



## Contents

1 Core Messages .....	1843
2 Introduction .....	1843
3 Contact Irritants and Allergens .....	1844
References .....	1848

### Keywords

Chemists · Allergic contact dermatitis · Irritant contact dermatitis · Occupational dermatitis · Contact urticaria · Wet work

## 1 Core Messages

Due to the diversity and large number of skin-hazardous chemicals to which chemists may be exposed, it is impossible to provide a comprehensive list.

A. Ezersky (✉)  
University of Southern California, Los Angeles, CA, USA  
e-mail: [andyezersky@gmail.com](mailto:andyezersky@gmail.com)

H. I. Maibach  
Department of Dermatology, University of California,  
San Francisco, CA, USA  
e-mail: [Howard.Maibach@ucsf.edu](mailto:Howard.Maibach@ucsf.edu)

R. Jolanki  
Section of Dermatology/Control of Hypersensitivity  
Diseases, Finnish Institute of Occupational Health (FIOH),  
Helsinki, Finland  
e-mail: [riitta.jolanki@ttl.fi](mailto:riitta.jolanki@ttl.fi); [riitta.jolanki@hiy.fi](mailto:riitta.jolanki@hiy.fi)

Occupational dermatosis is often the consequence of accidental exposure, such as a spillage of a chemical on the skin.

Distillation or other purification procedures carry an increased risk of skin exposure.

Often the sensitizers are not the final compounds, but intermediates.

Occupational contact allergy is diagnosed particularly often among chemistry students and those conducting their postgraduate studies in chemistry.

Allergic contact dermatitis among chemistry researchers is often the first clue that a new chemical is a potential contact sensitizer.

See ► [Chap. 169, "Laboratory Technicians,"](#) for the prevention of occupational skin diseases.

## 2 Introduction

Chemists perform chemical tests, carry out qualitative and quantitative analyses, conduct experiments for quality or process control, develop new products, and produce new knowledge. Nearly

every industry employs a chemist. Exposure to only a single chemical is exceptional. Due to the diversity and large number of skin-hazardous chemicals to which chemists may be exposed, it is impossible to provide a comprehensive list of such substances. Chemists are usually well aware of the hazardous properties of chemical substances and take the precautions necessary to ensure their safe use. Regrettably, chemists who habitually handle dangerous substances may become inclined to disregard the hazards associated with them.

In the laboratory, skin contact with chemicals is a frequent though not necessary consequence of work. Occupational dermatosis is often the consequence of accidental exposure, such as a spillage of a chemical on the skin (Warshaw 1988; Fousseureau 1989; Niklasson et al. 1990; Le Coz and Lepoittevin 2001; Goossens and Deschutter 2003; Tjiu et al. 2004). In analytical work, chemicals are used in small quantities and thus the potential hazard is reduced. The working processes which carry an increased risk of skin exposure are distillation or other purification procedures (Dooms-Goossens et al. 1990; Kerre et al. 1995), and synthesis (Rycroft 1983; Conde-Salazar et al. 1984; Sonnex and Rycroft 1986; Fousseureau 1989; Valsecchi et al. 1989; Bassi et al. 2008). Very often, the sensitizers are not the final compounds, but intermediates (Rycroft 1981; Conde-Salazar et al. 1984; Dooms-Goossens et al. 1986; Sonnex and Rycroft 1986; Carmichael et al. 1989; Romaguera et al. 1990; Wakelin et al. 1998). Furthermore, occupational contact allergy has been diagnosed particularly among chemistry students (Rothe 1988; Fousseureau 1989; Dooms-Goossens et al. 1991;

Thomas et al. 1997; Le Coz and Lepoittevin 2001; Verlinden and Gloossens 2003; Tjiu et al. 2004; Lammintausta and Neuvonen 2008) and those conducting their postgraduate studies in chemistry (Curley et al. 1986; Dooms-Goossens et al. 1990; Hausen 1992; Kerre et al. 1995). Allergic contact dermatitis among chemistry researchers is often the first clue that a new chemical is a potential contact sensitizer. Today's research chemicals often become tomorrow's routine laboratory reagents or industrial chemicals.

Dermatitis due to chemical irritants is vastly underreported. Allergens are more commonly reported than irritants; consequently, the documented allergens affecting chemists outnumber their irritant counterparts (Berne et al. 2008; Rycroft et al. 1995). Though the diagnosis of an irritant contact dermatitis is commonly less clear, publication of both allergens and irritants is encouraged.

For further information on the complex biology of irritant dermatitis, including chemicals that may cause irritant contact dermatitis in a chemist, see *Irritant Dermatitis* by Ai-Lean Chew (Chew and Maibach 2000).

### 3 Contact Irritants and Allergens

The main causes of irritant contact dermatitis among chemists are probably the same as those among laboratory technicians, i.e., frequent hand washing (wet work, soaps, and skin disinfectants), the use of polymer gloves, organic solvents, and acid and basic liquids (see ► Chap. 169, "Laboratory Technicians"). Most of the remaining irritants are specific to each workplace (Table 1).

**Table 1** Contact irritants found in case reports (with respect to other contact irritants see ► Chap. 169, "Laboratory Technicians")

Contact irritant	Chemical Abstract Service registry number (CAS)	References
2-Cyclohexen-1-one	930-68-7	Goossens and Deschutter (2003)
1,2-Ethanedithiol	540-63-6	Tjiu et al. (2004)
Ethyl chloro oximido acetate	14337-43-0	Hausen (1992)
3,4,6-Trichloropyridazine	6082-66-2	Dooms-Goossens et al. (1986)
Tetrafluoroterephthalonitrile	1835-49-0	Carmichael et al. (1989)

In a chemical laboratory, delayed-type contact allergy often develops to well-known allergens (Table 2), but also to rare and even new sensitizers (Table 3). Immediate-type contact allergy from laboratory animals (see details in ► Chap. 5, “Occupational Dermatology: Ethical Aspects”) is more common among people carrying out experiments with animals, e.g., laboratory technicians and chemists, than in those tending them. The former tasks involve more direct handling of the animals, their secretions, and their internal organs (Susitaival and Hannuksela 1997; Gimenez-Arnau and Maibach 2015). Other causative agents of contact urticaria found in case reports have been listed in Table 4.

**Table 2** Standard contact allergens

Test substance	Function
Potassium dichromate	Reagent, cleaning of glassware
Thiuram mix	Rubber gloves
Cobalt chloride	Reagent
Formaldehyde	Reagent, histopathological work, Bouin liquid, etc.
Mercapto mix	Rubber gloves
Nickel sulfate	Reagent
5-Chloro-2-methyl-4-isothiazolin-3-one + methyl-4-isothiazolin-3-one (3:1)	Biocide
Mercaptobenzothiazole	Rubber gloves

**Table 3** Additional potential contact allergens

Contact allergen – chemical name (CAS number)	Test substance <sup>b</sup>	Use or work task	References
Acrylamide (79-06-1)	1% pet	Alkylation of proteins	Aalto-Korte et al. (2002)
Acrylates	0.1% pet	Development of solder-resistant inks	Craven et al. (1999)
5-[(2-aminoethyl)thiomethyl]-N,N-dimethyl-2-furanmethanamine (66356-53-4)	1% aqua	H2 antagonist synthesis	Rycroft (1983)
1,4- bis(aminomethyl)-2,3,5,6-tetrafluorobenzene (TFX diamine) (89992-50-7)	0.01% pet	Insecticide intermediate	Carmichael et al. (1989)
2-Aminophenyl disulfide (1141-88-4)	0.01% aqua	Macromolecular chemistry	Tomb et al. (1991)
Benzylamine (100-46-9)	0.1% alc	Gematocide investigations	Van Ketel (1984)
Benzyl-1-amino-3 chloro-2 hydroxypropane	0.1% alc	Gematocide investigations	Van Ketel (1984)
Bromoacetonitrile (590-17-0)	1% pet	Synthetizing a new pharmaceutical product	Hernández-Machín et al. (2005)
4-(bromomethyl)benzoic acid (6232-88-8)	0.1% pet	Chemical synthesis	Lammintausta and Neuvonen (2008)

(continued)

*Patch Testing, 4th Edition* by Anton de Groot comprehensively reviews 4900 allergens and irritants and includes suggested dilution and vehicles, as relates to diagnostic patch testing. As many chemicals used by chemists are also used in other industries, one can find many chemicals applicable to a chemist included in the book.

For more information on the prevention of occupational skin diseases, see ► Chap. 169, “Laboratory Technicians.”

For other related issues, see ► Chaps. 169, “Laboratory Technicians,” ► 183, “Pharmaceutical and Cosmetic Industries,” and ► 31, “Occupational and Environmental Acne.”

**Table 3** (continued)

Contact allergen – chemical name (CAS number)	Test substance <sup>b</sup>	Use or work task	References
$\alpha$ -Bromomethyl-p-tolylsulfone	0.01% alc	Chemical synthesis	Kerre et al. (1995)
N-( $\alpha$ -chlorobenzylidene)phenylhydrazine <sup>a</sup>	0.01% acet	Scientific investigations	Rothe (1988)
1-(4-(2-chloroethyl)phenyl)-2-chloroethanol	1% MEK	Polymer chemistry	Wakelinj et al. (1997)
Chloromethyl heterocyclic intermediates	0.1% pet	Histamine antagonist synthesis	Sonnex and Rycroft (1986)
4-Chloro-2-(methylthio)pyrimidine-5-carboxylic acid ethyl ester (5909–24-0)	0.1 pet	Chemical synthesis	Bassi et al. (2008)
5-(1-chlorovinyl)-2,4-dichloropyrimidine	1% aqua	Pyrimidine derivative synthesis	Hodgson (1980)
Cistoran	0.5% pet	H2 antagonist synthesis	Valsecchi et al. (1989)
Clenbuterol intermediate (4-amino- $\alpha$ -bromo-3,5-dichloroacetophenone)	0.5% pet	Clenbuterol synthesis	Romagueria et al. (1990)
$\beta$ -Cyclcostunolide (2221-82-1)	0.1% pet	Manipulating costus resinoid	Le Coz and Lepoittevin (2001)
Cytosine arabinoside (Cytarabine, 147-94-4) intermediates	0.1% aqua	Cytarabine synthesis	Conde-Salazar et al. (1984)
6,8-Dibromo imidazo[1,2-a]pyrazine (63744-22-9)	0.01% alc	Cancer drug research	Abbott et al. (2009)
3,4-Dicarbethoxyhexane-2,5-dione (2049-86-7)	0.01% acet	Synthesis of X-ray contrast medium	Niklasson and Björkner (1990)
2,6-Dichloropurine (5451-40-1)	1% pet	Intermediate in pharmaceutical industry	Rycroft (1981)
Dicyclohexylcarbodiimide (DCCI) (538-75-0) <sup>a</sup>	0.1% pet	Coupling agent in protein synthesis	Bashir et al. (2007)
Dicyclohexylmethane-4,4'-diisocyanate (5124-30-1)	1% pet	Isocyanate glue	Frick et al. (2003)
Difolatan (captafol, 2425-06-1)	0.1% pet	Fungicide	Brown (1984)
2,4-Dinitrofluorobenzene (DNFB) (70-34-8)	0.01% acet	Sanger reagent	Garcia-Perez (1978)
Diphenylcyclopropenone (diphencyprone, DPCP) (886-38-4)	0.01% acet	Organotin compounds	Sansom et al. (1995)
2,3-Epoxypropyltrimethylammonium chloride (3033-77-0)	0.5% pet	Cationizing reagents	Estlander et al. (1997)
1,2-Ethanedithiol (540-63-6)	1% pet	Building block in organic synthesis	Tjiu et al. (2004)
Ethoxylated acrylate (EEA)	0.1% acet	Impregnation emulsions	Matura et al. (1995)
Ethoxymethylenemalononitrile (123-06-8)	0.01% pet	Herbicide intermediate	Wakelin et al. (1998)
Ethyl bromoacetate (105-36-2)	1% pet	Synthesizing a new pharmaceutical product	Hernández-Machín et al. (2005)
Ethyl chloro oximido acetate (14337-43-0)	0.1% pet	Reagent	Hausen (1992)
Glycidyl methacrylate (GMA) (106-91-2)	1% pet	Impregnation emulsions	Matura et al. (1995)
N-Hydroxyphthalimide (524-38-9)	0.1% alc	Peptide synthesis	Lang and Hensel (1987)
Iodoacetamide (CAS 144-48-9)	0.01% pet	Alkylation of proteins	Aalto-Korte et al. (2002)
Iodoacetoneitrile (624-75-9)	0.001% pet	Chemical synthesis	Foti et al. (2011)

(continued)

**Table 3** (continued)

Contact allergen – chemical name (CAS number)	Test substance <sup>b</sup>	Use or work task	References
Kitasamycin tartrate (37280-56-1)	100%	Antibiotics	Dooms-Goossens et al. (1990)
Mercury metal	0.5% pet	Reagents	Thomas et al. (1997)
Methacrylates	2% pet	Development of solder-resistant inks	Craven et al. (1999)
Methyl 4-hydroxy-2-hexynoate (112780-04-8)	0.1 pet	Chemical synthesis	Bassi et al. (2008)
2[4(5) methyl-5(4)-imidazolymethylthio]-C <sub>13</sub>	0.1% pet	H2 antagonist synthesis	Camarasa and Alomar (1980)
Midecamycin (35457-80-8)	100%	Antibiotics	Dooms-Goossens et al. (1990)
Nickel nanoparticles	200 µg/cm <sup>2</sup>	Polymer chemistry	Journey and Goldman (2014); Anderson et al. (2010)
<i>p</i> -Nitrobenzoyl chloride (122-04-3)	1% pet	Procaine synthesis	Foussereau (1989)
<i>p</i> -Nitrobenzyl bromide (100-11-8)	0.1% acet	Alkylating agent	Thompson et al. (1998)
4-Nitrophenyl-N-(2-chloroethyl)carbamate	0.001% acet	Synthesis of antitumor agents	Niklasson et al. (1990)
4-Nitrophenyl-N-(2-chloroethyl)-N-nitrosocarbamate (55661-42-2)	0.01% acet	Synthesis of antitumor agents	Niklasson et al. (1990)
Oxolamine (tannate) (959-14-8)	0.1% aqua	Antitussive agent	Conde-Salazar et al. (1984)
2, Phenyl tetralone tosylhydrazone	0.5% MEK	Synthesis of hydrazones	Curley et al. (1986)
Ranitidine (66357-35-5)	10% pet	H2 antagonist	Romaguera et al. (1990)
Ranitidine intermediates (cystopur and MTM)	0.5% pet	H2 antagonist synthesis	Romaguera et al. (1990)
Tego Diocto S <sup>®</sup> (Diocetyl trioctyl diethylenetriamine)	1% pet	Disinfectant	Piraccini et al. (1991)
Tetrafluoroterephthalonitrile (1835-49-0)	0.01% pet	Insecticide intermediate	Carmichael et al. (1989)
Tosyl chloride ( <i>p</i> -Toluenesulfonyl chloride) (98-59-9)	1% alc	Reagent in organic synthesis	Watsky et al. (1993)
3,4,6-Trichloropyridazine (6082-66-2) <sup>a</sup>	<<<1% pet	Drug intermediate	Dooms-Goossens et al. (1986)
Trifluoroacetic acid (76-05-1)	1% aqua	Organic synthesis	Byun et al. (2013)
Triglycidyl isocyanurate (2451-62-9)	0.5% pet	Development of solder-resistant inks	Craven et al. (1999)
4-Vinylpyridine (100-43-6) <sup>a</sup>	0.01 IPA	Polymer chemistry	Bergendorff and Wallengren (1999)

*acet* acetone, *alc* alcohol, *IPA* isopropyl alcohol, *MEK* methyl ethyl ketone, *pet* petrolatum

<sup>a</sup>Risk of patch test sensitization (De Groot 2018)

<sup>b</sup>Some of the test concentrations have been updated according to De Groot (2018)

**Table 4** Causative agents of contact urticaria found in case reports (for animals, see ► Chap. 5, “Occupational Dermatology: Ethical Aspects”)

Causative agent	References
Diethyl fumarate	White and Cronin (1984)
Enzymes	Vanhanen et al. (1997)
Gerbera	Estlander et al. 1998
Natural rubber latex	Jolanki and Kanerva (2000)
Pyridine carboxaldehyde	Archer and Cronin (1986)

## References

- Aalto-Korte K, Jolanki R, Suuronen K et al (2002) Biochemist's occupational allergic contact dermatitis from iodoacetamide and acrylamide. *Contact Dermatitis* 47:361–362
- Abbott RA, White JML, White IH (2009) Occupational allergic contact dermatitis in a chemist. *Contact Dermatitis* 60:233–234
- Anderson KE, White IR, Goossens A (2010) Allergens from the European baseline series. In: Johansen J, Frosch P, Lepoittevin JP (eds) *Contact dermatitis*, 5th edn. Springer, Berlin, pp 545–590
- Archer CB, Cronin E (1986) Contact urticaria induced by pyridine carboxaldehyde. *Contact Dermatitis* 15:308–309
- Bashir SJ, Ryan PJ, McFadden JP et al (2007) Contact dermatitis from dicyclohexylcarbodiimide. *Contact Dermatitis* 56:151–152
- Bassi N, Beck MH, Fawcett RL (2008) Allergic contact dermatitis from 4-chloro-2-[methylthio]pyrimidine-5-carboxylic acid ethyl ester and methyl 4-hydroxy-2-hexynoate in a laboratory chemist. *Contact Dermatitis* 58:115–116
- Bergendorff O, Wallgren J (1999) 4-Vinylpyridine-induced dermatitis in a laboratory worker. *Contact Dermatitis* 40:280–281
- Berne B, Tammela M, Farm G, Inerot A, Lindberg M (2008) Can the reporting of adverse skin reactions to cosmetics be improved? A prospective clinical study using a structured protocol. *Contact Dermatitis* 58:223–227
- Brown R (1984) Contact sensitivity to Difolatan (Captafol). *Contact Dermatitis* 10:181–182
- Byun JY, Woo JY, Choi YW, Choi HY (2013) Occupational airborne contact dermatitis caused by trifluoroacetic acid in an organic chemistry laboratory. *Contact Dermatitis* 70:63–64
- Camarasa G, Alomar A (1980) Contact dermatitis to an H2 antagonist. *Contact Dermatitis* 6:152–153
- Carmichael AJ, Foulds IS, Sadrha S (1989) Allergic contact dermatitis from tetrafluoroterephthalonitrile and TFX diamine. *Contact Dermatitis* 20:233–234
- Chew A, Maibach HI (eds) (2000) *Irritant dermatitis*. Springer, Berlin
- Conde-Salazar L, Guimaraens D, Romero L (1984) Occupational contact dermatitis from cytosine arabinoside synthesis. *Contact Dermatitis* 10:44–45
- Craven NM, Bhushan M, Beck MH (1999) Sensitization to triglycidyl isocyanurate, epoxy resins and acrylates in a developmental chemist. *Contact Dermatitis* 40:54–55
- Curley RK, MacFarlane AW, King CM (1986) Contact dermatitis to 2, phenyl tetralone tosylhydrazone. *Contact Dermatitis* 14:257–258
- De Groot AC (2018) Patch testing. Test concentrations and vehicles for 4900 chemicals, 4th edn. Acdegroot, Wapserveen
- Dooms-Goossens A, de Boule K, Snauwaert J et al (1986) Sensitization to 3,4,6-trichloropyridazine. *Contact Dermatitis* 14:64–65
- Dooms-Goossens A, Bedert R, Degreef H et al (1990) Airborne allergic contact dermatitis from kitasamycin and midecamycin. *Contact Dermatitis* 23:118–119
- Dooms-Goossens A, Garmyn M, Degreef H (1991) Contact allergy to acrylamide. *Contact Dermatitis* 24:71–72
- Estlander T, Jolanki R, Kanerva L (1997) Occupational allergic contact dermatitis from 2,3-epoxypropyl trimethyl ammonium chloride (EPTMAC) and Kathon LX in a starch modification factory. *Contact Dermatitis* 36:191–194
- Estlander T, Kanerva L, Tupasela O, Jolanki R (1998) Occupational contact urticaria and type I sensitization caused by gerbera. *Contact Dermatitis* 38:118–120
- Foti C, Soleo L, Romita P, Vestita M, Antonella B, Antelmi A (2011) Occupational erythema multiforme-like contact reaction to iodoacetamide in a chemistry student. *Contact Dermatitis* 64:180–181
- Foussereau J (1989) Accidental occupational sensitization to p-nitrobenzoyl chloride in a chemistry student synthesizing procaine. *Contact Dermatitis* 20:397–398
- Frick M, Björkner B, Hamnerius N et al (2003) Allergic contact dermatitis from dicyclohexylmethane-4,4'-diisocyanate. *Contact Dermatitis* 48:305–309
- Garcia-Perez A (1978) Occupational dermatitis from DNFB with cross sensitivity to DNCB. *Contact Dermatitis* 4:125–127
- Gimenez-Arnau AM, Maibach HI (2015) *Contact Urticaria syndrome*. CRC Press, Boca Raton
- Goossens A, Deschutter A (2003) Acute irritation followed by primary sensitization to 2-cyclohexen-1-one in a chemistry student. *Contact Dermatitis* 48:163–164
- Hausen BM (1992) Occupational allergic contact dermatitis from ethyl chloro oximido acetate. *Contact Dermatitis* 27:277–278. [Erratum (1993) *Contact Dermatitis* 28:312]
- Hernández-Machin B, Ortiz-Frutos FJ, Vanaclocha-Sebastian F (2005) Occupational allergic contact dermatitis in a chemist from ethyl bromoacetate and bromoacetonitrile. *Contact Dermatitis* 52:115–116
- Hodgson C (1980) Chlorovinylidichloropyrimidine. *Contact Dermatitis* 6:361
- Jolanki R, Kanerva L (2000) Chemists. In: Kanerva L, Elsner P, Wahlberg JE, Maibach HI (eds) *Handbook of occupational dermatology*. Springer, Berlin, pp 882–885
- Journey WS, Goldman RH (2014) Occupational handling of nickel nanoparticles: a case report. *Am J Ind Med* 57:1073–1076
- Kerre S, Demoor A, Sarmyn E, Van Beylen M, Dooms-Goossens A (1995) Contact dermatitis from alpha-bromomethylparatolylsulfone. *Contact Dermatitis* 33:130
- Lammintausta K, Neuvonen H (2008) Airborne allergic contact dermatitis from 4-(bromomethyl)benzoic acid in a university chemist. *Contact Dermatitis* 58:314–315
- Lang MH, Hensel O (1987) Kontaktallergie gegen Dicyclohexylcarbodiimid und N-Hydroxyphthalimid (in German). *Derm Beruf Umwelt* 35:212–213
- Le Coz CJ, Lepoittevin JP (2001) Occupational erythema-multiforme-like dermatitis from sensitization to costus resinoid, followed by flare-up and systemic contact

- dermatitis from  $\beta$ -cyclocostunolide in a chemistry student. *Contact Dermatitis* 44:310–311
- Matura M, Poesen N, de Moor A, Kerre S, Dooms-Goossens A (1995) Glycidyl methacrylate and ethoxyethyl acrylate: new allergens in emulsions used to impregnate paper and textile materials. *Contact Dermatitis* 33:123–124
- Niklasson B, Björkner B (1990) Contact allergy to 3,4-dicarbethoxyhexane-2,5-dione. *Contact Dermatitis* 23:46–47
- Niklasson B, Björkner B, Hansen L (1990) Occupational contact dermatitis from antitumor agent intermediates. *Contact Dermatitis* 22:233–235
- Piraccini BM, Peluso A, De Maria P, Tosti A (1991) Occupational contact dermatitis due to the disinfectant Tego Diocto S. *Contact Dermatitis* 24:228–229
- Romaguera C, Grimalt F, Vilaplana J (1990) Contact dermatitis caused by intermediate products in the manufacture of clenbuterol, ranitidine base, and ranitidine hydrochloride. *Dermatol Clin* 8:115–117
- Rothe A (1988) Contact dermatitis from N-( $\alpha$ -chlorobenzylidene)phenylhydrazine. *Contact Dermatitis* 18:16–19
- Rycroft RJ (1981) Occupational contact sensitization to 2,6-dichloropurine. *Contact Dermatitis* 7:349–350
- Rycroft RJ (1983) Allergic contact dermatitis from a novel diamino intermediate, 5-[(2-aminoethyl)thiomethyl]-N,N-dimethyl-2-furanmethanamine, in laboratory synthesis. *Contact Dermatitis* 9:456–458
- Rycroft RJ, Menne T, Frosch PJ (eds) (1995) *Textbook of contact dermatitis*, 2nd edn. Springer, Berlin, pp 351
- Sansom JE, Molloy KC, Lovell CR (1995) Occupational sensitization to diphenylprone in a chemist. *Contact Dermatitis* 32:363
- Sonnex TS, Rycroft RJ (1986) Allergic contact dermatitis from chloromethyl heterocyclic intermediates in the synthesis of a histamine antagonist. *Contact Dermatitis* 14:265–267
- Susitaival P, Hannuksela M (1997) Animal and animal products. In: Amin S, Lahti A, Maibach HI (eds) *Contact urticaria syndrome*. CRC Press, Boca Raton, pp 95–105
- Thomas P, Rueff F, Przybilla B (1997) Airborne allergic contact dermatitis from mercury in a chemistry student. *Contact Dermatitis* 37:297–298
- Thompson R, Finn AM, Rycroft RJ (1998) Allergic contact dermatitis from para-nitrobenzyl bromide. *Contact Dermatitis* 38:232
- Tjiu JW, Chu CY, Sun CC (2004) 1,2-ethanedithiol-induced erythema multiforme-like contact dermatitis. *Acta Derm Venereol* 84:393–396
- Tomb RR, Lepoittevin J, Caussade P (1991) Contact allergy to 2-aminophenyl disulfide. *Contact Dermatitis* 25:196–197
- Valsecchi R, Rohrich O, Cainelli T (1989) Contact allergy to cistoran, an intermediate in ranitidine synthesis. *Contact Dermatitis* 20:396–397. [Erratum (1990) *Contact Dermatitis* 23:128]
- Van Ketel WG (1984) Allergy to benzylamine and benzyl-1-amino-3-chloro-2-hydroxypropane. *Contact Dermatitis* 11:186
- Vanhanen M, Tuomi T, Nordman H, Tupasela O, Holmberg PC, Miettinen M, Mutanen P, Leisola M (1997) Sensitization to industrial enzymes in enzyme research and production. *Scand J Work Environ Health* 23:385–391
- Verlinden V, Gloossens A (2003) Airborne occupational allergic contact dermatitis from N, N-bis[2-bromoethyl] aniline and N, N-bis [2-[(methylsulfonyl)-oxy]ethyl]aniline in a chemistry student. *Contact Dermatitis* 49:169
- Wakelin SH, Price AE, Basketter DA, Rycroft RJ (1998) Allergic contact dermatitis from ethoxymethylenemalononitrile in an agrochemical chemist. *Contact Dermatitis* 38:237
- Wakelinj SH, Cordina G, Basketter D, White IR (1997) Contact sensitivity to 1-(4-(2-chloroethyl)phenyl)-2-chloroethanol in a polymer chemist. *Contact Dermatitis* 37:39–40
- Warsaw TG (1988) Primary irritant effect of 3,4,5-trichloropyridazine. *Contact Dermatitis* 18:257–258
- Watsky KL, Reynolds K, Berube D, Bayer FJ (1993) Occupational contact dermatitis from tosyl chloride in a chemist. *Contact Dermatitis* 29:211–212. [Comment (1995) *Contact Dermatitis* 32:124–125]
- White IR, Cronin E (1984) Irritant contact urticaria to diethyl fumarate. *Contact Dermatitis* 10:315