Contact Dermatitis
Definitions

- **Contact Dermatitis**
  - Reactions due to contact of an agent with the skin
  - Inflammation of the skin with spongiosis or intercellular edema
  - Results from interaction of chemical & skin
- **Nonimmunologic vs. Immunologic**
- **Many chemicals may act as both irritants and allergens**
- **Irritant Contact Dermatitis (ICD)**
  - 80% of contact dermatitis
- **Allergic Contact Dermatitis (ACD)**
  - 20% of contact dermatitis
Definitions

- Irritant Contact Dermatitis
  - Nonimmunologic/nonspecific
  - Variation in susceptibility
  - Most irritants produce delayed or cumulative rxns
  - Some rxns may be **necrotic** or **ulcerative**
  - An irritant is a substance that causes direct damage to skin without sensitization
Definitions

- Allergic Contact Dermatitis
  - Immunologic
  - Requires *sensitization* and occurs only in genetically determined subset of population
  - Classic delayed hypersensitivity (Type IV)
  - Mediated by immune cells rather than Abs
  - Occurs in 2 phases
    - Sensitization
    - Elicitation
Clinical Presentation

- May be difficult to distinguish between ICD and ACD, especially late
- Potent irritants may cause severe necrosis and “chemical burns” with ulceration
- Strong irritants—burning, stinging, vesicles
- Irritants and allergens may produce an acute, subacute, or chronic eczematous presentation
- Presentation relates to:
  - Chemical
  - Individual
  - Exposure
  - Environment
Immunology--Hypersensitivities

- Type I
  - Anaphylactic
- Type II
  - Cytotoxic
- Type III
  - Immune complex
- Type IV
  - Delayed hypersensitivity
  - T-cells
Immunology

- T-cells predominate in ACD and ICD (and most inflammatory dzs)
- **CD4 cells**
  - Th1
    - IL-2, IFN-γ, TNF-β
    - Mediate delayed hypersensitivity
    - IFN-γ inhibits Th2 activation
  - Th2
    - IL-4, IL-5, IL-6, IL-10
    - Help B cells produce antibodies
- **CD8 cells**
  - Suppressor/cytotoxic cells
Immunology

- **ACD**
  - Inflammatory cascade induced by exposure to an antigen capable of reacting with sensitized T-cells

- **ICD**
  - Inflammatory cascade induced by exposure to a chemical irritant or toxin capable of damaging keratinocytes, endothelium, or s. corneum

- **End result---inflammation**
  - Redness
  - Swelling
  - Heat
  - Pain
ICD Pathophysiology

- ICD
  - Irritant is a substance that causes direct damage to skin without prior sensitization
  - Membrane damage $\rightarrow$ phospholipase activation $\rightarrow$ release of arachidonic acid $\rightarrow$ synthesis of eicosanoids
  - Second messenger systems activated
  - T-cells are activated by IL-1, GMCSF, and eicosanoids
  - Eicosanoids also lead to vasodilation, increased vascular permeability directly and indirectly through mast cell activation
ACD Pathophysiology

- **Sensitization**
  - Allergens are usually: low molecular weight, highly reactive, and lipid soluble
  - Unprocessed allergen is a hapten
  - Hapten penetrates epidermis and taken up by Langerhans’ cells by pinocytosis
  - Hapten chemically altered in cell via lysosomal or cytosolic enzymes
  - Hapten conjugated to HLA-DR-->this complex expressed on Langerhans’ cell surface
ACD Pathophysiology

- **Sensitization**
  - Langerhans’ cells (LC) exposed to allergens --> keratinocytes secrete cytokines --> activates Langerhans’ cells --> **stimulates T cells**
  - Antigen presented to **CD4** (maybe also CD8) T cells via the **T-cell receptor-CD3 complex**
  - Presence or absence of certain T cell subsets is **genetically predetermined**
  - LCs migrate to lymph nodes > interaction with CD4 cells
  - LCs secrete **IL-1** --> stimulates T cells to secrete **IL-2** and express **IL-2 receptors** --> T cell proliferation of cells capable of responding to the antigen
  - NOW you’re sensitized!!!
ACD Pathophysiology

- Elicitation
  - Reexposure
  - LC takes up hapten and presents to primed T cell either in skin or lymph node --> activation
  - LCs secrete IL-1 --> T cells produce IL-2 and IL-2Rs --> T cell proliferation and expansion WITHIN THE SKIN!
  - T cells also secrete IFN-γ --> activates keratinocyte --> expression of ICAM-1 (WBC interaction) and HLA-DR and production of IL-1, IL-6, and GMCSF
ACD Pathophysiology

- Elicitation
  - Cytokines and eicosanoids are produced --> activation of mast cells and macrophages
  - All these processes lead to vascular dilation and increased permeability
  - INFLAMMATION!
ACD Pathophysiology

• Suppressor T cells may also be generated on exposure to antigen
• Balance between sensitization and suppression results in disease or no disease on reexposure
• Atopes have a decreased capacity to be sensitized to common allergens
  • Atopes mount a Th2 response to allergens
  • ACD is a Th1 response
  • Atopes more likely to develop ICD (barrier)
Clinical Features

- ACD
  - Well-demarcated pruritic eczematous eruption
  - Acute--blistering and weeping
  - Chronic--lichenified and scaly, fissured
  - Rash usually delayed by 1-2 days of exposure, maybe a week
  - Allergy may develop after years of contact
  - Distribution, distribution, distribution
Clinical Features

ACD Common Misconceptions/Pearls

- Allergy is not dose-dependent
- May not be bilateral (e.g. both hands for glove dermatitis)
- May be patchy
- May affect the palms and soles
- Most severely affected site may be different from the primary site of exposure
- Allergy not cost-dependent
- Certain sites are more susceptible to allergens--eyelids, genitals
Clinical Features

• ICD--multiple types
  • Acute ICD
  • Acute Delayed ICD
  • Irritant Reaction ICD
  • Cumulative ICD
  • Asteatotic Dermatitis
  • Traumatic ICD
  • Pustular and Acneiform ICD
  • Non-erythematous ICD
  • Subjective or Sensory ICD
  • Airborne ICD
  • Frictional ICD
Clinical Features

- Acute ICD
  - Burning, stinging, soreness
  - Erythema
  - Edema
  - Bullae
  - Possibly Necrosis
  - Usually due to potent irritants--acids, alkalis
Patch Testing

- Should be done more often
- All patients should be tested to a standard series
- T.R.U.E. test system--antigens dispensed in polymer base
  - 23 or 24 antigens
- Finn Chamber System--small syringes and dropper bottles attached with Scanpor tape
  - 20 antigens
What does T.R.U.E. Test stand for?

- Thin-layer Rapid Use Epicutaneous Test
Finn Chamber
Finn Chamber/Scanpor® Tape
Patch Testing

- Don’t patch test when dermatitis is acute/severe
- Don’t test if on systemic steroids or at least 1 week after d/c
- Remove patch test in 2 days and read and then read again 3-7 days after initial application
- May not shower or bathe, keep back dry
- Shave hairy backs--day of application
- Don’t do patch testing on patients with immediate, urticarial type of disease
### Table 15.2 International Grading System for patch tests.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+/-</td>
<td>Doubtful reaction, faint macular erythema</td>
</tr>
<tr>
<td>+</td>
<td>Weak, non-vesicular reaction with erythema, infiltration and papules</td>
</tr>
<tr>
<td>++</td>
<td>Strong, vesicular reaction with erythema, infiltration and papules</td>
</tr>
<tr>
<td>+++</td>
<td>Spreading bullous reaction</td>
</tr>
<tr>
<td>-</td>
<td>Negative reaction</td>
</tr>
<tr>
<td>IR</td>
<td>Irritant reaction</td>
</tr>
</tbody>
</table>

Irritants

- Acids
  - Epidermal damage via protein denaturation and cytotoxicity
  - Hydrofluoric acid and sulfuric acid cause most severe burns
  - Erythema, vesication, and necrosis

- Alkalis
  - Often cause more severe and painful reactions
  - Degrade lipids
  - Saponification of fatty acids results in deeper penetration of alkalis

- Metal salts

- Solvents
Irritants

- Alcohols
- Detergents and Cleansers
- Disinfectants
- Plastics
- Food
- Water (the universal solvent)
- Fabric/man-made vitreous fibers
- Plants
Contact Urticaria

- Pruritus wheal and flare
- Develops within 60 minutes of exposure, resolves 24 hrs
- Protein content of latex rubber is responsible
- Occurs more often in atopes, spina bifida patients or those who have undergone multiple surgeries/catheterizations
Diagnosis/Causative Agent?
Diagnosis/Causative Agent?
Chloracne

- Open and closed comedones
- Uninflamed nodules and cysts
- Exposure to halogenated polycyclic hydrocarbons such as polychlorinated dibenzodioxins (PCDDs)--fungicides, insecticides, herbicides, and wood preservatives
- Classically Agent Orange
- 2,3,7,8-tetrachlorodibenzo-p-dioxin
Name/Allergen?
Poison Ivy

- Urushiol (Oleoresin)
- Family Anacardiaceae
  - Poison Ivy/Oak/Sumac
  - Mango peel
  - Cashew nut shells
  - Rengas tree
  - Indian marking tree nut
  - Brazilian pepper tree
  - Japanese lacquer tree
  - Ginkgo biloba tree (not Anacardiaceae)
Poison Ivy

- Family **Anacardiaceae**
- Genus **Toxicodendron** -- poison ivy/oak/sumac
- *Toxicodendron radicans* -- Common or Eastern Poison Ivy
- Historically called **Rhus dermatitis**
- *Rhus* is the largest genus in the family Anacardiaceae but doesn’t contain the allergeneic plants
- Allergeneic plants--> *Toxicodendron*
Poison Ivy

- Urushiol self-melanizes on exposure to oxygen
- "Black-spot test" -- crush plant between folds of white paper
  - Urushiol turns dark brown in 10 minutes and black by 24 hours
  - Urushiol is self-melanizing on exposure to oxygen
Poison Ivy
Name/Allergen?
Poison Sumac/Urushiol
Name/Allergen?
Poison Oak/Urushiol
Name?
Stinging Nettle (*Urtica dioica*)

- Toxin-mediated (non-immunologic) contact urticaria
- Sharp hairs (*trichromes*) contain **histamine**, **serotonin**, and **acetylcholine**
Name?
Mechanical Irritant Dermatitis

- Small spines—Glochids—act like little fish hooks embedded in skin
- Prickly pear (Opuntia spp.) common cause
- **Sabra dermatitis**
  - Names for dermatitis developed by harvesters of the Sabra fig (Indian fig)
- Side effect of mechanical irritant dermatitis—inculcation of organisms
Mechanical Irritant Dermatitis

- *M. kansasii*
- Blackberries
- *Sporothrix schenckii*
- Rose thorns, sphagnum moss, grasses
- *M. marinum*
- Cactus spines
- *M. ulcerans*
- Spiky tropical vegetation
- *S. aureus* and *C. tetani*
- Spines and thorns
Name/Diagnosis?
Chemical Irritant Dermatitis

- **Calcium oxalate**--*Dieffenbachia picta* (Araceae)--Dumb cane
- Bulb dermatitis--daffodils contain calcium oxalate
- Hunan Hand Syndrome?
- Capsaicin
- Buttercups?
- Ranunculin
- Spurges (euphorbiaceae) contain irritant phorbol esters in latex
This leads to?
This leads to?
This leads to?
And this?
Phytophotodermatitis

- Phototoxic reaction
- Erythema (with or without blistering)
- Delayed hyperpigmentation
- Non-immunologic/Phototoxic
- UVA light + topical or oral contact with photosensitizer -- furocoumarins (psoralens)
- Limes, celery, rue most common causes
Phytophotodermatitis

- Plants of family **Apiaceae** (formerly **Umbelliferae**) most common cause
  - Hogweed -- *Heracleum sphondylium*
  - False Bishop’s weed
  - Angelica/Wild Angelica
  - Cow parsley
  - Wild chervil
  - Celery
  - Fennel
  - Parsnip
  - Cow parsnip
  - Parsley
Phytophotodermatitis

- **Rutaceae**
  - Limes
  - Orange
  - Lemon
  - Grapefruit
  - Gas plant/Burning Bush
  - Rue
  - Blister plant
- **Moraceae -- mulberry**
- **Fabaceae (Leguminosae)**
- **St. John’s Wort**
Phytophotodermatitis

- Berlock dermatitis -- **bergamot oil** (perfumes or tan promoters)
- **Strimmer™** dermatitis
  - Red, irregular macules and papules -- like buckshot on chest
  - Hogweed (*Heracleum sphondylium*)
  - Giant Hogweed (*Heracleum mantegazzianum*)
  - Cow parsley (*Anthriscus sylvestris*)
Name/Antigen?

Hint: It’s a Dahlia
Name/Antigen?
Name/Antigen?
Asteraceae (Compositae)

- **Sesquiterpene lactone**
- Over 200 allergenic members of Asteraceae
- Daisy
- Chrysanthemum
- Artichoke
- Feverfew
- Liverwort
- Dandelion
- Sunflower
- Chicory
- Lettuce
- *Parthenium hysterophorus* -- “Scourge of India”
Name/Antigen?
Alstroemeria spp.

- Peruvian lily
- **Tuliposide A** -- a glycoside
- Acid hydrolysis converts to **tulipalin A** -- the allergen
- Allergen passes through vinyl gloves
Name/Antigen?
Garlic/Radish

- Diallyl disulfide
- Alliaceae family
- Irritant and allergen
Primrose

Allergen -- Primin
Croton Plant (Spurge Family)

- Irritant
  - Phorbol esters
Castor Bean

- Allergen
- Ricin
- Clinical
- Anaphylaxis
Sesame Oil

- Allergen
  - Sesamine
What commonly prescribed topical medication is found in rubber?

- Hydroquinone
Mustard, radish

- Allergen
  - Allyl isothiocyanate
Lichen

- Allergen
  - D-usnic acid
  - Evenic acid
  - Atronorin
Allergen?

- Melaleuca plant
- D-limonene
Allergen?

- Mercaptobenzothiazole is present in spandex
Pine tree

- Allergen
  - Colophony
What cross-reacts with latex?

- Banana, Avocado, Chestnut, Kiwi, Passion Fruit
- **Banana, Avocado, Chestnut have highest association**
- Other foods include papaya, tomatoes, melon, potato, carrot, celery, apple, and the list goes on and on.
- Just remember BACK uP!
Colophony

- Aka rosin or abeitic acid
- Athletic grips
- Cosmetics (mascara, rouge, eye shadow)
- Chewing gum
- Pine products
- Medications (wart remover, hemorrhoid creams)
- Paper and paper products
- Printing inks
- Varnishes
- Adhesives
- Dental cements and impression pastes
- Glue tackifiers (shoes)
What?
Nickel Dermatitis

- Most common allergen
- What test might you use in clinic?
- Dimethylglyoxime test is a test for nickel content -- turns pink
- Cross-reacts with?
- *Cobalt and chromate*
Cobalt

- Combined with other metals in hard alloys
- Cobalt is sometimes synthetically combined with nickel and chromium and is also found in association with these metals in nature
- **80% of individuals who are sensitive to cobalt are sensitive to nickel or chromate or both**
- This is a cosensitivity, not a cross-sensitivity
- In men, this is usually chromate--b/c of the presence of chromate and cobalt in cement
- Sensitization to nickel or chromate (or both), with active dermatitis, predisposes to cobalt sensitivity
Allergen?
Chromate

- Potassium dichromate
- Leather
- Ceramics
- Cement
- Green tattoos
- Engraving and printing chemicals, paints and inks, wood preservatives, and photographic developing chemicals
Allergen?
Spearmint

- Carvone
- Family Lamiaceae
Allergen?
Peppermint

- Menthol
- Family Lamiaceae
Glycerol Thioglycololate

- Hairdressers and clients
- Acid permanents
Allergen in Permanent Hair Dye?

- \( p \)-Phenylenediamine (PPD)
- Also Henna tattoos
- Rubber
- Plastics
- PPD cross-reacts with?
  - Azo- and aniline dyes, ester anesthetics, PABA, sulfonamides
Henna tattoo
Allergen?
Ammonium persulfate

Often used to “boost” peroxide hair bleaches
Allergen?
Components of Fragrance Mix I

- Geraniol
- Cinnamic aldehyde (Cinnamaldehyde)
- Cinnamyl alcohol
- Hydroxycitronellal
- A-Amylcinnamaldehyde
- Isoeugenol
- Eugenol
- Oak moss
Cross-Reactions with Fragrance Mix

- Balsam of Peru
- Cassia oil
- Cinnamon
- Cloves
- Citronella candles
- Ethylene bassylate
- Tiger balm
Fragrance Mix Controversy

- Many believe that Fragrance Mix I (with 8 antigens) was missing a significant number of patients sensitive to fragrance
- Many perfumes contain 100 or more substances and the search continues for a more “appropriate” antigen panel
Fragrance Mix II

- *Hydroxyisohexyl 3-cyclohexene carboxaldehyde* (Lyral®)
- Citral
- Citronellol
- Farnesol
- Coumarin
- \( \alpha \)-hexyl-cinnamic aldehyde
Tattoo Pigments

- Chromium
- Green
- Mercury or Cinnabar
- Red
- Cobalt
- Blue
- Cadmium
- Yellow
- Iron oxide
- Brown
Tattoo Pigments

- Zinc oxide
- White
- Carbon
- Blue-Black
- Gold
- Lilac
- Manganese
- Purple
- Ferric hydrate
- Ochre
What is the allergen in vaccines (e.g. hepatitis), contact lens solution, antitoxins, liquid soap?
• **Thimerosal**

• **Piroxicam** cross-reactivity (photosensitivity)

• **Mercury** cross-reactivity due to mercurial component, previously thought to be due to the thiosalicylate portion.
Allergen?
Ethyl Cyanoacrylate
What is the other name for Euxyl K 400?
• **Methyldibromoglutaronitrile = Euxyl K 400**
  • Preservative found in many creams, cosmetics, shampoos, lotions, etc.
  • Other names
    • Merquat 2200
    • Tektamer 38
What is the other name for Euxyl K100?

- **Euxyl K100 = Kathon CG = Methylchloroisothiazolinone**
Allergen and Common Location of Dermatitis?
Nail Polish

- **Tosylamide/formaldehyde resin**
- Formerly known as toluenesulfonamide/formaldehyde resin
- **Eyelid dermatitis** is common
- Also on face and neck and periungually
Most common sensitizing topical antibiotic?

- Neomycin
- Neomycin and bacitracin sensitivity frequently occur concurrently in the same patient.
Which allergen, found in rubber, becomes antigenic when washed in bleach?

- Zinc dibenzylthiocarbamate
Corticosteroids

- Cross-reactivity occurs within a group but may occur among groups especially between B and D
- 3 good screening panels
  - Tixocortol pivalate -- A (most HCs)
  - Budesonide -- B (TAC) {and D}
  - Hydrocortisone-17-butyrate -- D (Clobetasol)
Table 15.6 Corticosteroid classes and patch test concentrations. *Available without prescription in the US. †Suggested screening agents. In petrolatum unless stated otherwise. Eth, Ethanol; Pet, petrolatum; parentheses contain other, suggested concentrations or vehicles.

<table>
<thead>
<tr>
<th>CORTICOSTEROID CLASSES AND PATCH TEST CONCENTRATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drug</strong></td>
</tr>
<tr>
<td><strong>Class A: Hydrocortisone and tixocortol type</strong></td>
</tr>
<tr>
<td>Cortisone</td>
</tr>
<tr>
<td>Cortisone acetate</td>
</tr>
<tr>
<td>Hydrocortisone*†</td>
</tr>
<tr>
<td>Hydrocortisone acetate*</td>
</tr>
<tr>
<td>Methylprednisolone</td>
</tr>
<tr>
<td>Methylprednisolone acetate</td>
</tr>
<tr>
<td>Prednisolone</td>
</tr>
<tr>
<td>Prednisolone acetate</td>
</tr>
<tr>
<td>Tixocortol pivalate†</td>
</tr>
<tr>
<td><strong>Class B: Triamcinolone acetonide type</strong></td>
</tr>
<tr>
<td>Triamcinolone acetonide†</td>
</tr>
<tr>
<td>Triamcinolone alcohol</td>
</tr>
<tr>
<td>Halcinonide</td>
</tr>
<tr>
<td>Flucinonide</td>
</tr>
<tr>
<td>Flucinolone acetonide†</td>
</tr>
<tr>
<td>Desonide</td>
</tr>
<tr>
<td>Budesonide†</td>
</tr>
<tr>
<td>Aminiconide</td>
</tr>
<tr>
<td><strong>Class C: Betamethasone type</strong></td>
</tr>
<tr>
<td>Betamethasone</td>
</tr>
<tr>
<td>Betamethasone-disodium phosphate</td>
</tr>
<tr>
<td>Dexamethasone</td>
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<tr>
<td>Dexamethasone-disodium phosphate</td>
</tr>
<tr>
<td>Fluocortolone</td>
</tr>
<tr>
<td><strong>Class D: Hydrocortisone-17-butyrate and clobetasone-17-butyrate type</strong></td>
</tr>
<tr>
<td>Hydrocortisone butyrate†</td>
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<tr>
<td>Hydrocortisone valerate</td>
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<tr>
<td>Clobetasol butyrate</td>
</tr>
<tr>
<td>Clobetasol propionate</td>
</tr>
<tr>
<td>Betamethasone valerate</td>
</tr>
<tr>
<td>Betamethasone dipropionate</td>
</tr>
<tr>
<td>Fluocortolone hexanate</td>
</tr>
<tr>
<td>Fluocortolone pivalate</td>
</tr>
<tr>
<td>Prencicarbate</td>
</tr>
</tbody>
</table>
What are the three most common causes of cosmetic ACD?

1. Fragrance
2. Preservatives
3. PPD

- Parabens are the most common preservative used in cosmetics, but don’t commonly cause ACD
Preservatives

- Parabens
- Formaldehyde
- Formaldehyde releasing (FRPs)
- Methychloroisothiazolinone
- Para-tertiary butyl phenol
- Thimerosal

- Sorbic acid
- Benzophenones
- Butylated hydroxyanisole & hydroxytoluene
- Chloroxylenol
- Phenoxyethanol
- Parachlorometacresol
- Iodine compounds
Formaldehyde Releasers

- **Quaternium-15=Dowisil 200**
  - Acts against yeast, molds, bacteria, and pseudomonas
  - *Most common cause of preservative induced ACD*
  - Shampoos, hair conditioners, make-up, moisturizing lotions, liquid soaps bath gels, sunscreens, shaving products, mascara
- **Imidazolidinyl urea**
  - Antibacterial
  - *Safe for use in formaldehyde sensitive pts*
- **Diazolidinyl urea**
  - Antibacterial
  - More potent sensitizer than imidazolidinyl
- **Bronopol**
  - Broad spectrum
  - Degraded to formaldehyde over time
- **Dimethyloldimethyl (DMDM) hydantoin**
  - Highly water soluble
  - Cross reacts with formaldehyde sensitive pts
  - Shampoos and skin moisturizers
- **MDM hydantoin**
- **Hydantoin**
- **Glutaraldehyde**
  - *Cold sterilizer*, embalming, X-ray film solution
  - Dental workers
Formaldehyde Releasers

- DMHP
- Formaldehyde solution
- p-Formaldehyde
- Tris (hydroxymethyl) nitromethane
- 5-bromo-5-nitro-1,3-dioxane
- 2-bromo-2-nitropropane-1,3-diol
Rubber Dermatitis

- Accelerators -- used in vulcanization (treatment to give strength, elasticity, and resistance to solvents)
  - Tetramethylthiuram disulfide
  - Mercaptobenzothiazole
  - Diphenylguanidine
  - **Mercaptobenzothiazole most common cause of shoe allergy**
  - **Thiuram most common cause of glove allergy**
Rubber Dermatitis

- **Antioxidants**
  - Used to preserve rubber
  - Phenyl-alpha-naphthylamine (amine type)
  - Hydroquinone
  - N-Isopropyl-N-phenyl-paraphenylenediamine (IPPD)
  - Propyl p-paraphenylenediamine
    - Tires
    - Heavy-duty rubber goods
    - Boots
    - Elastic underwear
Allergen?
Thiuram Mix

- Includes 4 chemicals
- In rubber, prevents degradation
- Found in latex, condoms, adhesives, pesticides, medications like Antabuse, diaphragms, repellents, fungicides
With what does ethylenediamine cross-react?
Ethylenediamine

- Aminophylline = Theophylline + ethylenediamine
- Hydroxyzine: multiple piperazine-based antihistamines
- Ethylenediamine is a stabilizer in medicated creams
- Present in generic nystatin creams
- Mycolog II cream does not have ethylenediamine
What irritant/allergen is used as a surfactant in shampoos and cosmetics?
• Cocamidopropyl betaine
• One of the most commonly used surfactants
• Contact lens solution
• Antiseptics
• Shampoos