Chemistry in everyday life..

Role of chemistry in 3 major areas →
① Medicine
② Chemical in food
③ Cleansing agent

Drug and their Classification →

Drug → Chemical of low molecular mass (100u - 500u) which interact with macromolecule and produce biological response

Medicine → Biological response is theraputic + useful.

potential poison → Overdose/high dose of medicine.

Chemotherapy → Use of chemical for theraputic effect.

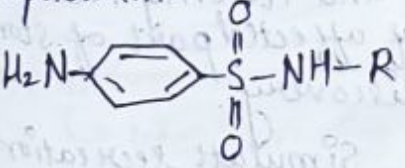
Classification of Drug

① Based on pharmacological effect →
- for Doctors, as it provide whole range of drug for treatment of particular problem.

analgestics — pain killing effect
antiseptics — kill/stop micro-organism growth

② Based on drug action →
action of drug on particular biochemical process
eg- all antihistamine inhibits action of histamine → inflammation

③ Based on Chemical structure →
drugs having common str. have similar pharmacological activity
eg- Sulphonamides



④ Based on molecular target →
drug interact with biomolecule (Carbohydro, protein, nucleic acid)
They are target molecule — drug target

Drug target Interaction →

Enzyme — protein that perform role of biological catalyst in body

Receptor — protein which are crucial to communication system. Carrier protein carry polar molecules across cell membrane

Structural part of cell membrane → Lipid and carbohydrate.

Nucleic acids → genetic information of cell.

Enzyme as Drug Target →

① Catalytic action of enzyme.
② Drug enzyme interaction

Catalytic action of Enzyme (2 functions)

1st function → hold substrate for chemical rx.n
active/binding site of enzyme holds the substrate
Substrate binds to active site of enzyme by ionic bond/H-bond/Vanderwaal/dipole-dipole interaction

2nd function → provide functional grp. that will attack substrate and carry chemical rx.n

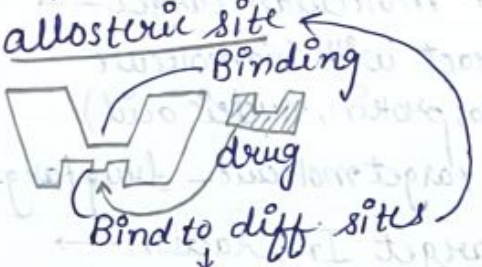
Drug enzyme interaction →

- Drug blocks the binding site of enzyme and prevent binding of substrate and inhibit catalytic activity of enzyme. These are enzyme inhibitors.

2 ways of inhibition of substrate →

① Competitive Inhibitors →

② allosteric site



due to this shape of active site change and substrate can't bind.

If bond b/w inhibitor and enzyme is strong covalent bond, and can't be broken easily, then enzyme is blocked permanently.

Body then degrades enzyme-inhibitor complex and synthesize new enzyme

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Receptor as drug Target →

Receptors → protein – Body's communication system

embedded in cell membrane.

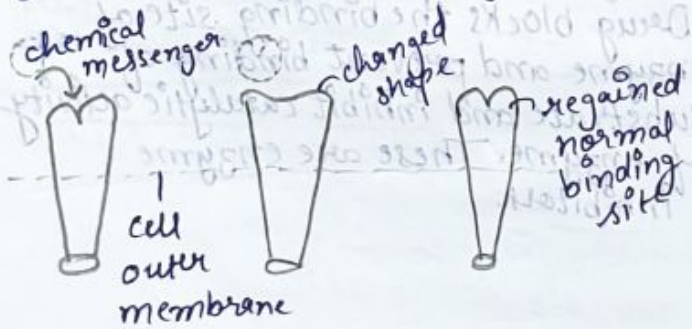
active site of receptor projects out of surface of membrane.

chemical messenger – message b/w 2 neurons / neuron to muscles is communicated by certain chemicals, chemical messenger.

Chemical messenger are received at binding site of receptor

→ To accomodate messenger, shape of receptor active site change due to which transfer of message is done into cell.

→ chemical messenger give message to cell without entering the cell



Agonist → Drug which supports communication process, by switching on Receptor

Antagonist → drugs which bind to receptor side and inhibits the communication process

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Theraputic action of different class of drug → ⋆ Vimp

① Antaacid

② Antihistamine

③ neurologically active drug ⋆

Traquilizers, Analgensics (non narcotic, narcotic)

④ Antimicrobials

antibiotic, antiseptic and disinfectant

⑤ Antifertility drugs

Antaacid →

Over production of acid in stomach causes irritation and pain

severe cases – ulcers

Treatment → Antaacids

① Sodium Hydrogen Carbonate

$NaHCO_3$ → XX

excess use of $NaHCO_3$ makes stomach alkaline and trigger production of ever more acid.

② Mix of $Al(OH)_3$ + $Mg(OH)_2$

Better alternative, insoluble and hence don't ↑ pH above neutrality.

→ These anta-acids can only control symptom and not cause.

Hence, patient not treated well

→ Ulcers in advanced stages is life threatning and it's only treatment is removal of affected part of stomach

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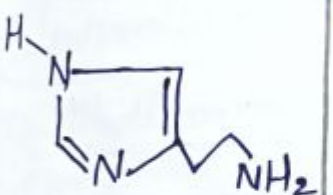
→ Later – discovery.

→ Chemical Histamine – Simulate secreation of pepsin and HCl in stomach

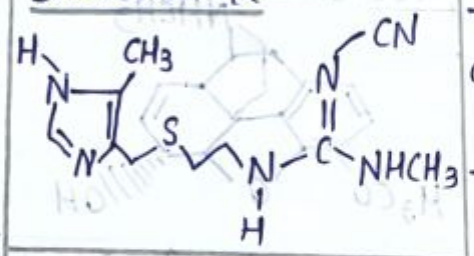
drug → Cimatide, Tegament, world's largest selling drug, until other drug came – Ranitidine (Zantac). ★

prevent interaction of histamine with receptors present in stomach wall.

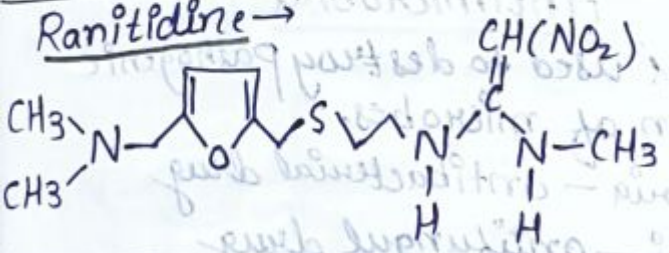
Histamine →



cimetidine →



Ranitidine →



Antihistamine →

Histamine – potent vasodilator ↓ drug that widens blood vessels, used to treat high pressure.

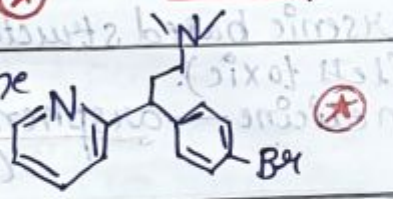
– Contains smooth muscles in bronchi and gut and relaxes other muscles present in walls of fine blood vessels.

– nasal congestion

antihistamine – Brompheniramine (Dimetapp)

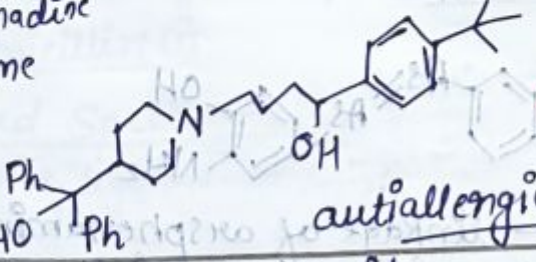
Terfindine (selane) ★

Brompheniramine
Dimetapp
Dimetane



★

Terefinadine
Seladane



★ antiallergic

Que), anti allergic, and antiacids

antihistamine
↳ Work on diff. receptors.

Neurological active drugs →

These affect message transfer mechanism from nerve to receptor

a) Tranquilizers →

– Chemical used for treatment of stress/anxiety, mild/severe mental disease.

– Relieves anxiety, stress, irritability, over excitement by inducing sense of well being

– These are essential component of sleeping pills

Noradrenaline – neurotransmitter ↓ role in mood change

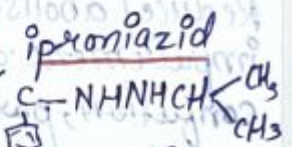
↓ low level.

signal sending activity becomes low, ↳ depression

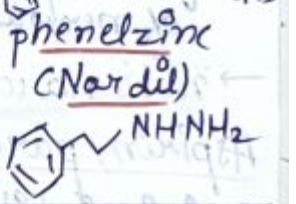
antidepressent drugs required

↓ inhibit enzyme which catalysis degradation of noradrenaline

★ iproniazid

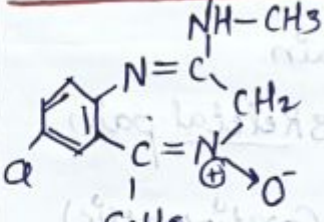


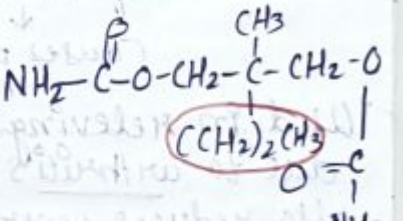
phenelzine (Nardil)



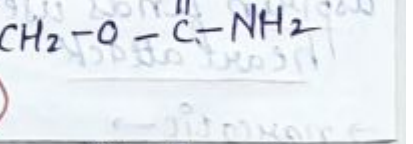
Mild tranquilizer → Relieve tension

chlordiazepoxide, meprobamate





equanil – used in controlling depression and hypertension ★



Derivative of barbituric acids (barbiturate) are imp class of tranquilizer. — hypnotic (sleep producing)

Veronal, aroytal, nembutal, luminal, Seconal, Valium, Serotonin.

Tranquilizer-Tricks →

Equal - Equanil
Sharing - Serotonin
Vali - Valium
Madam - meprobamate
In - iproniazid
Second Year - secronal
Very - Varonal
Low - luminal
number - nembutal
dia - Chlordiazepoxide
attempted - amytal
phenyl - phenelzine

Analgesics (pain Killer) →

Reduce/abolish pain with causing impairment of consciousness, mental confusion, paralysis, other disturbances of nervous system

→ non-narcotic (non-addictive) →

Aspirin, paracetamol ⊛

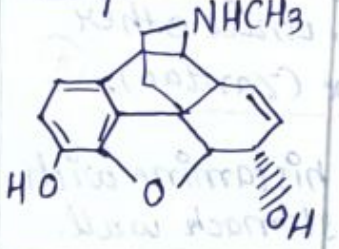
Aspirin inhibit synthesis of prostaglandin
↳ inflamate tissues
↓
Causes pain

- Used in releving skeletal pain due to arthritis
- also reduces fever (antipyretic)
- prevent platelets coagulation
- due to antiblood clotting action aspirin finds use in prevention of heart attack

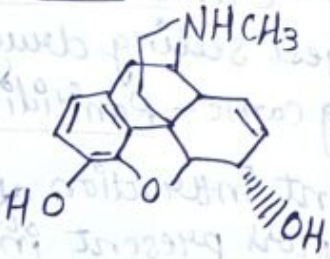
→ narcotic →

- used in relief of post operative pain, cardiac pain, pain of terminal cancer, in child birth.
- Morphine, Heroine, Codein ⊛
  ↳ Opiates (opium poppy)
- In poisonous doses these produce stupor, Coma, convusion → Death!!

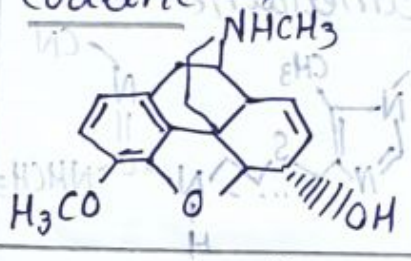
morphine →



Heroine →



Codeine →



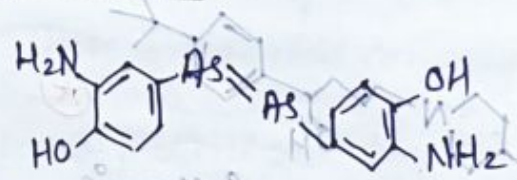
Antimicrobial

Drugs used to destroy pathogenic action of microbes.
Bacteria - antibacterial drug
Fungi - antifungal drug
Virus - antiviral drug
Parasite - antiparasitic drug
→ Antibiotics, antiseptics, disinfectant are antimicrobial drugs.

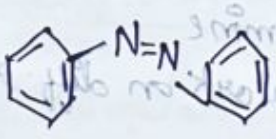
Antibiotic → treat infection

Substance in low conc. inhibit growth of micro-organism.
Syphilis disease → spirochet bacteria
↓
Treatment →
arsenic based structures taken. (less toxic).
medicine - arsphenamine (Salversan)

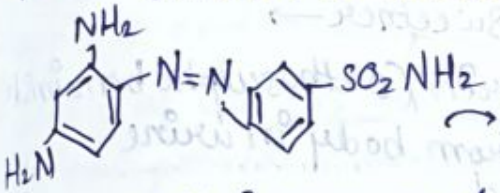
Salvarsan →



As = As - linkage of arsphenamine resembles with -N=N- linkage of azodyes -



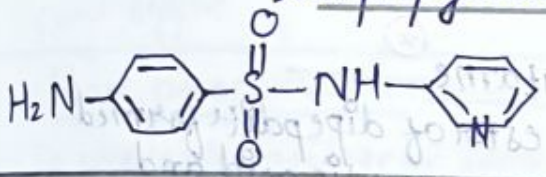
-more effect antibacterial agent (prontosil) was discovered similar to Salvarsan.



→ prontosil is converted to sulphanilamide → real active compound

SO_2NH_2 discovery of sulpha drug took place.

effective sulph drug is sulphpyridine.



antibiotic effect

Cidal effect (Kill)	Static effect (inhibitory)
Bactericidal	Bacteriostatic
Penicillin	Erythromycin
Aminoglycoside	Tetracyclin
Oflaxcin	Chloramphenicol.

Broad Spectrum Antibiotic → Kill/inhibit wide range of (+ve) and (-ve) gram bacteria. Ampicillin, amoxycillin } synthetic modification of penicillin.

Narrow Spectrum Antibiotic → effect against gram (+)/(−) bacteria.

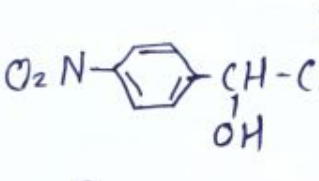
Penicillin G

Limited Spectrum Antibiotic → effective against a single organism or disease.

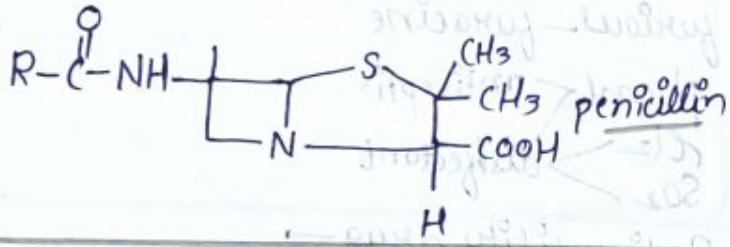
Chloramphenicol → Rapidly absorbed from gastrointestinal tract. and hence given orally in typhoid, dysentary, acute fever, urinary infection, meningitis, pneumonia.

- Ofloxacin, Vancomycin.

Trick – OCHVA



Chloramphenicol.



penicillin

Antiseptic → applied to living tissue. wounds, cute, ulcer, skin surface.

eg - Fiviacine, Soframicine, Dettol → chloroxylenol, Terpinol

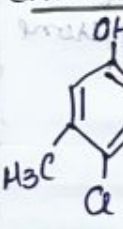
→ Bithional is added to soap for antiseptic property.

→ Iodine is an antiseptic (2-3% of iodine in alcohol water mixture – tincture of Iodine).

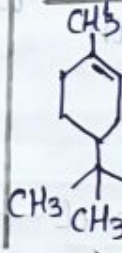
→ Iodoform (CHI_3) – antiseptic in wounds.

→ Boric acid (H_3BO_3) in water is weak antiseptic for eyes.

Chloroxylenol

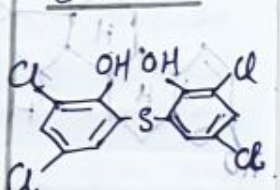


Terpinol



Dettol.

Bithional →



Disinfectant → applied to inanimate object (floor, tools, drainage ....)

✓ Same substance can be used as antiseptic as well as disinfectant.
└ by varying concentration

0.2% phenol – antiseptic
1% phenol – disinfectant

Cl_2 → 0.2 – 0.4 ppm in Sol.ⁿ → Disinfectant
SO_2 ↓↓ conc.

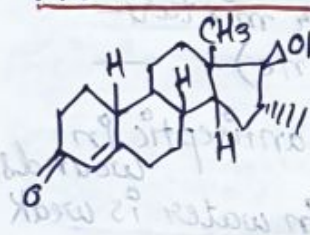
Trick →

Saaf – Sofamicine
Baat – Bithional
InKi – I_2
Daant – Dettol
Bhot – Boric acid
furious – furacine

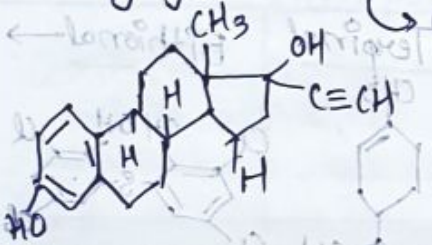
phenol ← antiseptic
Cl_2 → disinfectant
SO_2 → disinfectant

Antifertility drug →

- Birth Control pill → mixture
  - synthetic estrogen derivative
  - synthetic progesterone derivative
- progesterone suppress Ovulation
- Synthetic progesterone – more potent
- Norethindrone – widely used as antifertility drug.



- ethynylestradiol (mestranol) → estrogen derivate used with progesterone



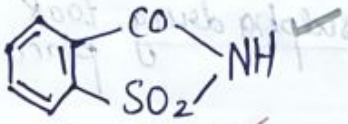
Chemical in food →

1. Food Colour
2. Flavour and sweetner
3. Fat emulsifier and stablizer
4. Flour improver – antistaling agent and bleaches
5. antioxidant
6. preservative
7. nutritional supplement (mineral, vitamin, amino acid)

Artificial sweetening agent →

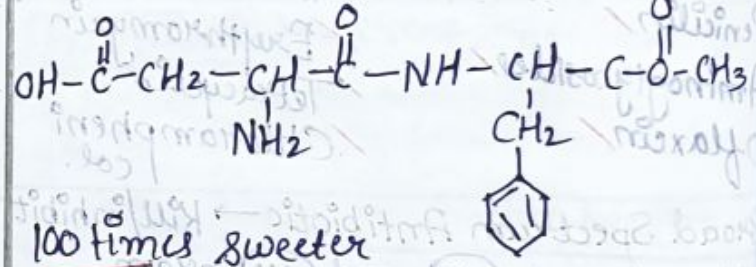
natural sweetner – Sucrose – Caloric
artificial sweetner →

① Saccharin (orthosulpho benzimide)
- excreted from body in urine unchanged
- entirely inert and harmless.
- Diabetic can eat.



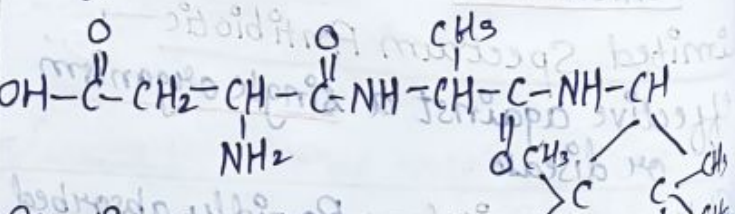
550 times sweeter than cane sugar

② Aspartame
- methyl ester of dipeptide formed from from aspartic acid and phenylalanine.
- Used in cold food, soft drink.
- Unstable at cooking temp.



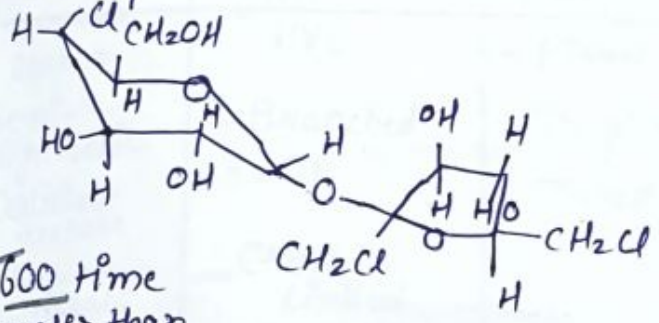
100 times sweeter than cane sugar

③ Alitame
High potency sweetner.
More stable than aspartame
Control of sweetner of food is difficult



200 times more sweeter than cane sugar

④ Sucralose → Sucrose + Chlorine
- Trichloro derivative of chlorine.
- appears and taste like sugar.
- Stable at cooking temp.
- do not provide calorie.



↳ 600 time sweeter than cane sugar

Food preservative —
- To prevent spoilage of food, due to microbial growth.
eg- Table salt, sugar, Vegetable oil, Sodium Benzoate, Salt of Sorbic and propanoic acid.

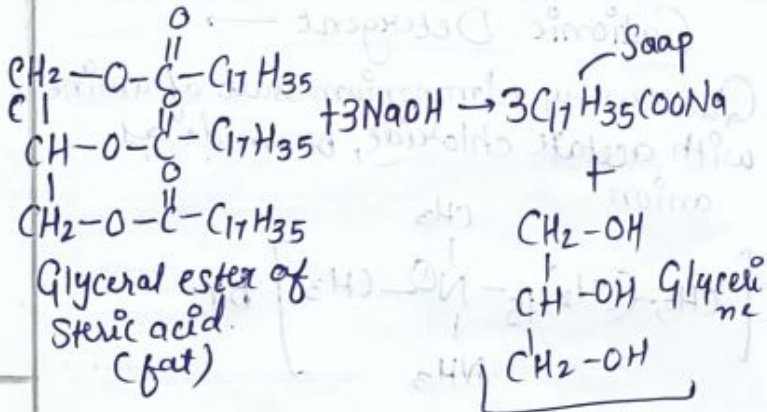
Antioxidant — food preservation by retarding action of oxygen on food.
eg- BHT (Butylated Hydroxy Toulene)
BHA (——11—— Anisole)
→ Addition of BHA to butter ↑ Its Shelf life from months to Yrs.
→ BHT and BHA + Citric acid
↳ to produce more effect.

Sulphur dioxide, Sulphite are useful antioxident for wine and beer, sugar syrup, dried vegetable and fruit.

← **Cleansing Agent** →
Detergent
Soap | Synthetic detergent
Helps in improving cleansing property of H_2O
Remove fats which binds other material, to fabric / skin

Soap → Sodium / potassium salt of long chain fatty acid.
eg- Stearic, Oleic and palmitic acid

Saponification — Heating fat (Glyceral ester of fatty / Stearic acid) with NaOH

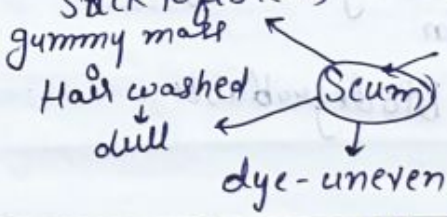


Glyceral is seperated from spentlye by reduced pressure distillation

- pottasium soaps are soft to skin than sodium soap.

- Soap → Hardwater XX
Hardwater — Ca^{+2} / Mg^{+2} ion

$2C_{17}H_{15}COONa + CaCl_2 \rightarrow NaCl + C[C_{17}H_{35}(COO)_2Ca$



Shaving soap → rosin gum added called Sodium rosinate
↳ lather produce

Synthetic Detergents →

① Anionic → ASSSA
anionic detergents are sodium salts of sulphonated alcohol / hydrocarbon

long chain alcohol + H_2SO_4 → Alkyl hydrogen Sulphate $\xrightarrow{NaOH}$ anionic detergent

$CH_3(CH_2)_{10}CH_2OH + H_2SO_4 \rightarrow CH_3(CH_2)_{10}CH_2OSO_3H \xrightarrow{NaOH} CH_3(CH_2)_{10}CH_2OSO_3^-Na^+$

lauryl alcohol — lauryl hydrogen sulphate — Sodium lauryl sulphate (Anionic detergent) SLS

alkyl Benze + H_2SO_4 → alkyl bene sulphonic acid → NaOH → Alkyl Benzene sulphonate

Cationic Detergent →

Quaternary Ammonium salt of amine with acetate chloride, bromide as anion

$$\left[CH_3-(CH_2)_{15}-\overset{\overset{CH_3}{|}}{\underset{\underset{NH_3}{|}}{N^{\oplus}}}-CH_3\right] Br^-$$

CTMAB — Cetyl trimethyl ammonium Bromide.

(used in hair conditioner

Non-ionic Detergent →

Steraic acid + polyethyl glycol → polyethylene glycol sterate.

- liq. dishwashing detergent.
- remove oil, greese, by missl formation

non-biodegradable.