

Boards' Fodder: Contact Dermatitis Allergens

by Alina Goldenberg, MD, MAS; Elise M. Herro, MD; and Sharon E. Jacob, MD



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| Category | Allergen (Standardized concentrations) | AOY | NACDG Rank ^a | Common Sources | Allergen TRUE Test | Clinical Pearls |
|--|---|------|-------------------------|--|--------------------|--|
| Metals | Nickel 2.5% pet. | 2008 | 1 | Jewelry, alloys, dentures, orthopedic devices, scissors, razors, eating utensils, electronics (phone, tablets, computers), metal buttons, belts, metals finishes | Y | #1 allergen in tested populations. Reactions can be local, ID, systemic. High point dietary nickel: legumes, chocolate, oat, dark green leafy vegetables. Dimethylglyoxime [DMG] test-pink indicator. Clear-coating option may help but prone to chipping. |
| | Cobalt 1.0% pet. | | 14 | Metals/finishes; vitamin B12; jewelry, cosmetics, cement | Y | Co-sensitizer with nickel and gold due to frequency of use together; blue tattoos. Cobalt spot test: disodium-1-nitroso-2-naphthol-3,6-disulfonate |
| | Potassium dichromate 0.25% pet. | | 40 | Metals/finishes | Y | Used in leather tanning, green felt, green textiles, green tattoos, cement |
| | Gold sodium thiosulfate 0.5% pet. | 2001 | - | Jewelry, electronics, glass frames, dental crowns | Y | Direct sensitivity to gold containing items is rare, more common is concomitant contact between gold and titanium dioxide and zinc oxide (such as eyeglasses frames or jewelry with sunscreen)-- these harder metals abrade the gold and release sensitizing gold particles. |
| Fragrances | Fragrance Mix I 8.0% pet. | 2007 | 2 | Personal hygiene products (PHP) perfumes, cinnamon, flavoring agents, soaps, detergents, paper products,, metal working fluids, incense, tobaccos | Y | 8 fragrances: Geraniol, Hydroxycitronellal, a-Amylcinnamaldehyde, Eugenol (cloves), Cinnamaldehyde, Cinnamyl alcohol, Isoeugenol and Evernia prunastri (Oak moss). |
| | Balsam of Peru 25% pet. (Myroxylon.pereirae resin) | | 3 | PHP; diaper balm; wound salves | Y | Tree sap from El Salvador; cross reacts with tomatoes because of cinnamic alcohol commonality; significant sources: chocolate, soda, artificial flavors and benzoates. |
| | Fragrance Mix II 14% pet. | | 8 | PHP | - | Fragrance (Citronellol, Hexyl cinnamal, Citral, Coumarin, Farnesol, Hydroxyisohexyl 3-cyclohexene carboxaldehyde (Lyrall) 2.5%) |
| | Cinnamic aldehyde 1% pet. | - | 13 | Oral hygiene products/PHP | Y ^ | Component of Fragrance Mix 1 and balsam of Peru |
| | Colophonium (rosin) 20% pet. | - | 29 | Paper products, magazine gloss, toilet seats, make up, adhesives, paints, varnishes; chewing gum, violin bows, epilation wax | Y | Abeitic acid – allergenic component in glues; pine (conifer) derivative; may cross react with BOP and propolis, contains coniferyl alcohol. |
| | Majantol 5% pet. | | 39 | PHP | - | Fragrance |
| | Ylang-ylang oil 2% pet. | - | 52 | PHP | - | Fragrance |
| NON-FRP (Formaldehyde Releasing Preservative) | MCI/MI 0.01% aq = 100 ppm aq (aka Kathon CG) ^h aq. | 2013 | 4 | Baby wipes, moist toilet tissue, leather couch wipes, shampoo, lotion, cosmetics, airborne associated with latex paint | Y | 40% of MI allergy missed when only test with MCI/MI mix |
| | Iodopropyl butyl carbamate 0.1% pet. | - | 12 | Baby wipes, cosmetic products, PHP | - | Under regulation in cosmetic products in New Zealand |
| | Methylidibromoglutarate nitrile + Phenoxyethanol (Euxyl K400) 1% pet. | - | 16 | Preservative in paper products (paper towels), ultrasound gels, PHP | Y# | Industrial exposures include: cutting oils, coolants and adhesives |
| | Paraben mix 12% pet. | - | 22 | Preservative in creams, lotions, and foods | Y | "paraben paradox" – aka only reactive on involved skin - patch test on normal skin (-) |
| | Quinoline mix 190 mcg/cm ² | - | - | Antifungals, antibacterials, topical antibiotic and antifungal creams, lotions, ointments, paste bandages | Y | Clioquinol and Chlorquinaldol |
| | Thimerosal 7mg/cm ² or 0.1% pet. | 2002 | - | Cosmetic preservative, vaccines, mercurial contact lens solution, tuberculin skin test | Y | Mercurial preservatives, until recently was found in a number of vaccines. Significant # of irrelevant reactions (aka "non-allergen" of the year award). Cross-reacts with piroxicam. |
| | Propyl Gallate 0.5% pet. | - | - | PHP, lubricants, foods | - | |
| Antibiotics | Bacitracin 20% pet. | 2003 | 10 | Component of triple antibiotic | Y | Contact urticarial and DTH reported; CO-reacts (NOT cross-react) with neomycin. |
| | Neomycin 20% pet. | 2010 | 17 | Component of triple antibiotic; aminoglycoside | Y | Cross reacts with gentamycin, tobramycin. CO-reacts with bacitracin. |
| | Chloroxylenol (4-chloro-3,5-xyleneol) 1% pet. | - | 56 | Carbolated Vaseline, Cooling fluids, PHP, Disinfectants, EKG paste, Surgical Scrubs | - | |

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|------------------------------|---|------|-------------------------|--|--------------------|--|
| Formaldehyde and FRPs | Quaternium-15 2% pet. | - | 5 | FRP latex paints, topics meds, adhesives | Y | #1 cause hand dermatitis Not allergic patients have a cross-reactivity with formaldehyde |
| | Formaldehyde 1% aq. | 2015 | 7 | Embalming/preserving fluid, aspartame, pressed wood, industrial metal working fluids and coolants, glues, inks, toners, paints, cleaning agents, waxes and polishes, cosmetics, PHP durable press (wrinkle-resistant) fabrics, cleaning products, tobacco and cigarette smoke, smoke from wood, coal, kerosene, or charcoal fires. | Y | Reactions can be local, ID, systemic. Aspartame may trigger systemic response |
| | Diazolidinyl urea 1% pet. | - | 20 | FRP | Y | Cosmetics; lotions |
| | DMDM hydantoin 1% pet. | - | 23 | FRP | Y | Hand soaps; lotions |
| | Bronopol (2-Bromo-2-nitropropane-1,3-diol) 0.5% pet. | - | 26 | FRP | Y | Baby wipes |
| | Imidazolidinyl urea 2% pet. | - | 28 | Cleansers,PHP, cosmetics, burn remedies | Y | #1 FRP in medicaments; used in cosmetics |
| Hair Care | Paraphenylenediamine (PPD) 1% pet. | 2006 | 6 | Antioxidant – used as hair dye -inks, photodeveloping solutions, textile dyes, henna tattoos | Y | PABA-back bone, may cross react with disperse dyes, hydrochlorothiazide, ester anesthetics, sulfonamides, azo and aniline dyes, sulfonamides, para-aminosalicylic acid |
| | Glyceryl thioglycolate (GTG) 1% pet. | - | - | Permanent wave solutions | - | "Acid" permanent waves solution |
| | Ammonium persulfate 2.5% pet. | - | - | Hair bleach, western blot | - | Oxidizing agent |
| | Ammonium thioglycolate 1% aq. | - | - | Perm salt used in perm-ing hair | - | 'Allergy often assumed, but rarely if ever, proven'. Cross-reaction with GTG rare. May cause ICD. |
| Rubber Additives | Carba mix 3% (includes: zinc diethyldithiocarbamate, zinc dibutyldithiocarbamate, Diphenylguanidine) pet. | - | 11 | Rubber accelerator (eg: vulcanizes liquid latex to solid rubbery product, through sulfide bonds) | Y | "Thio" in name indicates the sulfa bonds to vulcanize. Used in underpants – "do not bleach" due to bleached rubber syndrome. |
| | Thiuram mix 1% pet. | - | 18 | Rubber accelerator -prevents degradation in rubber products, latex, adhesives, pesticides, medications -condoms, diaphragms, repellents | Y | Significant glove-hand dermatitis association |
| | BRM (includes: N-phenyl-N' isopropyl p-phenylenediamine, N-phenyl-N' cyclohexyl-phenylenediamine, and N,N' diphenyl-phenylenediamine) 0.6% pet. | - | 45 | Aka black rubber mix, antioxidant used in rubber materials | Y | PABA-back bone, may cross react with disperse dyes, hydrochlorothiazide, ester anesthetics, sulfonamides; hair dressers at risk |
| | Mixed dialkyl thioureas 1% pet. | 2009 | 48 | Rubber accelerator, one of the neoprene cement allergens | - | Neoprene is Thiourea + PTBFR |
| | 2-Mercaptobenzothiazole 1% pet. | - | 58 | Rubber accelerator | Y | Significant cause of shoe-foot dermatitis |
| | Mercapto mix 1% (4-morpholinyl-2-benzothiazyl disulfide, N-cyclohexyl-2-benzothiazolesulfenamide, 2,2-benzothiazyl disulfide) pet. | - | 61 | Rubber accelerator | Y | Surgeons, nurses, dentists, hairdressers at risk for occupational exposure |

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|--------------------------------------|--|------|---|--|----------------------|--|
| Vehicle and PHP/cosmetic ingredients | Lanolin alcohol 50% (wool wax alcohols) pet. | - | 9 | Emollients, cosmetics, adhesives, topical medications, polishes, soaps, printing inks, and textiles. | Y | From sheep sebum; allergenic component amerchol; biologic variability may get "lanolin paradox" – aka only reactive on involved skin - patch test on normal skin (-) --common allergen in leg ulcers |
| | Propylene glycol 30% aq. | - | 15 | Solvent, emulsifier, preservative, vehicle, humectant and/or penetration enhancer, medicaments, foods | - | May also be an irritant; systemic reaction due to oral medication or food ingestion reported |
| | Oleamidopropyl betaine 1% pet. | - | 21 | PHP | - | |
| | Cocamidopropyl betaine (CAPB) 1% aq. | 2004 | 24 | Surfactant chemical – used in no more tear ingredient | - | Amido amine, 3-(dimethylamino) propylamine (DMAPA) may be the true allergens |
| | Dimethylaminopropylamine (DMAPA) 1% pet. | - | 27 | CAPB-component | - | Manufacturing component for CAPB – may be a contaminant allergen post production |
| | Shellac 20% pet. | - | 31 | Cosmetics, polishes, coating for medications, fruit, candies and dental varnish | - | From secretions of Lacifer lacca (formerly Coccus lacca), which feeds on certain trees in southern Asia. |
| | Amidoamine (stearamidopropyl dimethylamine) 0.01% ^b aq. | - | 33 | CAPB component found in: body washes; conditioners; cosmetics; hair detanglers; hair dyes; shampoos; soaps | - | Manufacturing component for CAPB – may be a contaminant allergen post production |
| | DI alpha tocopherol 100% | - | 36 | Vitamin E | - | #2 allergen in sunscreen; used in PHP |
| | Cocamide DEA (coconut diethanolamide) 0.5% pet | - | 37 | PHP, especially shampoos, hand-washing liquids and body washes. | - | |
| | Decyl glucoside 5% pet. | - | 44 | PHP | - | Surfactant |
| | Carvone 5% pet. | - | 50 | Spearmint oil; toothpaste, chewing gum; mandarin orange peels | - | |
| | Benzyl alcohol 10% pet. | - | 57 | Preservative used in PHP and medicaments | - | Balsam of Peru-derivative – used in fragrance free products as a preservative; cross reacts with benzoates. |
| | Ethylenediamine dihydrochloride 1% pet. | - | 59 | Stabilizer, emulsifier and preservative, used in some mycology formulations | Y | X-reacts with piperazine antihistamines aminophylline & hydroxyzine |
| Benzalkonium chloride 0.1% pet. | - | - | Preservative, used in hand wipes, hand sanitizers, Spermicidal creams | - | In toilettes (wipes) | |
| Corticosteroids | Tixocortol-21-pivalate 1% pet. | - | 19 | Group A | Y | Screening agent for hydrocortisone type (OTC) steroids; prednisone group |
| | Budesonide 0.1% pet. | - | 42 | Group B | Y | Triamcinolone and Budesonide often used for screening of group B, because budesonide specifically can cross react with D2 steroids |
| | Clobetasol-17-propionate 1% pet. | 2005 | 65 | Group D1 | - | |
| | Hydrocortisone-17-butyrate 1% pet. | - | 68 | Group D2 | Y | Cross-reacts with Group A |
| | Desoximetasone 1% pet. | - | 69 | Group C | - | Do not cross-react with each other, thus considered more "hypoallergenic" |
| Plastics and Glues | 2-Hydroxyethyl methacrylate (HEMA) 2% pet. | 2012 | 30 | Artificial nails, dental work | - | |
| | Bisphenol A epoxy resin 1% pet. | - | 35 | Glues, coating for steel, cars, electrical insulation, some plastics, vinyl | Y | |
| | Methyl methacrylate 2% pet. | - | 46 | Exterior latex house paint, dental restorations, adhesive cements and surgical bone implants. | - | Dental technicians, artificial nails |
| | Ethyl acrylate 0.1% pet. | - | 51 | Resins, plastics, rubber, and denture material | - | |
| | p-tertbutyl formaldehyde resin (PTBFR) 1% pet. | - | 62 | Adhesive in leather/rubber products and neoprene | Y | Neoprene cement chemical; cross-reacts with formaldehyde; may cause depigmentation |
| | Ethyl-2-cyanoacrylate 10% pet. | - | 66 | Liquid bandages & for suture-less surgery | - | |
| | Tosylamide/formaldehyde resin 10% pet. | - | 47 | Nail polish | - | Tosylamide (toluene sulfonamide is the main allergen over the formaldehyde resin) |

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| Compositae | Propolis 10% pet. | - | 32 | 'Organic' cosmetics; gummy vitamins | - | Pro-before, Polis- the city. Lines the channels into the beehive (combination of beeswax, plant extracts and bee saliva). |
| | Compositae mix 6% pet. | - | 34 | PHP, Teas, Group of plants; leaf/stem/ flower (<i>Tanacetum vulgare</i> , <i>Arnica montana</i> , <i>Parthenolide</i> , <i>Chamomilla romana</i> , and <i>Achillea millefolium</i>). | - | The Compositae family refers to plants in which the flower heads are a composite of individual flowers. (Asteraceae: flowerheads are star-shaped (aster is Greek for star) ~20,000 species of flowers, herbs, weeds and vegetables (including asters, daisies and sunflowers) account for 10% of all flowering plants. (Chrysanthemum, daisy, echineacea, thistle, feverfew, ragweed, artichoke, tansy, endive). |
| | Sesquiterpene lactone mix (SQL) 0.1% pet. | - | 55 | PHP Compositae plants: oleoresin fraction of leaf, stem, flower and possibly in the pollen | - | Alantolactone, dehydroxosus lactone, costunolide Florists and gardeners; cross-reactors: parthenolide, compositae mix, propolis. |
| | Parthenolide 3 mcg/cm ² | - | - | Natural remedies and supplements | Y | Used on the commercially available patch test device in lieu of SQL. Naturally found in the flowers and fruit of the plant, feverfew (<i>Tanacetum parthenium</i>); relief of migraines and blood clots; anti-inflammatory for the relief of arthritis and as a digestive aid. |
| Anesthetics | Lidocaine hydrochloride 15% pet. | - | 49 | Amide anesthetic | - | Paraben preservative reported to cause allergy in association with this medication. |
| | Benzocaine 5% pet. | - | 54 | Ester anesthetics | Y [^] | PABA-derivative, basis for ester anesthetics cross-reactions; caine mix includes: benzocaine, tetracaine, and dibucaine. Dibucaine is an amide. |
| | Dibucaine (cinchocaine-Hcl) 2.5% pet. | - | 63 | Amide anesthetic | Y [^] | |
| | Tetracaine 2% pet. or 630 mcg/cm ² | - | - | Ester anesthetic | Y [^] | |
| Uroshiol (Toxicodendron genus Anacardiaceae) | Poison ivy (<i>toxicodendron radican</i>) | - | - | Leaves of 3+ let them be | - | Highly sensitizing resin oil/black dot dermatitis (black lacquer-like substance forms on skin after exposure of resin to air). |
| | Poison sumac (<i>toxicodendron vernix</i>) | - | - | | - | " |
| | Poison oak (<i>toxicodendron quercifolium</i> and <i>toxicodendron diversilobum</i>) | - | - | | - | " |
| | Mango (<i>Mangifera indica</i>) | - | - | Leaves, bark, stems and skin of mango contain uroshiol | - | " |
| | Japanese Lacquer tree (<i>Toxicodendron vernicillua</i>) | - | - | Viscous bark sap used for varnishing furniture, floors, wooden toilets, ornaments | - | Varnish; stays allergenic for >100 years! |
| | Ginkgo biloba* (<i>Ginkgoaceae</i>) (maidenhair tree) | - | - | Pulp and seed kernel | - | Cross-reacts with poison ivy and poison oak. Oldest tree known (fossils date 200 million years old). |
| | Indian Marking nut (<i>Semecarpus anacardium</i>) (bhilawa tree) | - | - | Black juice of the tree is mixed with alum to mark laundry in India | - | Dhobie Mark dermatitis (Indian laundry workers are dhobies). |
| | Cashew (<i>Anacardium occidentale</i>) | - | - | Shell oil contains cardol | - | The oil is an occupational sensitizer mechanics; urushiol, containing cardol and ancardic acid, is found in cashew nut shell oil; resorcinol cardol is both an irritant and an allergen. |
| | Florida Holly/Brazilian Pepper Tree (<i>Schinus terebinthifolius</i>) | - | - | Tree bark and berries | - | Common cause of ACD in southern Florida |
| | Pistachio (<i>Pistacia vera</i>) | - | - | | - | Cross-reacts to cashew nut |
| Pepeo tree (<i>Mauria puberula</i>) | - | - | | - | ACD and ICD | |

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| Other plants | <i>Melaleuca alternifolia</i> (tea tree leaf oil) oxidized | - | 41 | Used as an anti-inflammatory in PHP | - | Co-reactions/cross-reactions to d-limonene (a fragrance) and turpentine have been reported. |
| | <i>Lavandula angustifolia</i> oil (lavender oil) 2% | - | 60 | Used as an anti-inflammatory in PHP | - | Massage therapists at risk |
| | <i>Jasminum officinale</i> oil (<i>J. grandiflorum</i>) 2% pet. | - | 64 | PHP, massage oils, aromatherapy | - | |
| | <i>M. piperita</i> oil (peppermint oil) 2% pet. | - | 67 | PHP, aromatherapy | - | |
| | Lichen (d-usnic acid, evenic acid) | - | - | Cosmetics, PHP | - | |
| | Furocoumarin | - | - | Celery, dill, fig, lime, bergamot orange (berloque dermatitis) parsley, parsnip, meadow grass, hogweed (strimmer dermatitis) | - | Phytophotodermatitis (Apiaceae, Rutaceae, Moraceae, Leguminosae; psoralens) |
| | St. John's wort | - | - | | - | Hypericaceae Family |
| | Daffodil (<i>Narcissus</i> spp, Amaryllidaceae) | - | - | Sap contains calcium oxalate crystals | - | "daffodil itch" is an irritant contact dermatitis seen in flower pickers, packers, florists and gardeners; similar chemical found in "dumb cane". |
| | Allyl isothiocyanate Brassicaceae | - | - | Mustard, radish | - | Bakers with hand dermatitis; Thiocyanate is an irritant. |
| | Diallyl disulfide | - | - | Onions, garlic, leeks, chives (bulbs) | - | Alliaceae Family |
| | Peruvian Lily (Tulipalin A, tuliposide A) (<i>Alstromeriaceae</i>) and Tulip (Tulipalin A/B) (<i>Liliaceae</i>) | - | - | Peruvian lily stem and tulip bulb respectively | - | Liliaceae has tulipalin A/B (ACD) and calcium oxalate (ICD) – leads to combined ACD and ICD called "tulip fingers". |
| | <i>Primula obconica</i> (<i>Primulaceae</i>) | - | - | Primin on leaves, stems, flowers | - | May be direct contact, indirect or airborne dermatitis. Primin-free <i>Primula obconica</i> has been developed |
| Castor Oil Plant (<i>Ricinus communis</i>) | | | PHP Seeds contain ricin (poisonous) | - | Castor oil is contact irritant | |
| Sunscreens | Oxybenzone 10% pet. (benzophenone-3 & 2-hydroxy-4-methoxybenzophenone) | 2014 | 38 | Sunscreen ingredient | - | Photocontact dermatitis; low prevalent allergen; risk of hormone disruption reported in animal studies; most common sunscreen agent to cause photoallergic contact dermatitis; cross-reacts with other aminoglycosides often co-reacts with bacitracin. |
| | Padimate O (PABA) 5% pet. | - | - | Sunscreen | - | Cross reacts with paraphenylene diamine, ester anesthetics, disperse dyes. |
| | Sulisobenzene/benzophenone -4 10% pet. | - | - | Sunscreen | - | |
| Other | Carmine 2.5% pet. | - | 25 | Food dye | - | |
| | Disperse blue mix 124/106 1% pet. | 2000 | 43 | Clothing dyes used on synthetics (nylon, polyesters, blends) | Y# | Cross-reacts with PABA based chemicals (paraphenylene diamine); only disperse blue 106 on TRUE |
| | Glutaraldehyde (Glutaral) 1% pet. | - | 53 | Cold sterilizer | - | Cross-reacts with formaldehyde |
| | Benzoyl peroxide 1% pet. | - | - | Bleaching agent in flour, acne medication | - | |
| | Dimethyl fumarate 0.001% pet. | 2011 | - | Anti-yeast/bacterial agent used in sachets to prevent molding of wares during shipping | - | Shoes, sofas, and garments |

Abbreviations:

ACD: allergic contact dermatitis; aq: aqueous; AOY: "Allergen of the Year" is an ACDS "award" reviewed annually in *Dermatitis*; ICD: irritant contact dermatitis; FRP: formaldehyde releasing preservative; MCI/MI: Methylchloroisothiazolinon; PABA: para-aminobenzoic acid; pet: petrolatum; PHP: personal hygiene products; SQL: Sesquiterpene lactone.

Annotations:

[a] Based on Table 8 Significance-Prevalence Index Number from Warsaw et al. *Dermatitis*, 2015; 26:56-57. *Dermatitis*, 2015; 26:56-57; [h] also in category of "Hair Care"; [Y^] included in a mix; [Y#] MDBGN on TRUE, PE is not; Disperse blue 106 on TRUE, not 124.

Reference:

- Jacob SE, Herro EM. Practical Patch Testing and Chemical Allergens in Contact Dermatitis. London, England: Springer-Verlag; 2013.
- Warsaw EM1, Maibach HI, Taylor JS, Sasseville D, DeKoven JG, Zirwas MJ, Fransway AF, Mathias CG, Zug KA, DeLeo VA, Fowler JF Jr, Marks JG, Pratt MD, Storrs FJ, Belsito DV. North American contact dermatitis group patch test results: 2011-2012. *Dermatitis*. 2015 Jan-Feb;26(1):49-59.

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Disclosure:

SEJ is a member of the ACDS Education Committee. This committee has developed a lecture series for the ACDS aimed at practical knowledge and boards review. Available at www.contactderm.org. EH and AG have nothing to declare.

Table Reviewed by the Executive Committee of the American Contact Dermatitis Society June 5, 2015.