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|  | ***Put it in Practice*** |

**Most Common Contact Allergens and Sources of Exposure**

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| **Acrylate***Acrylate, specifically acrylic acid, has rigid plastic and flexible glass qualities and has been used in dentistry as a dental filler and in cosmetics as a nail enhancing substance. Allergies to acrylics are most commonly seen in individuals who work with artificial nails, dental cements and composite dental resins. This is thought to be due to MMA exposure. Kwok et al showed that in 257 cases of ACD in beauticians, identified between 1996 and 2011, acrylates were the most common cause. It can also manifest as fingertip dermatitis and paresthesia, periungual and eyelid dermatitis.* |
| Acrylates are found in:* Dental cements and resins, dentures
* Bone cement, orthopedic implants
* Artificial nails
* Adhesives
* Soft contact lenses, hearing aid resins
* Paints
* Plexiglas
* Floor polish
* Leather finishings
* Paper coatings

*A noteworthy point, patch test preparations of acrylates may evaporate during storage, which may lead to markedly reduced patch test concentrations and false negative results. Mose et al investigated the stability of various acrylates after storage in 3 different chambers and at 2 different temperatures. They showed how the patch test concentrations of MMA, 2-hydroxyethyl methacrylate (2-HEMA), and 2-hydroxypropyl acrylate (2-HPA) decreased after storage in 2 of the chambers, the IQ chamber and IQ Ultimate. However, MMA and 2-HPA maintained their concentrations when kept refrigerated in the Van der Blend transport container. It is thus recommended that acrylates be loaded in the patch test chambers immediately before application of the patch test.* *In 2014 Fremlin et al reported a case of ACD to UV-cured acrylates in a windscreen repair worker. The worker presented with dryness, vesicles and desquamation of the fingers. He initially used vinyl gloves, and patch testing was positive for 2-HEMA. Nitrile gloves have been noted to confer better protection and a longer “breakthrough time” than vinyl or latex gloves in acrylate sensitized individuals; and, once switching to nitrile gloves, the patient had marked improvement.* |

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| **Benzophenones***Benzophenones are a group of aromatic ketones that can absorb UVA and UVB rays. The 4 benzophenone derivatives commonly used in skin products are oxybenzone, sulisobenzone, dioxybenzone and mexenone. Oxybenzone is used most frequently in sunscreens, and is also the number 1 photoallergen in sunscreens. A photoallergic contact dermatitis results from a cell-mediated immune reaction to a photoactivated antigen. In the recent NACDG data, benzophenone-3 yielded a 0.9% positive reaction rate in the referred population, with 47% of these being of definite or probable clinical relevance.* |
| Benzophenones can be found in:* Sunscreens
* Perfumes
* Soaps and shampoos
* Nail polish
* Hair sprays and dyes
* Body washes and moisturizers
* Paints
* Pesticides
* Textiles
* Inks
* Adhesives
* Plastic lens filters used in color photography

*In 2014, Liao et al studied the benzophenone content of 231 PHPs, such as toothpastes, hair products, body washes, hand soaps, skin lotions, facial creams and makeup. More than 80% of these products were shown to have oxybenzone, underscoring its high utilization in the cosmetic industry.* |

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| **Cobalt***The chemical element cobalt is a rare element that only makes up 0.001% of the earth’s crust. It is a brittle, hard white metal that may be found naturally in soil, dust and seawater. However, it is very rarely found in its pure form when mined from the earth, as it is normally produced as a byproduct of iron, nickel, copper and silver mining.**Patch testing is often necessary to confirm the diagnosis of ACD and to identify the relevant allergen(s) responsible. Screening patch test trays are available, which may identify the offending chemicals and offer the provider clues for potential sources.* *Cobalt chloride (1% Pet) is included on the American Contact Dermatitis Society Standard Series, the North American Contact Dermatitis Group (NACDG) series and cobalt dichloride, 20 mcg/cm2 is on the thin-layer rapid use epicutaneous patch test (T.R.U.E).* |
| Cobalt is found in:

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| * Food (via vitamin B12)
* Buckles, zippers, buttons, jewelry, coins
* Painting, ceramics, porcelain, glass (blue pigment)
* Metal mining, smelting and refining
* Making or using cutting, grinding, or drilling tools
* Making or using magnets
* Using welding rods
* Making or repairing aircraft engines
 | * Manufacturing rubber or plastic
* Manufacturing batteries
* Cement industry
* Orthopedic implants/prosthesis
* Dental brace, plates or implants
* Vitamin B12 therapy
* Tattoos (blue pigment)
* Hair dye (light brown color shades)
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| **Dimethyl fumarate** *Dimethyl fumarate (DMF) is a fumaric acid ester that has been used for many years in the treatment of psoriasis and as a preservative, stored in desiccant sachets for the transport of furniture and shoes. In 2009, the European Commission banned the importation of consumer products containing greater than the maximum allowable amount of DMF due to the increasing incidence of allergic reactions to furniture and shoes. DMF was chosen as the Allergen of the Year for 2011 to highlight that it was still used in overseas products.* |
| DMF is seen primarily overseas in:* Furniture
* Shoes
* Anti-psoriatic treatments
* Desiccants
* Clothing

*Some cases of DMF dermatitis have been more difficult to decipher given the presentation of posterior lower extremity and back dermatitis. These were eventually linked to exposure to leather sofas and armchairs imported from China. DMF used in sachets placed inside sofas can cause pruritic eruptions in areas of skin-to-sofa contact.**In 2014, it was reported that DMF may also cause contact urticaria. Stingeni et al reported a case of a patient with DMF-induced immediate contact urticaria to a pair of jeans. The association was eventually confirmed via a positive immediate occluded patch test (reading at 20 minutes, rather than delayed) and a positive prick test with DMF.* |

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| **Formaldehyde***In the latest reported NACDG frequency data, formaldehyde ranked seventh, with 5.8% positive reactions noted in the 4,308 patients referred for testing. This high rank as well as formaldehyde’s ubiquity and important role as a top allergen have been noted for the last 75 years. Notably, it is also 1 of only 5 chemicals that have been listed by the Consumer Product Safety Commission as “strong sensitizers” since 1961.* |
| Formaldehyde is an inexpensive biocidal preservative used in a wide range of products:* Tissue specimen and cadaveric preservation solutions
* Nail polish
* Brazilian blowout treatments
* Wrinkle-free fabric
* Contamination prevention agent in personal hygiene products (PHPs).*Morse et al reported 6 cases of septicemia resulting from* **Klebsiella pneumoniae***contamination of a nurses’ hand cream due to a lack of appropriate germicidal preservatives.*
* Formaldehyde was used to inactivate poliovirus in the development of Salk’s 1952 polio vaccine.

Formaldehyde-releasing preservatives (FRPs) are among the leading contact allergens and are found in many PHPs:* Medications
* Household cleansers
* Shampoos, body washes and hand soaps
* Lotions and creams
* Baby wipes
* Mascara
* Disinfectants
* Fabric softeners
* Topical wart remedies
* Adhesives and tissue specimen preservation solutions

*According to the FDA Voluntary Cosmetic Registration Program database, about 20% of PHPs and cosmetics contain a FRP, with imidazolidinyl urea as the most common. Of interest, FRPs were developed to avoid formaldehyde-induced contact allergies assuming that the formaldehyde release level would not be sufficient from the releaser to cause a skin reaction. However, many FRPs have also been demonstrated to be contact allergens, some related to the release of formaldehyde, while others by their own chemical properties.* |

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| **Fragrance***Fragrances consist of both natural and synthetic materials. Natural fragrances are derived from distilled botanical compounds, yet the difficulty in acquiring consistently high volumes of natural products has led to the development of synthetic fragrances. Nearly 90% of fragrances are synthetic compounds, which estimates to more than 5,000 different compounds.**Fragrances are responsible for 30% to 45% of ACD to cosmetics. In the latest published NACDG allergen frequency data, fragrance mix I was the third ranking allergen, with 8.3% positive reactions in those patch tested, with 90% of these positive results being of definite, probable or possible relevance. Particularly, Myroxylon pereirae had a 7.2% positive reaction rate (with 86% having definite, probable or possible relevance) and fragrance mix II had a 4.7% positive reaction rate (with 94% having definite, probable or possible relevance).* |
| Fragrances in many, many products such as:* Colognes
* Cosmetics
* Medications
* Foods
* Personal hygiene products
* Cleaning products

The fragrance antigens in the current T.R.U.E. Test include Balsam of Peru (BOP, a fragrant resinous natural product containing a mixture of many substances), and Fragrance Mix I. Previous studies suggest that the standard FM I and BOP will detect approximately 60% to 70% of fragrance-allergic individuals. The addition of other commonly used fragrance ingredients (FMII, ylang ylang oil, narcissus oil, and sandalwood oil) may increase the yield of positive patch test.  |

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| **Methylisothiazolinone***Methylisothiazolinones (MIs) are biocidal preservatives added to bubble solutions, bubble baths, soaps and cosmetic products. The biocidal activity comes from their ability to interact with microorganisms and oxidize accessible cellular thiols. The chemical structure (2-methyl-4-isothiazolin-3-one) makes them highly compatible with surfactants and emulsifiers. In addition, MIs can maintain their biocidal activity over a wide pH range, making them favorable for use as preservatives in surfactants. Since the 1980s, these preservatives have been noted to be a source of ACD. Castanedo-Tardan et al reported that twice as many US cosmetic products contained MIs in 2010 than in 2007, and in 2013, Urwin et al showed that there has been an increase in the prevalence of MIs or methylchloroisothiazolinones (MCI) to a level of 4.9% of those who are patch tested. Of special note, it has been reported that the MCI/MI mix can miss approximately 40% of MI allergies and testing with MI (0.2% aqueous) may be necessary to improve detection rates.* |
| MIs can be found in:* Bubble solutions
* Bubble baths
* Soaps
* Cosmetic products
* Cleansing products

*In 2014, Vandevenne et al reported a case in which a middle-aged man developed severe and recurrent generalized dermatitis; his lesions were shown to be linked to MI-containing leather products that had been applied to his leather sofa, underscoring the role of household cleaning agents in causing significant disease.* |

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| **Mixed Dialkylthiourea***Thioureas are organosulfur compounds used in synthetic rubber synthesis to speed up the cross-linking of chloroprene to neoprene (polychloroprene) in a process called vulcanization. Thiourea allergy may be missed by only screening for mixed dialkylthiourea; therefore, it is recommended that patch testing with a component of the patient’s neoprene product be considered.* |
| Thioureas can be found in:* Car parts
* Diving and sports gear
* Orthopedic medical devices
* Fixative agents for photography and photocopiers
* Swimming goggles
* Rubber gloves
* Paint removers
* Keyboard wrist supports

*Powell et al illustrated a case in which a soccer player developed ACD to the padding of his shin guards, which contained neoprene. Because mixed dialkylthioureas may be encountered on a daily basis from a number of sources, they were chosen as the 2009 ACDS Allergen of the Year.* |

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| **Neomycin***Neomycin is an aminoglycoside antibiotic that is commonly used in triple antibiotic ointments to prevent or treat bacterial skin infections. In the recent NACDG allergen frequency data, neomycin tested positive in 8.7% of patients referred for patch testing, with 30% of positive tests being of definite, probable or possible clinical relevance.**Patients with neomycin sensitivity may have a cross-reaction with other related aminoglycoside antibiotics, such as gentamicin, tobramycin, kanamycin and streptomycin. Landeck et al conducted a 10-year retrospective study of patients in Europe who were referred for periorbital dermatitis due to suspected contact allergy to ophthalmic medications. Patch testing results were positive in 8.1%, 5.9% and 4.9% of patients for gentamicin, neomycin and kanamycin, respectively. Because kanamycin is exclusively used in topical ophthalmic preparations, some patients may indirectly be sensitized to neomycin.**Polysensitization is when a patient has a positive patch test reaction to 3 or more unrelated allergens. In 2014, Fraser et al reported neomycin as one of several allergens with demonstrable clinical relevance in polysensitized patients, highlighting the point that secondary contact dermatitis can occur to medicaments used to treat long-standing dermatoses and dermatitis.* |
| Neomycin is found in:* Triple antibiotic ointments
* Ophthalmic and antibiotic drops
* Deodorants
* Soaps
* Root canal fillings
* Vaccine preservative

*Committee on Infectious Diseases of the AAP no longer considers contact hypersensitivity to neomycin a contraindication to vaccination.* |

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| **Nickel***Nickel is a natural element and transition metal that makes up 3% of the earth’s composition. The word nickel is derived from the German word kupfernickel, which means devil’s copper.* *Nickel is currently the most prevalent allergen with a prevalence rate of about 17% in those who are patch tested worldwide. The alarming rise in the prevalence of ACD to nickel led to its designation as the 2008 ACDS Allergen of the Year. Nickel may cause localized, id (at areas that may not have direct contact with nickel) and systemic contact dermatitis. Localized dermatitis typically occurs on the earlobes, neck, wrists and periumbilical areas due to jewelry or metal snaps of jeans and belt buckles. Clinically, the dermatitis presents as pruritic papules or papulovesicles, but lichenification can occur with chronic dermatitis.* |
| Nickel is frequently found in:

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| * Zippers
* Safety pins
* Doorknobs
* Keys
* Scissors
* Eyelash curlers
* Belt buckles
* Metal eyeglass frames
* Razors
* Thimbles
 | * Coins
* Construction tools
* Appliances
* Household utensils
* Alkaline batteries
* Paper clips
* Multivitamins
* Jewelry
* Mobile phones
* Nickel-plated objects
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*There have been increasing numbers of reports of ACD to nickel-containing electronics, such as cell phones, laptops and iPhones. In 2014, iPads were found to release a significant amount of nickel and have been associated with a systematized nickel reaction. It is important for sensitive individuals to be aware of various electronic exposures and to use nickel-free cases to reduce skin-to-device contact.* |

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| **p-Phenylenediamine***Para-phenylenediamine (PPD) is an easily oxidized substance that gained popularity in the early 20th century as a permanent dye. In the most recent NACDG frequency data, PPD ranked ninth, with 5.5% of patients patched tested exhibiting a positive reaction, with 54% of these positive results being of definite, probable or possible clinical relevance.* *Reactions to PPD are variable and can range from mild dermatitis to severe blistering of the scalp, eyelids and ears. There have been accounts of urticaria and, rarely, anaphylaxis from PPD exposure. In addition, ingestion of PPD has been associated with angioedema, rhabdomyolysis, direct renal tubule damage, methemoglobinemia, myocarditis and right bundle branch block. In 2014, cutaneous pseudolymphoma has also been linked to PPD dye use, underscoring the continued recognition of this allergen’s role in clinical disease.* |
| PPD is found in:* Hair dye
* Temporary tattoos
* Textiles
* Cosmetics
* Photographic developer
* Black rubber
* Oils
* Gasoline

*To address the paucity of data on the incidence of ACD secondary to black henna temporary tattoo use, the FDA launched a website (MedWatch, www.fda.gov/Safety/MedWatch/) and hotline (800-332-1088) in 2001 to warn consumers of the dangers of temporary tattoo use. These efforts were fueled by reports of severe bullous eruptions from temporary tattoo use.* |