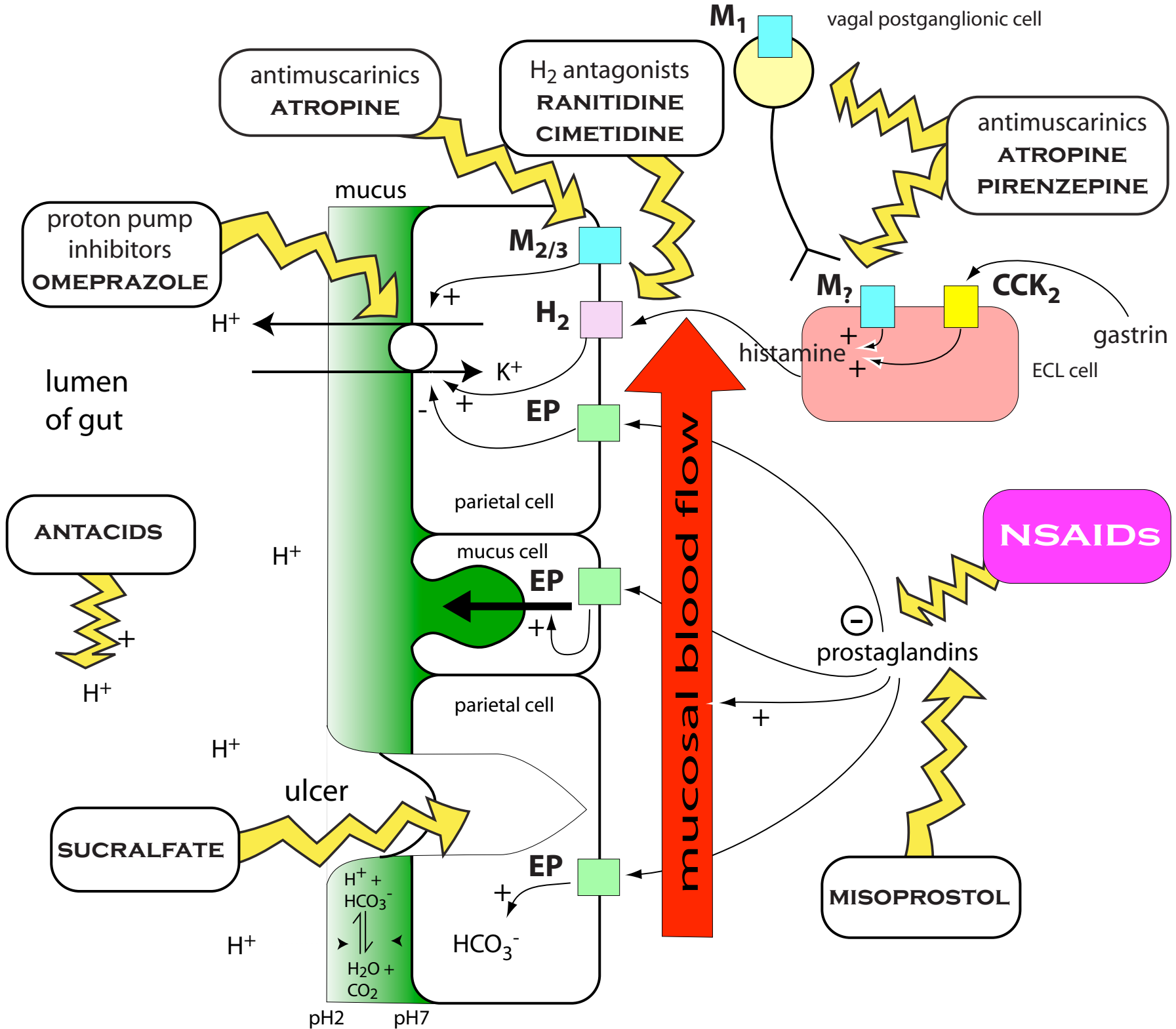
- use only in species for which you have information
- remember protein binding

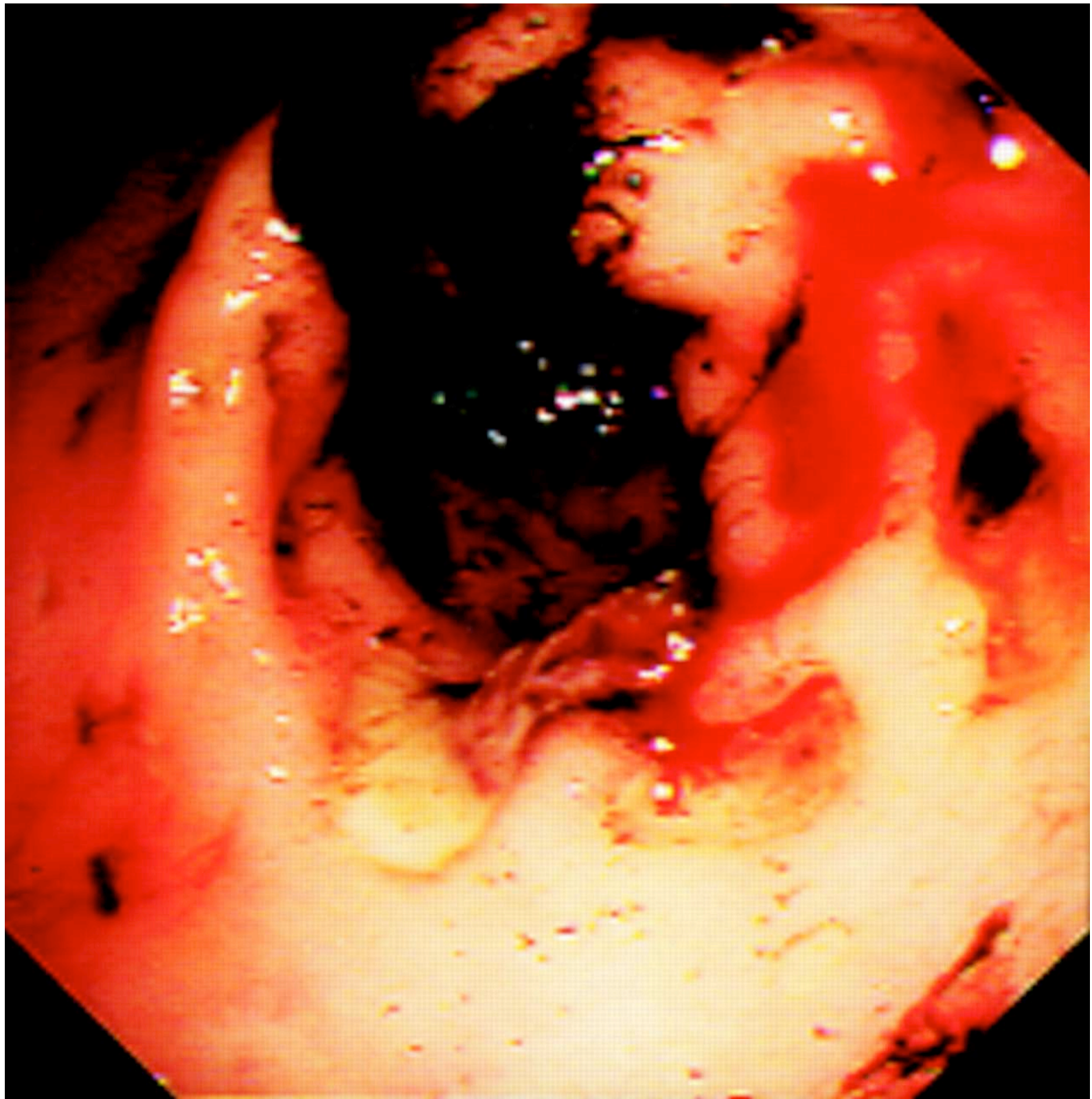


# side effects

- gastric ulceration
- kidney failure
- increased bleeding time
- liver damage
- asthma
- agranulocytosis
- dermal reactions



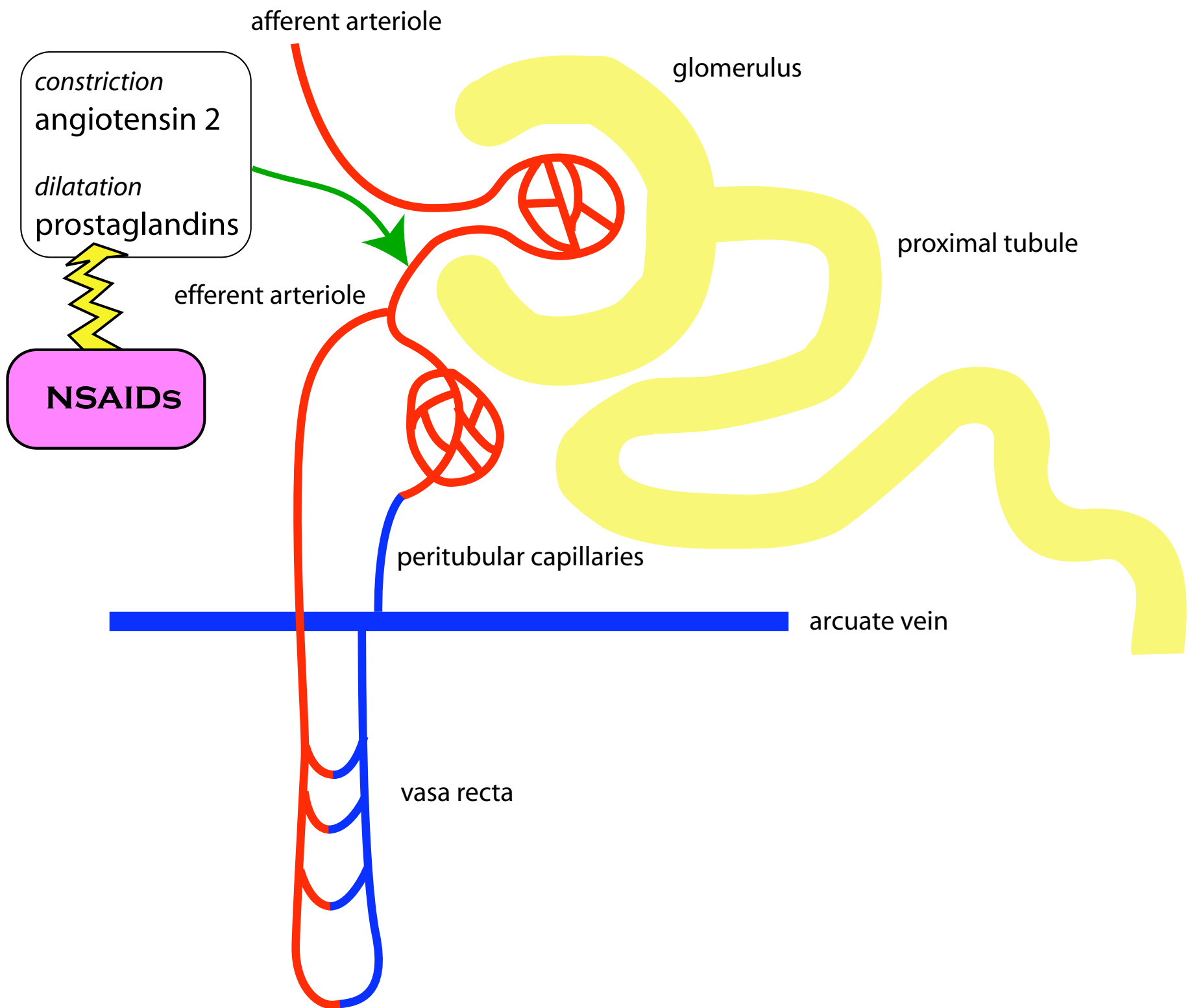




# side effects

- gastric ulceration
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afferent arteriole

glomerulus

proximal tubule

efferent arteriole

peritubular capillaries

arcuate vein

vasa recta

*constriction*  
angiotensin 2  
*dilatation*  
prostaglandins

**NSAIDs**



# side effects

- **increased bleeding time**
  - aspirin
- **liver damage**
  - carprofen
- **asthma**
- **agranulocytosis**
  - phenylbutazone
- **dermal reactions**
- **heart failure (people)**
  - coxibs



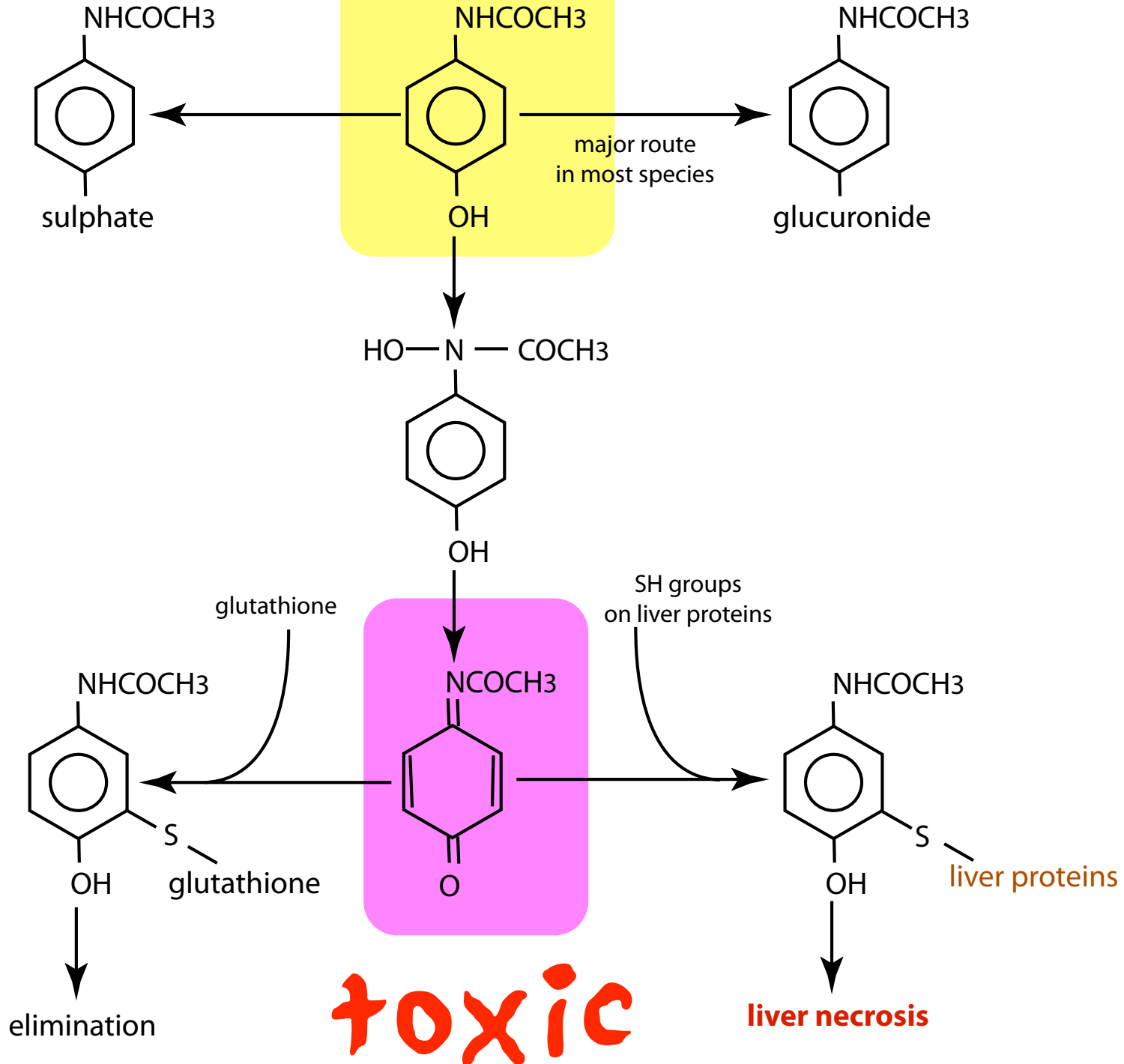


**beware**

- **paracetamol (acetaminophen USAN)  
in cats**



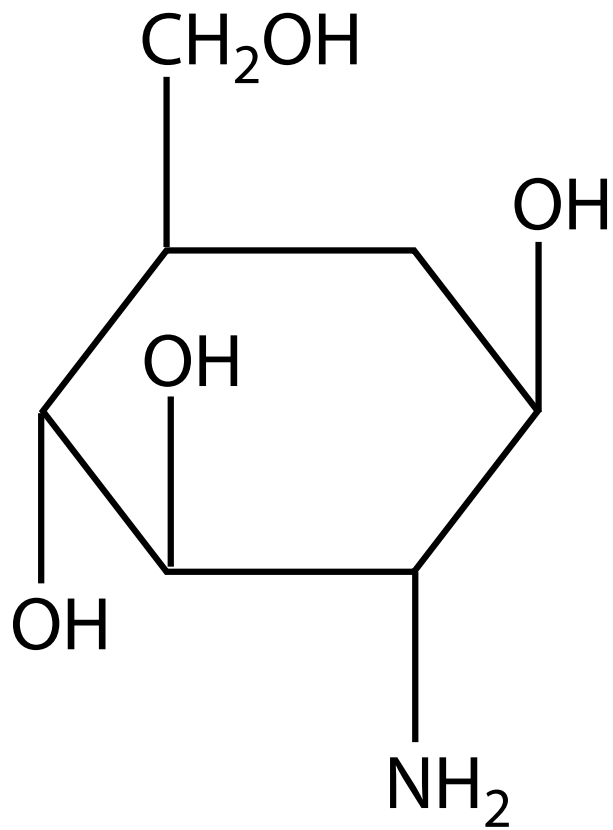
# PARACETAMOL



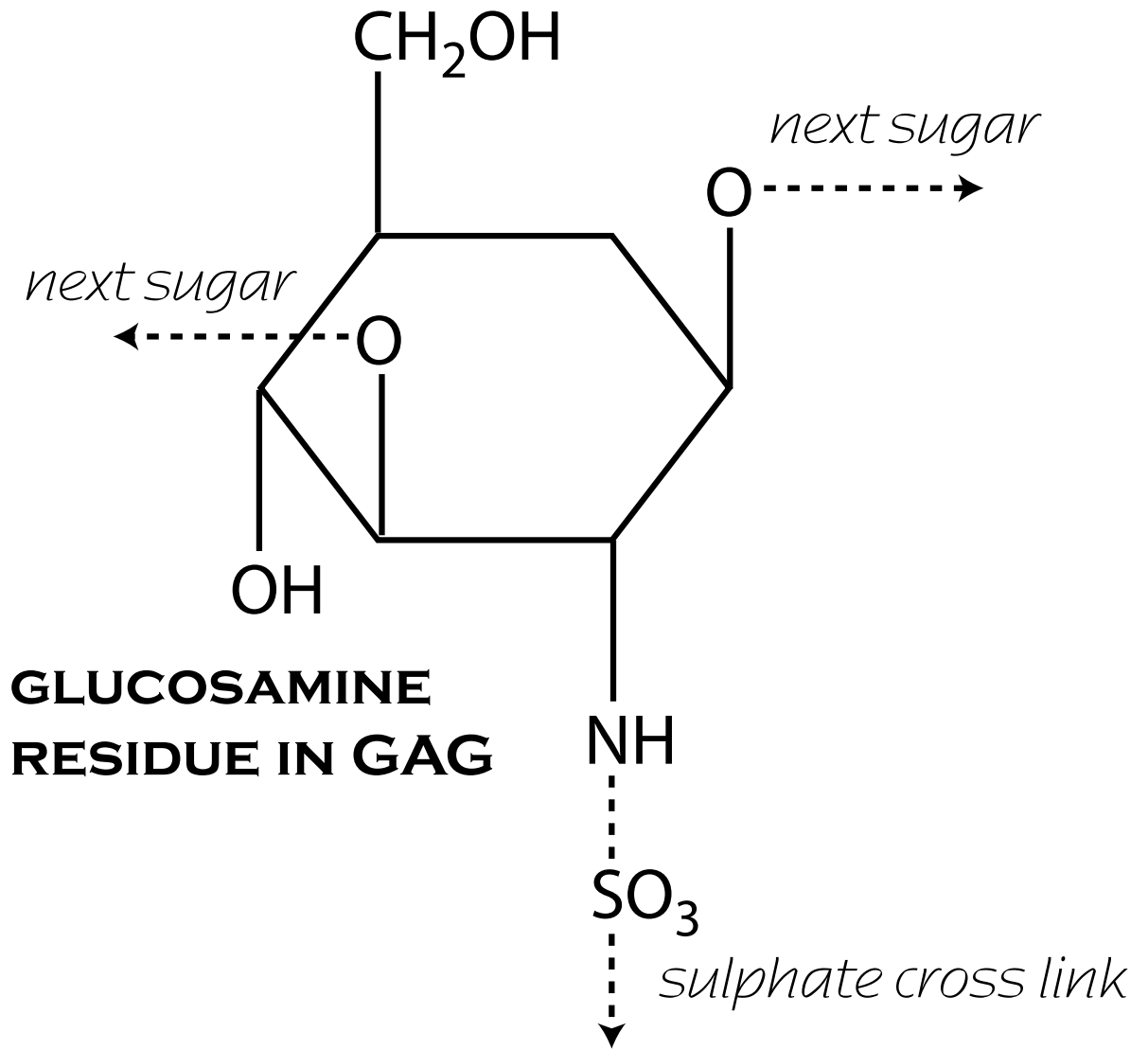
# anti-arthritis drugs

- **glycosaminoglycans**
  - chondroitin
  - hyaluronic acid
  - pentosan
  - (heparin)
- **glucosamine**
- **green mussel extract**
- **antioxidants**





**GLUCOSAMINE**



# mechanisms???

- mechanical effect
- stops proteoglycan breakdown
- increases proteoglycan synthesis
- block PG production
- block several cytokines' production
  - fibroblast growth factor
- anticoagulant



# indications

- **horses & dogs**
  - mild osteoarthritis
  - degenerative joint disease?
  - limit growth of tumours?
    - fibroblast growth factor?



# administration

- intra-articular
- im
- po?



# contra-indications

- infection
- clotting defects / bleeding
- liver or kidney disease





# side effects

- local reaction
- infection
- clotting problems
- hypersensitivity
- impoverish owner



# antioxidants

- mop up free radicals
- prevent membrane damage
- endogenous systems overloaded
  - superoxide dismutase
  - catalase
  - glutathione peroxidase



# antioxidants

- vitamin E
- glutathione
- herbal medicines??



# fatty acids

- n-3 fatty acids produce PGE3
- mild anti-inflammatory effect
- no known side effects
- “natural” (in fish anyway)



# odds & ends

- copper
- DMSO
- gold
- penicillamine
- chloroquine
- quinine
- sulphasalazine
- antihistamines



# dimethylsulphoxide

- solvent for both hydrophobic and hydrophilic drugs
- anti-inflammatory & antimicrobial
- carries other drugs across skin



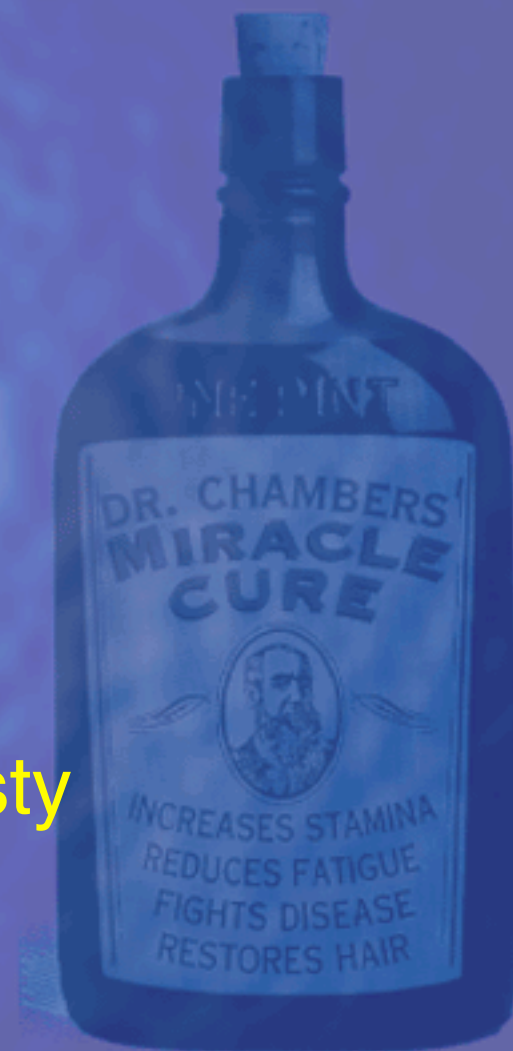
# new drugs

- **interleukin antagonists**
- **tumour necrosis factor**
  - antagonists
  - antibodies - infliximab
  - PDE4 inhibitors - thalidomide?
- **transcription factor regulators**
  - mitogen activated protein kinase inhibitors



# arthritis

- treat cause if possible
- relieve discomfort
  - rest
  - diet
  - drugs
  - (joint replacement)
  - arthrodesis / excision arthroplasty
  - euthanasia





# drugs in arthritis

- NSAIDs
- PSGAGs
- corticosteroids





# problems?

- tissue damage
- inflammation
- pain
- loss of function



# treatment

- gentle exercise
- NSAIDs



# anti-inflammatory drugs

- steroids are the most potent anti-inflammatory drugs
- NSAIDs are useful for both acute and chronic inflammation, but gastric ulceration limits duration of use
- mucopolysaccharides are sometimes used for arthritis in horses and dogs
- many drugs have some anti-inflammatory effect

