

2602. LONG-TERM EXPOSURE TO VINYL CHLORIDE

Jüho, Susanne u. Lange, C.-E. (1972). Sklerodermieartige Hautveränderungen, Raynaud-Syndrom und Akroosteolysen bei Arbeitern der PVC-herstellenden Industrie. Dt. med. Wschr. 97, 1922.

Exposure to about 300 ppm vinyl chloride may have an adverse effect on liver function (BIBRA Bull. 1972, 11, 492), and under certain circumstances industrial exposure to vinyl chloride may be followed by softening of the bones of the extremities, by neurological and circulatory disturbances and by liver enlargement.

The paper cited above describes seven patients who reported symptoms of illness after working for 1-3.5 yr on polymerization processes for PVC production. Their symptoms included hypersensitivity to cold, paraesthesia, deafness, blanching of the fingers, pressure-pain in the finger-tips and loss of grip. Later, swelling of the terminal finger joints and changes in the nails developed. In single cases, failure of vision, abdominal pain or giddiness was reported. Five patients developed Raynaud's syndrome, five a drumstick-type thickening of the finger-tips and prominent hour-glass deformation of the nails, and five had swollen fingers with nodular infiltration of the finger webs, the back of the hand and the region distal to the elbow. Banded osteolysis of the terminal phalanges of the fingers appeared in five of the seven.

Clinical tests showed indications of liver dysfunction in two of the patients and obstructive respiratory disease in one. Three patients showed skin changes characteristic of the early inflammatory stage of a progressive scleroderma. So far, the pathogenesis of this array of effects remains obscure.

given in vivo selectively inhibits for 10-60 min a nucleoplasmic type of RNA polymerase in rat liver but the synthesis in vivo of all species of bear RNA remains blocked for several hours.--J. F. L.

3 BROOKS, ROBERT D. Jr. and JAMES A. VICK. (Dep. Pharmacol., Walter Reed Army Inst. Res., Walter Reed Army Med. Cent., Washington, D. C. 20012, USA.) Toxicological studies of bee venom in mice, dogs and monkeys. AMBEE J 112(7): 250-251, 1972.--Venom of *Apis mellifera* was injected, either i.v. or s.c., into experimental animals. I.V. injections caused a precipitous decrease in blood pressure within 35 sec in both dogs and monkeys. It also decreased heart rate and depressed respiration. Dosages of 5 mg/kg in dogs, or 2.5 mg/kg in monkeys, i.v., caused death from cardiovascular failure. Similar responses were noted after s.c. injections, but median lethal dosages were higher: 200 mg/kg in dogs and 50 mg/kg in monkeys. The former is equivalent to about 2000 bee stings. Smaller dosages were fatal to mice. Other physiological reactions are noted.

--J. D. Hitchcock.

34772. ULANOVA, I. P., A. I. KHALEPO and A. I. EITINGON. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci. USSR, Moscow, USSR.) Issledovanie kumulyativnykh svoystv khimicheskikh soedinenii na porogovom urovne kak osnova prognozirovaniya khronicheskikh intoksikatsii. [Study into cumulative properties of chemical compounds at the threshold level as a basis for prognostication of chronic poisonings.] GIG TR PROF ZABOL 16(3): 36-39, 1972. [Engl. summ.]--Cumulative properties of chemical compounds at the threshold of their acute action were analyzed. Cumulation coefficients were deduced from the integral test changes and with reference to the summary-threshold value featuring the functional state of the nervous system. These coefficients proved to be much inferior to coefficients of cumulation determined with reference to the animal lethality figures. The cumulation coefficients at the threshold level supported a well-marked cumulative capacity of benzene, carbon tetrachloride, m-aminobenzotrifluoride and morpholine. This was supported by the data derived from chronic experiments, considering CCl₄ and benzene, also by the available clinical and hygienic observations. The estimated coefficient of correlation between the areas of chronic action and coefficients of cumulation for the substances under study at the threshold level was 0.99. This makes it possible to forecast possible developments of chronic poisoning. The investigation time was cut down to a maximum of 1 mo.--J. P. K.

1773. KOBULIYA, N. S., L. E. GEDYMIN, F. R. Effektivnost' AKHOVSKII i O. P. ARKHIPOVA. (Cent. Res. Inst. Tuberc., Min. Health USSR, Moscow, USSR.) Izuchenie pronitsaemosti gistogematicheskikh bar'erov pri razlichnykh rezhimakh giperbaricheskoi oksigenatsii v eksperimente. [Permeability of histo-haematic barriers in different regimes of experimental hyperbaric oxygenation.] EKSP KHIR ANESTEZIOL 17(2): 31-33, 1972. [Engl. summ.]--Experimentally, 70 guinea pigs were subjected to 100% O₂ in therapeutic (1-2.2 up to 3 ata) and toxic (4-5 ata) regimes of hyperbaric oxygenation for 1-4 hr. Histology and radioactive indication (with streptomycin-³⁵S in 20,000 U/kg and with 14.2 μCi activity in 1 ml) were used to assess various permeability levels in the histo-haematic barriers of the lungs, liver, kidneys, spleen, myocardium and brain. Toxic regimes were accompanied by a universal increase of vascular walls permeability, conditioned by structural lesions of the histo-haematic barriers. With therapeutic regimes, vascular permeability rose only in the spleen, liver and kidneys, i.e., in the organs with an increasing functional activity under hyperbaric oxygenation, and was not accompanied by histo-structural changes of the main elements of the histo-haematic barrier.

--J. L. S.

34774. CONDER, D. W., P. C. OLOFFS and Y. S. SZETO. (Pestol. Cent., Dep. Biol. Sci., Simon Fraser Univ., Burnaby 2, B. C., Can.) GLC separation of heptachlor epoxide oxychlorane, α- and γ-chlordane. BULL ENVIRON CONTAM TOXICOL 7(1): 33-35, 1972.--GLC [gas liquid chromatography] columns were used to identify and quantitate organochloride pesticide residues. Such as 3% OV 1, 2% SE 30 plus 6% OV 1, or 2% OV 1 plus 6% OV 210. They did not satisfactorily separate the compounds of α-chlordane, γ-chlordane oxychlorane and heptachlorepoide. Gas chromatograph Micro Tek MT 220 with N1-63 electron capture detector method was employed in this experiment.

--J. P. K.

34775. WALTSCHEWA, W. (Forschungsinst. Arbeitsschutz, Berufschr., Blvd. Petko Napetov 34, Sofia, Bulg.), M. SLATEWA and I. MICHAÏLOW. Hodenveränderungen bei weissen Ratten durch chronische Verabreichung von Nickelsulfat. [Testicular changes due to long-term administration of nickel sulfate in rats.] EXP PATHOL (JENA) 6(3/4): 116-120, 1972. [Engl. summ.]--Following long-term nickel-sulfate intoxication in rats, severe lesions in the germ cells and spermatogenesis could be demonstrated. Very few changes were observed in the livers and kidneys. Nickel sulfate had a selective effect on testicular parenchyma.--A. B. M.

34776. BASALAEV, A. V., A. N. VAZIN and A. G. KOCHETKOV. (S. M. Kirov Gorki. Med. Inst., Gorki, USSR.) K patogenezu izmenenii, voznikayushchikh pri dlitel'nom vozdeistvii vinilkhlorda. [Pathogenesis

of changes developing due to long-term exposure to the effect of vinylchloride.] GIG TR PROF ZABOL 16(2): 24-27, 1972. [Engl. summ.]--Rabbits and rats which inhaled vinylchloride fumes in a maximal permissible concentration (0.03-0.04 mg/l), underwent a 6-mo. long all-round examination by physiological, biochemical, histomorphological and roentgenodensitometric methods. Changes in the bioelectric activity of the hypothalamus, hyperadrenalinemia and functional troubles of the cardiovascular system were disclosed. Development of resorptive manifestations in the bone tissue was brought out morphologically and osteoporosis--roentgenologically. An inference is drawn as to a key importance of hypothalamic dysfunction in the pathogenesis of the disease, this dysfunction giving rise to neurohumoral and neurovascular troubles leading to development of dystrophic processes in the bone tissue.--P. L.

34777. BAZIN, SUZANNE and ALBERT DELAUNAY. (CNRS, Inst. Pasteur, Serv. Pathol. Exp., 92-Garches, Fr.) Action exercée par des substances lathyrogènes sur le collagène de granulomes. [Action exerted by lathyrogenic substances on the collagen of granulomas.] C R HEBD SEANCES ACAD SCI SER D SCI NAT (PARIS) 274(4): 618-620, 1972.--Polyvinyl sponges were implanted s.c. in Wistar rats. Ten days later, penicillamine was given orally in a dose of 20 mg/100 g of weight. In another group, β-mercaptoethylamine was given in a dose of 0.5 mg/100 g, i.p. Granulomatous tissue surrounding the sponges and normal skin were extracted to give neutral and acid soluble collagen, collagen labile at 60° and insoluble collagen. Both drugs gave comparable results. They did not modify the total collagen of normal skin, but decreased the collagen of granulomatous tissue slightly. Neutral soluble collagen was increased and insoluble collagen decreased in both types of tissue. The labile collagen increased in the granuloma and diminished in the skin. The acid soluble collagen increased 200% in the granuloma and 30% in the skin. Intermolecular bonds in collagen which are sensitive to lathyrogens are comparable in granuloma and in normal skin.--M. D. S.

34778. KUDZINA, G. D. and D. I. GOLOVAN'. (A. N. Marzeeva Kiev Res. Inst. Gen. Public Hyg., Kiev, USSR.) Sravnitel'naya otsenka gerbitsidov gruppy khlorbenzoinoi kisloty sanitarno-toksikologicheskim metodom i metodom kul'tur kletok. [Comparative sanitary-toxicological and cell-culture evaluation of the chlorbenzoic acid herbicide group.] VRACH DELO 1: 125-128, 1972. [Engl. summ.]--Data of chronic sanitary-toxicological experiment on rabbits and a study of the effect of chlorbenzoic herbicide group indicate that the results by these 2 methods concerning the toxicity of the herbicides coincided. The use of cell-culture method for rapid hygienic evaluation of the toxicity of some herbicides is promising and further investigations of this method are justified.--P. L. W.

34779. COOPER, PHILIP and STEPHEN H. TOLINS. (Dep. Surg., Bronx Veterans Admin. Hosp., Bronx, N. Y. 10463, USA.) Relationship between smoking history and complications immediately following surgery for duodenal ulcer. MT SINAI J MED 39(3): 287-292, 1972.--No evidence is given of an association between smoking and complications, nor between smoking and operative mortality, nor between smoking and days to discharge. The most obvious trend is probably predictable, namely, patients over 50 have more complications and a higher mortality rate than those under 50. In spite of the relatively large number of patients included in this report the smoking habits, the age distribution, and disease rate in the population studied are quite likely to differ from the general population. Some inconsistencies were found between smoking histories taken on the same patient at different times. This may have resulted from the quality and accuracy of the information given to the examiner by the patient. Few, if any, generalities should be drawn from this research. Results apply only to immediate postoperative findings and do not apply to long-range effects of smoking upon the patient after surgery for duodenal ulcer disease.--E. M. D.

34780. LISITS, F. M. and L. A. MOTROVA. (Fac. Postgrad. Med., Riga Med. Inst., Riga, USSR.) O klinicheskikh osobennostyakh alkohol'nykh polinevritov. [Clinical traits of alcoholic polyneuritis.] ZH NEVROPATOL PSIKHIATR IM S S KORSAKOVA 72(5): 647-651, 1972. [Engl. summ.]--The traits of alcoholic polyneuritis in 27 patients were studied. Four main clinical variants of the disease were distinguished. The most characteristic and frequent form of alcoholic polyneuritis was the syndrome of sluggish paralysis in the parts of the lower extremities. A more common and mixed form of polyneuritis, sensorial and atactic forms, were rarely observed.--J. P. K.

34781. STEGER, ROBERT E. (Coop. Ext. Serv., N. M. State Univ., Las Cruces, N. M., USA.) Native plants poisonous to humans. J RANGE MANAGE 25(1): 71-72, 1972.--A summary is given of the toxic principles, the plants, toxic parts, symptoms and some general comments for several commonly toxic plants in the U.S.A.--D. T. S.

34782. PARIS, RENE-RAYMOND and ANNE-MARIE TESSIER. (Fac. Pharm., Lab. Matière Méd., 4-ave. Observatoire, 75-Paris 6, Fr.) Presence de substances du groupe des Cucurbitacines chez diverses Euphorbiacées toxiques africaines, notamment chez Maprounea membranacea Pax et K. Hofm. [Presence of substances of the group of cucurbitacines in various African toxic Euphorbiaceae especially in Ma-

ENVIRONMENTAL AND INDUSTRIAL TOXICOLOGY

See also: Public Health; Occupational Health, Radiation Health

11445. JONES, R. D. (Pharm. Div., I. C. I. Ltd., Alderley Park, Macclesfield, Cheshire, Engl., UK.), B. T. COMMINS and A. A. FRANK. Blood lead and carboxyhaemoglobin levels in London taxi drivers. *LANCET (NORTH AM ED)* 2(7772): 302-303, 1972.--Among 50 London taxi drivers the mean blood-lead was 28.7 $\mu\text{g}/100\text{ ml}$. There was no difference of statistical significance in the blood-levels of smokers and non-smokers, nor between the blood-leads of night-shift and day-shift drivers. Carboxyhaemoglobin levels of smokers were significantly higher than those of non-smokers, and the levels were significantly higher in day drivers than in night drivers.
11446. MC ENTIRE, MATILDA S. and CAROL R. ANGLE. (Dep. Pediatr., Univ. Nebr. Coll. Med., Omaha, Nebr. 68105, USA.) Air lead: Relation to lead in blood of black school children deficient in glucose-6-phosphate dehydrogenase. *SCIENCE (WASH)* 177(4048): 520-522, 1972.--Black children (44) at 2 elementary schools within 0.7 mi of a battery plant had significantly higher ($P < 0.01$) concentrations of Pb in their bloods (34.1 ± 9.7 , $\mu\text{g}/100\text{ mm}$, mean $\pm$ SD) than 122 students (26.3 ± 7.1) at 7 schools 1-3 mi distant; 5 mo. later there was a comparable difference between red cell Pb values (54.1 ± 18.5 vs. 37.4 ± 12.6). Among the blacks, those deficient in glucose-6-phosphate dehydrogenase had a higher ($P < .005$) concentration of Pb in the blood after correction for anemia (32.9 ± 9.7) than the nondeficient (25.7 ± 8.8), and a higher concentration in the red cells (47.3 ± 14.7 as compared to 35.6 ± 15.8 , $P < .001$); the enzyme effect was independent of geographic location.
11447. MARKOWITZ, SAUL S., CHARLES J. MC DONALD (Roger Williams Gen. Hosp., 825 Chalkstone Ave., Providence, R. I. 02908, USA.), WILLIAM FETHERE and MARVIN S. KERZNER. Occupational acroosteolysis. *ARCH DERMATOL* 106(2): 219-223, 1972.--Occupational acroosteolysis is an unusual disease in which affected persons have sclerodermoid-like lesions of the skin, conditions similar to Raynaud's phenomenon, and asymptomatic, bony defects of the extremities. Evidently, the disease is confined solely to workers in the plastics industry, specifically those engaged in the production of polyvinyl chloride from vinyl chloride. The incidence of the disease is unknown but is thought to occur in 3% or less of workers.
11448. WILDISH, D. J. (Fish. Res. Board, Can. Biol. Stn., St. Andrews, N. B., Can.) Acute toxicity of polyoxyethylene esters and polyoxyethylene ethers to *S. salar* and *G. oceanicus*. *WATER RES* 6(7): 759-762, 1972.--Polyoxyethylene ethers are more toxic to aquatic fauna than polyoxyethylene esters. Polyoxyethylene (4) lauryl ether is 9 times more toxic than polyoxyethylene (14) monolaurate at the LL (incipient lethal levels) to *Salmo salar* and 14,000 times more toxic at the 96-hr LC50 [lethal concentration median] to *Gammarus oceanicus* Sergestrale.
11449. HOFMANN, A. (Inst. Toxikol., E. Merck Darmstadt, D-6100 Darmstadt 2, West Ger.) and M. NEUFELDER. Tierexperimentelle Untersuchungen zur gewerbetoxikologischen Beurteilung von 2-chloräthylisocyanat. [An investigation of 2-chloroethyl isocyanate in laboratory animals with regard to the implications as a potential occupational hazard.] *ARCH TOXIKOL* 29(1): 73-84, 1972. [Engl. summ.]--The acute oral toxicity of 2-chloroethyl isocyanate (CAIC) is 396 mg/kg for male rats and 630 mg/kg for female mice. The extremely small quantity of 5 μl CAIC caused severe irritation in the eyes of rabbits, particularly of the conjunctiva. The skin was also affected considerably. Inhalation experiments, involving a new version of a proven method for generating air-vapor mixtures, produced no evidence of systemic toxicity, but let CAIC be classified as an irritant vapor to the respiratory tract. The LC50 for rats is 6.3 ppm after exposure for 6 hr, while rats in 2 experiments involving 10-day exposures to vapor concentrations of 3.1 and 3.8 ppm, respectively, survived. After a fortnight's withdrawal following each experiment, histological examinations showed tracheobronchitis and bronchopneumonia but no pathological change in any other organ examined. A threshold limit value (TLV) of 0.02 ppm was suggested.
11450. JOSE, FRANCISCO R. (Dep. Physiol. Hyg. Nutr., Univ. Philipp., Manila, Philipp.) A study of lead hazard in some lead processing industries. *ACTA MED PHILIPP* 8(2): 48-54, 1972.--Two battery plants, 2 paint establishments and 1 company manufacturing lead oxide were studied to evaluate the extent and intensity of Pb hazard. Methods of evaluation used were levels of Pb in air, and urinary Pb, stippled red cell count and clinical manifestations suggestive of Pb intoxication among employees in the establishments. Levels of Pb in air, Pb concentration in the urine and stippled red cell count were higher in the lead oxide and battery plants than in those engaged in paint manufacturing. Clinical manifestations suggestive of Pb poisoning were also more frequent. Good correlation was observed between the laboratory findings and the clinical manifestations indicative of mild Pb poisoning.
11451. GOODWIN, JOHN W. (Day, Zimmermann, Inc., Lone Star Div., Texarkana, Tex. 75501, USA.) Twenty years handling TNT in a shell loading plant. *AM IND HYG ASSOC J* 33(1): 41-44, 1972.--In the handling of TNT within the munitions industry, human exposure to this substance cannot be completely avoided. The goal of a Preventive Medical Program is to prevent such exposures from causing any permanent damage to workers. Exhaust ventilation with wet scrubbers, use of protective clothing, mandatory practice of good personal hygiene, and careful medical supervision have combined to accomplish this goal. The use of the Thymol Turbidity Test in such a program was a valuable indicator of liver malfunction.
11452. KRAMER, C. G. (Dow Chem. Co., Midland, Mich. 48640, USA) and J. E. MUTCHLER. The correlation of clinical and environmental measurements for workers exposed to vinyl chloride. *AM IND HYG ASSOC J* 33(1): 19-30, 1972.--A method is described for the statistical consolidation and correlation of environmental measurements and clinical findings using as an example a group of healthy male workers exposed routinely to vinyl chloride for periods up to 25 yr. Retrospective in nature the study reveals several statistically significant effects from chronic exposures to vinyl chloride and traces of vinylidene chloride.
11453. EL-DAKHAKHNY, ABDEL-ARIZ and YASSIN M. EL-SADIK. (Dep. Occup. Health, High Inst. Public Health, Alexandria Univ., Alexandria, UAR.) Lead in hair among exposed workers. *AM IND HYG ASSOC J* 33(1): 31-34, 1972.--In a study performed on 67 Pb exposed workers, a correlation was found between levels of Pb in hair and the biochemical and clinical findings. A Pb level in hair of more than 30 $\mu\text{g}/\text{g}$ could be considered as a sign of excessive Pb level.
11454. LAUWERYS, R., R. DELBROECK and M. D. VENS. (Unite Toxicol. Pathol. Travail, Catholic Univ. Louvain, Ave. Chapelle-aux Champs 4, 1200 Brussels, Belg.) Automated analysis of delta-amino-laevulinic acid in urine. *CLIN CHIM ACTA* 40(2): 443-447, 1972.--The addition of an internal standard of δ -aminolevulinic acid to the urine allows the colorimetric determination of this metabolite without the need of a preliminary chromatographic separation. The speed and accuracy make the procedure suitable for the periodic control of workers exposed to Pb.
11455. MIKSIC, J. and S. HUKOVIC. (Inst. Farmakol. Tiskol., Med. Fak., Sarajevo, Yugosl.) Uzroci nastajanja kroničnog opstruktivnog bronhitisa u radnika crne metalurgije. [Causes of chronic obstructive bronchitis in ferrous metallurgy workers.] *ARCH HIG RADA TOKSIKOL* 22(1): 9-32, 1971 [recd. 1972]. [Engl. summ.]--An analysis was performed on 400 people working and living under different conditions of exposure to air pollution. Respiratory symptoms were questioned and the ventilation function of the lungs, O_2 and CO_2 content of arterial blood, presence of allergic phenomena, data on smoking habits and the consequences in pulmonary and cardiovascular systems were studied. The 8 metal ions that constituted the dust were investigated. Experiments were also performed on frogs (*Rana ridibunda*).--J. F. L.
11456. GONCHARUK, E. I., A. A. POLYANSKII, I. I. SHVAIKO and A. A. CHIKIN. (Dep. Public Hyg., Kiev Med. Inst., Kiev, USSR.) Fazovye izmeneniya funktsii shchitovidnoi zhelezy u krysi pri khronicheskom vozdeistvii dibromantina. [Phase alterations of thyroid function in rats exposed to the chronic activity of dibromanthin.] *GIG SANIT* 36(10): 108-109, 1971 [recd. 1972].--The functional condition of the thyroid was studied in rats with 1-131 after drinking H_2O with dibromanthin concentrations close to those found in swimming pools disinfected with this chemical. In the 1st mo., there was some excitation of thyroid function. In a 4 mo. experiment, this latter effect was replaced at later periods by pronounced inhibition. Harmful effects on humans are not certain.--N. L. G.
11457. FROLOVA, A. D. [On the methods of studying biotransformation of poisons in organisms.] *PRAC LÉK* 24(2/3): 61-66, 1972. [Czech, and Engl. summ.]--The mechanism of the toxic effect of industrial poisons was discussed. The lack of methods for identification of chemical substances and products of their transformation in biologic material, made these studies rather difficult. Simple methodic approach affording indirect assessment of the fate of foreign substances in the organism had not yet lost its importance. The effectiveness of proposed simple procedures for studies of the fate of poisons was demonstrated with 3 representatives from the series of fluorinated compounds.--J. A. L.
11458. FISEROVA-BERGEROVA, VERA (Reprints: Vera Fiserova-Bergerova Thomas, 145 S.E. 25th Road, Miami, Fla. 33129, USA.) and J. LUDVIK CETTL. Elektricky model pro vstrebavani metabolismu s vyhucovani benzenu u cloveka. [Electric model for the absorption metabolism and excretion of benzene in man.] *PRAC LÉK* 24(2/3): 66-60, 1972. [Russ. and Engl. summ.]--The values for the resistance and capacities in the electrical analogue were derived by analogy to physiological factors for a 70 kilo man (blood flow in tissue,

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THE STATE OF THE ANALYZER FUNCTIONS DURING CHRONIC OCCUPATIONAL
INTOXICATION WITH CERTAIN SUBSTANCES HAVING A NARCOTIC EFFECT

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Professional'noy Intoksikatsii Nekotorymi Veshchestvami," Gig.Truda, 9,
pp. 19-22, 1972.

Soviet literature contains a significant number of publications devoted to the study of analyzer functions during various forms of occupational pathology (E. A. Drogichina et al.; L. G. Okhyanskaya; V. G. Osipova and L. G. Okhnyanskaya; Z. F. Nestrugina; B. A. Atchabarov et al., and others). In a number of studies the high sensitivity of certain analyzers to the effect of toxic agents is pointed out.

Thus, according to the data of V. Ye. Ostapovich et al., the vestibular apparatus has an elevated sensitivity to substances which exert a narcotic effect (benzine, vulcanizing gases). A complex investigation of the analyzer functions having the goal of revealing the degree of involvement of each of the analyzers, as well as a study of the mechanisms of formation of their disorders during exposure to various harmful factors are of interest.

We studied the state of the basic analyzer functions (taste, olfactory, vestibular, auditory, visual) in 60 patients with a pronounced form (second and third stage) of occupational intoxication caused by inhalation exposure to narcotics. In half the patients (in 30) intoxication with unsaturated and chlorinated hydrocarbons (ethylene, propylene, vinylchloride, trichlorethylene, and others) was noted, while the remainder suffered from methylmethacrylate intoxication. The intoxication appeared as a syndrome of the so-called vegetative-sensory polyneuritis against a background of significant asthenization with the presence of more or less pronounced brain stem symptoms. The latter, in pronounced cases, were represented by profound oculomotor disorders (strabismus of the -[illegible]- Maghandi variety, nystagmus, tremor of the eyeballs with the -[illegible]- phenomenon of them, and also by disorders of swallowing, with hypotrophy of the tongue, and hypothalamic paroxysms. In mildly pronounced cases one detected only mild oculomotor and trigeminal [Translator's note: the word is blurred, but it appears to be deficiency].

During the study of the analyzer functions the data of clinical examinations were used. Moreover, for investigating each of the analyzers individually, a combination of special methods were employed which made it possible to study excitation, lability, and their adaptational capacity. As a control, six practically healthy people of an analogous age composition were examined; these people had not been in contact with toxic substances (they were clinical associates of ours). The obtained numerical figures were statistically processed.

The most pronounced, clinically clear deviations were found with respect to the vestibular analyzer. In patients with gross brain stem symptoms, these deviations organically entered the clinical picture of intoxication and were evidenced by complaints of dizziness, indeterminate sensation of unsteady gait, sensation of the ground moving beneath the feet, and unsteadiness of surrounding objects.

Objectively during this process, close misses during the finger-nose test were revealed as well as unsteadiness in the Romberg position. Similar clinical signs of vestibular inadequacy were detected less seldom among a group of persons with microorganic brain stem symptoms and were also less pronounced. They were not found at all in the control.

The use of load tests made it possible to establish disorder of vestibular function among all patients, frequently identically pronounced on both sides. The caloric test proved most adequate. An investigation of caloric nystagmus (washing the outside auditory passage with 60 ml water at 19° for 10 seconds) in more than one-half of the patients revealed complete absence of vestibulo-motor reaction. In the remaining cases, a decrease in excitability of the vestibular apparatus was noted; this was manifested in lengthening of the latent period and shortening of the duration of nystagmus to 10-15 seconds (in the norm 60-80 seconds). In addition to this, in one-third of the patients (more frequently in patients with pronounced brain stem symptoms), the caloric test revealed an enormous vegetative reaction with whitening of the face, cold sweat, bouts of vomiting with subsequent deterioration of overall condition for several hours or even days. The rotation test was particularly poorly tolerated by these patients. We refrained from carrying out this test further after two patients experienced short term respiratory failure during the test. An investigation of the optokinetic nystagmus in a significant portion of the patients revealed its rapid exhaustion with the appearance of "lapses" in tracking movements of the eyes. Active fixation of attention and glance (calculation of the hearing range) made possible an increase in the amplitude and uniformity of nystagmus in a number of cases.

The subjectively estimated disorders of visual function are intimately linked with the pathology of the vestibular analyzer. Most of these disorders were caused by the inadequacy of the oculomotor apparatus. An attempt actively to fix a glance on an object frequently caused dizziness, and a sense of nausea with reddening or paling of the face. In pronounced cases the patients were forced to refrain from reading and watching television transmissions. An investigation of the analyzer function in the indicated categories of patients was extremely difficult, while in certain of them (three) it proved to be impossible. In the absence of oculomotor disorders, most of the patients did not complain of disorders of vision. Nevertheless, an examination of the state of the visual analyzer -- adequate optic chronaxia, adaptation to darkness, and the critical frequency of blending flashes caused a change in all indices in most patients. The curve of adequate optic chronaxia was sharply altered. As a rule, it was of a fluctuating character, frequently with an increase toward the end of the investigation. The level of the curve reflecting the adaptation capacity of the visual analyzer principally decreased toward the end of the investigation. In an overwhelming majority of the patients, the critical frequency of merge blinks also proved to be diminished. With respect to the remaining analyzer functions investigated by us (auditory, taste, olfactory), none of the patients revealed any active complaints with respect to disorders affecting them. However in a special questionnaire, success was achieved in establishing inadequacy of certain of these in part of the subjects. This primarily pertains to the auditory analyzer. Thus, disorders in the sphere of the auditory analyzer appeared in the form of more difficult perception of the spoken voice with good hearability of sounds. In a number of cases poor tolerance to extreme noises was noted.

During an objective examination, in two-thirds of the patients a slight and most frequently identical bilateral decrease in hearing was revealed; this took the form of different types of audiometric curves. Somewhat more frequently, an ascending type of audiogram was found with a decrease in hearing with respect to low frequency tones down to 35-40 db. However, there were also curves with two slopes which were characterized by increased thresholds of both low and high frequency tones (up to 40-45 db) with preservation of normal hearing in the speech zone (1,000-2,000 Hz). In a number of cases a slight decrease in hearing throughout the entire frequency range was noted. In the control group the thresholds of tonal audiometry in both air and bone transmission were 0-10 db, which is in agreement with the data of the literature. With respect to the degree of functional mobility of the auditory analyzer, judgment was made by the maximum duplication of rhythmic stimuli and according to the critical interval of differentiating between two sounds. An increase in the interval of discretion was revealed as well as a decrease in the critical frequency of merging of sound bursts.

During the special examination of the taste analyzer by the drop stimulus method, taking into account the taste zones of the tongue, a statistically reliable increase in the threshold of noting bitterness was revealed (0.005 ± 0.00023) and with respect to sweet stimuli (3.4 ± 0.31) ($P < 0.01$). The sensitivity to acid and salt was within the limits of the norm in most patients. In a number of cases, in addition to an increase in the threshold of sensitivity, there was an inversion of the taste sensations: acid was perceived as salt while salt was perceived as acid or as a bitter taste. A residual effect was also frequently noted (up to 1-2 hours) after placing a bitter substance on the tongue.

Similar data were also obtained during a study of the olfactory analyzer. The investigation of olfactory function carried out by the Elsberg-Levi method revealed in most patients an increase in the threshold of olfactory sensitivity to thymol and camphor to 16-18 mm, while at the same time the threshold with respect to coal tar and Rosemary remained within the limits of the norm. In addition to dissociated hyposmia, in most patients an increase in the time of adaptation was noted as well as a slow down in the restoration of the original threshold after load.

Hence, as the result of a special investigation, inadequacy of all the analyzer functions investigated by us was found. The most profound in clinically well-defined changes were detected in the sphere of the vestibular analyzer. Disorders of the remaining analyzer functions most frequently were of a subclinical character. An analysis of the revealed vestibular disorders makes it possible to theorize a significant deficiency of its central regions. This indicates a character of disorders of optokinetic nystagmus as well as the presence of dissociation between the degree of pronouncement of the vestibulomotor and vestibulovegetative reactions with predominance of the latter. There is every basis to hypothesize a significant involvement of the vestibular nuclei of the brain stem, which is indicated by the pronounced clinical picture of vestibular insufficiency, as well as by the presence of other symptoms of brain stem pathology.

Disorders in the sphere of the other analyzers are primarily linked with inadequacy of their cortical terminus, which provides for finely specialized functions. These types of disorders are particularly clearly revealed during the examination of the auditory, taste and olfactory analyzers. For the very visual analyzer, pronounced deficiency of the central neural mechanisms is characteristic, as is their significant degree of exhaustion, which is possibly worsened to a certain extent by the oculomotor disorders.

The functional dynamic character of the revealed disorders in the sphere of the visual, auditory, taste, and olfactory analyzers in the presence of local brain stem pathology provides a basis to evaluate them as a manifestation of dysfunction of the brain stem's reticular formation. It is in fact this formation which is primarily damaged during long term exposure to narcotics, which are the cause of intoxication in the patients examined by us.

REFERENCES

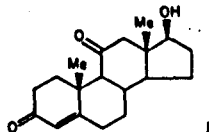
- Атчабаров Б. А., Мошкенич В. С., Пятаев Г. Д. Ж. ушн. пос. и гора. Сан., 1967, № 4, с. 42. — Дрогичина Э. А., Охиянская Л. Г. и др. Труды АМН СССР, 1964, т. 31, с. 9. — Пестругина З. Ф. Слуховая и вестибулярная функции при профитоксикациях тяжелыми металлами. Автореф. дисс. канд. Харков, 1958. — Осипова В. Г. Гиг. труда, 1957, № 3, с. 41. — Останкович Е. В., Милков Л. Е., Макаренко Ю. Л. В кн: Материалы I-й Всесоюз. конференции по ранней диагностике, экспертизе трудоспособности и профилактике профессиональных заболеваний химической этиологии. М., 1971, с. 101. — Охиянская Л. Г. Труды АМН СССР, 1954, т. 31, с. 28.

cancerous line. *Carbon disulfide* [75-15-0] formed during the decompn. of edithon is important in poisoning with this compd. In the absence of dithiocarbamates, edithon does not form *ethylene thiourea* [96-45-7] in the animal.

67835e Experimental cadmium poisoning. 2. Effect of protein and calcium deficiency in chronic cadmium rat poisoning. Abe, Tomoko; Tanaka, Seisuke; Itokawa, Yoshinori (Doshisha Women's Coll., Kyoto, Japan). *Nippon Eisrigaku Zasshi* 1972, 27(3), 308-15 (Japan). The av. body wt. of rats fed a low or high protein diet contg. cadmium [7440-43-9] was decreased as compared with controls. This body wt. loss was accompanied by cervicodorsal lordosis, dorsolumbar kyphosis and scoliosis. The Cd-fed rats also showed increased Cd levels and decreased magnesium [7439-95-4] and zinc [7440-66-6] levels in bones. Calcium [7440-70-2] levels in red muscle and white muscle was increased in the Cd-fed rats. The addn. of Ca to a high protein diet contg. Cd partially counteracted the toxicity of Cd.

67836f Chromosome breaking effect of a gasoline additive in cultured human lymphocytes. Soderman, Gunilla (Inst. Genet., Lund, Swed.). *Hereditas* 1972, 71(2), 335-8 (Eng). *Trimethyl phosphate* [512-56-1], a gasoline additive, added to cultured human lymphocytes increased the no. of cells with chromosome aberrations. Both the no. of cells with breaks and the no. of breaks/cell increased with increasing dose and exposure time. With the longer exposure time many cells with rearrangements were obsd., indicating that DNA repair takes place despite the presence of trimethyl phosphate.

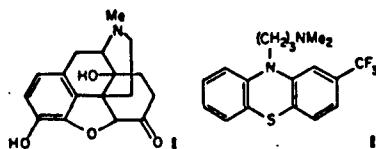
67837g Cadmium-induced testicular injury and alterations of androgen synthesis in brook trout. Sangalang, G. B.; O'Halloran, M. J. (Fish. Res. Board Canada, Halifax, Nova Scotia). *Nature (London)* 1972, 240(5382), 470-1 (Eng).



The exposure of the brook trout (*Salvelinus fontinalis*) to 25 ppb cadmium [7440-43-9] in 300 l. of fresh water for 24 hr induced hemorrhagic necrosis in the testis. Histol. examn. of the damaged tissues revealed that a large no. of erythrocytes were surrounding and invading the testis lobule. The testis prepn. from the fish exposed to Cd failed to produce *11-ketotestosterone* (I) [564-35-2] from *pregnenolone* [145-13-1] in the incubation medium. The yields of *11β-hydroxytestosterone* [1816-85-9] and *testosterone* [58-22-0] were higher in the control than in the Cd-incubate.

67838h Antidotes for hexachlorobutadiene. Kurchatov, G. V. (USSR). *Gig. Primen., Toksikol. Pestits. Klin. Otrav.* 1971, No. 9, 264-8 (Russ). From Ref. Zh., Khim. 1972, Abstr. No. 91557. *Unithiol* (I) [4076-02-2], mercaptide, and *cysteine* [52-90-4] when given hypodermically or intragastrically 20-30 min before the administration of *hexachlorobutadiene* (II) [87-68-3] and again right after the poisoning, in amts. comprising a 2-fold equimol. excess in relation to I, effectively reduced I intoxication. I analogs such as the 2,3-dimercaptopropane sulfonic acid amine salt [38555-04-3], especially mono- and diethanolamine salts were the most active. Their curative effect was evident with LD₅₀ doses of II (300 mg/kg) and also with a 90% LD dose of II. I and its N-contg. analogs prevented the II-blockade of SH groups in proteins such as thiol enzymes and low-mol. wt. thio compds., by entering the reaction with its own SH groups and combining with the active centers of II.

67839j Effect of chloroform anesthesia on dogs. Dhillon, K. S.; Paul, B. S. (Punjab Agric. Univ., Punjab, India). *Indian J. Anim. Sci.* 1972, 42(6), 450-2 (Eng). Hematol. parameters

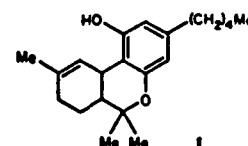


such as blood clotting time and hematocrit percentage were not affected by the administration of *chloroform* [67-66-3] in oxygen [7782-44-7] or in a mixt. of O and *nitrous oxide* [10024-97-2] to dogs, or by the administration of *CHCl₃* in an O-N₂O mixt. to animals premedicated with 0.2 mg *oxymorphone-HCl* (I-HCl) [357-07-3]/kg, 2.2 mg *trifluoromazine-HCl* (II-HCl) [1098-60-8]/kg, or with a mixt. of I (0.1 mg/kg) and II (1.1 mg/kg). Except for changes in the heart rate, there was no other effect on the electrocardiogram. Liver efficiency, as indicated by bromosulfal-

ein retention, was decreased in all the animals anesthetized, but the least decrease was obsd. in animals pretreated with I-HCl, possibly because less *CHCl₃* was needed to maintain anesthesia in these animals.

67840c Effects of chemical irritants and tobacco smoke condensate on the chorioallantoic membrane of the fertile hen's egg. Comber, R.; Grasso, P. (Group Res. Dev. Cent., Brit.-Am. Tob. Co., Ltd., Southampton, Engl.). *Chem.-Biol. Interactions* 1973, 6(1), 25-34 (Eng). The effects of various materials on the chorioallantoic membrane of the 10-day incubated fertile hen's egg were studied. The materials produced thickening of the membrane in the following decreasing order of potency: croton oil, formaldehyde [50-00-0], flue-cured tobacco smoke condensate, acetic acid [64-19-7], cigar tobacco smoke condensate, phenol [108-95-2], Na chloride [7647-14-5], carrageenan, colloidal silica, and glycerol [56-81-5]. Histol. study indicated that croton oil and tobacco smoke condensate induced local haemorrhage and necrosis, followed by hyperplasia. A test procedure for comparing the irritant activity of tobacco smoke condensates was developed. The procedure involved measuring the max. thickness of the membranes at 72 hr after application of the condensates.

67841d Effects of Δ¹-tetrahydrocannabinol (Δ¹-THC) and DDT on the hepatic microsomal metabolism of Δ¹-THC and other compounds in the rat. Kupfer, David; Levin, Elan; Burstein, Sumner H. (Worcester Found. Exp. Biol., Shrewsbury Mass.). *Chem.-Biol. Interactions* 1973, 6(1), 59-66 (Eng)



The i.p. administration of 25 mg Δ¹-tetrahydrocannabinol (I) [1972-08-3]/kg/day for 9 days, or of 50 mg I/kg/day for 3 days to rats, or the oral administration of 50 mg I/kg/day for 1 day and 36 mg I/kg/day on the subsequent 2 days, did not affect the in vitro hepatic microsomal demethylation of *aminopurine* [58-15-1] and *p-chloro-N-methylaniline* [932-96-7], or the oxidative metabolism of I-¹⁴C. Similarly neg. effect was shown following the oral administration of a whole marihuana ext. The i.p. administration of 25 mg DDT [50-29-3]/kg/day for 3 days increased about 2-fold the oxidative metab. of I, demonstrating that the microsomal oxidn. of I can be enhanced by an inducer of the monooxygenase system.

→ **67842e** Histological and histochemical changes in liver during experimental poly(vinyl chloride) pneumoconiosis. Cylwik, Bogdan (Akad. Med., Bialystok, Pol.). *Rocz. Akad. Med. Bialystoku* 1972, 17, 93-111 (Pol). Hepatic changes such as clouding of the parenchyma, microfocal necrosis, and decreased glycogen [9005-79-2] and protein content were obsd. in rats exposed to 97 g PVC [9002-86-2] dust/m³ for 1-4 months. As the exposure time increased, inflammatory infiltration, hyperplasia of spurious ducts, and focal hyperplastic growth of reticular fibers appeared, and fatty degeneration was sometimes obsd.

67843f Fibrogenic activity of aluminum and its compounds. Ligacz, Jerzy (Inst. Med. Pracy, Zabrze, Pol.). *Med. Pr.* 1972, 23(4), 349-55 (Pol). The i.p. administration of dusts contg. aluminum [7429-90-5] or Al compds. induced peritoneal fibrosis in rats. The fibrogenic activity was correlated with the hemolytic activity of the compds., and the intensity of fibrogenesis decreased in the order Al, aluminum hydroxide [21645-51-2], aluminum acetate [139-12-8], and aluminum oxide [1344-28-1].

J. Lange

67844g Leukocyte recruitment through airway walls by condensed vegetable tannins and quercetin. Kilburn, Kaye H.; Lynn, William S.; Tres, Laura L.; McKenzie, Wayland N. (Med. Cent., Duke Univ., Durham, N. C.). *Lab. Invest.* 1973, 28(1), 55-9 (Eng). Polymorphonuclear leukocytes appeared beneath the basement membrane, between epithelial cells, and on luminal surfaces of the intrapulmonary airways and tracheas of hamsters and guinea pigs exposed for 4 hr to aerosols of crude and refined exts. of cotton mill trash, cotton mill dust, and quercetin [117-39-5], a polyphenolic monomer present in many vegetables. Intratracheal killing by fixation of the lungs of anesthetized exposed rodents using osmium tetroxide suspended in fluorocarbon (FC-80) kept the recruited cells on bronchial and tracheal surfaces while other fixatives did not retain them. This is suggested as a new rapid assay for inhalation toxic effects.

67845h Neurophysiological findings in chronic carbon disulfide poisoning. Descriptive study. Seppalainen, Anna Maija; Tolonen, Matti; Karli, Pauli; Hanninen, Helena; Hernberg, Sven (Inst. Occup. Health, Helsinki, Finland). *Work, Environ., Health* 1972, 9(2), 71-5 (Eng). Frequent occurrence of an org. psychoendocrine and redn. of sensorimotor

Sept. *Anopheles vagus*, *An. hyrcanus*, and *An. subpictus* are highly zoophilic. The 1st 2 of these species did not bite man during this work; a few *An. subpictus* bit man in the daytime. *An. annularis*, *M. anullifera*, *M. uniformis*, *C. gelidus*, and *C. tritaeniorhynchus* showed zoophily; they were more attracted to cows than man during this work. *C. pipiens fatigans* and *Ae. aegypti* showed slight anthropophily. Twenty species of resting mosquitoes were collected at night compared to only 14 species in the daytime. Number of mosquitoes collected per man-hr at night was approximately 50% higher than that collected in the daytime. Although *C. tritaeniorhynchus* feed mainly at night, a considerable number of them fed in the daytime also. *Ae. aegypti* and *Ae. albopictus* were more active during the daytime. In Dacca *C. pipiens fatigans*, *C. tritaeniorhynchus*, *Ae. aegypti*, and *Ae. albopictus* are likely to be the important species in the transmission of various mosquito-borne epidemic diseases.--R. L. K.

INANIMATE

See also: Food and Industrial Microbiology
Soil Microbiology

Toxicology - Foods, Food Residues, Additives and Preservatives

51629. MORRIS, ALAN H. (U. S. Army Inst. Surg. Res., Brooke Army Med. Cent., Fort Sam Houston, Tex. 78234, USA.) Nebulizer contamination in a burn unit. *AM REV RESPIR DIS* 107(5): 802-808. Illus. 1973.--The degree of bacterial contamination of aerosol-generating equipment in use at the U. S. Army Institute of Surgical Research was assessed, and the effectiveness of a decontamination program recommended by the American Thoracic Society was demonstrated. Before institution of the decontamination procedure, bacteria were recovered from 46% of 382 specimens that were collected from the nebulization chambers of equipment used on 15 patients. Of the specimens, 24% were contaminated with gram-negative organisms. *Pseudomonas* species represented 54% and *Providencia stuartii* 21% of the gram-negative organisms cultured. After the introduction of a decontamination program, bacteria were recovered from only 3.6% of 612 specimens that were collected from the nebulization chambers of equipment used on 27 patients ($P < 0.001$). Aerosol-producing inhalation therapy equipment, a potential source of infection in a burn unit, can be maintained relatively free of bacterial contamination with an appropriate decontamination program.

51630. CHOI, DONG WIK (Dep. Parasitol., Kyungpook Natl. Univ. Sch. Med., Taegu, South Korea.) and SUP LEE. Incidence of parasites found on vegetables collected from markets and vegetable gardens in Taegu area. *KOREAN J PARASITOL* 10(1): 44-51. 1972. [Korean summ.]-Parasitic eggs and larvae of humans were collected from lettuce (*Lactuca sativa*), young radishes (*Raphanus sativus*) and Chinese cabbage (*Brassica pekinensis*). The species of parasites and the approximate mean number of parasitic eggs/200 g of washed vegetable leaves were investigated. Vegetables collected from markets showed 5 spp. of parasite eggs (ascaris, trichurid, *Trichostrongylus*, *Clonorchis* and hookworms) and 2 larvae (filariform and rhabditoid). A number of eggs and larvae of undetermined species were also observed. The percentage of ascarid eggs was 49.0%, *Trichostrongylus* eggs 18.0%, filariform larvae of hookworms 19.7% and rhabditoid larvae of hookworms 0.7%. Lettuce, young radishes and Chinese cabbage collected from markets showed a parasite level ranging from 23.2-91.9%. In vegetable gardens, Chinese cabbage showed levels of 91.9%; lettuce showed 49.0% positive levels of ascarid eggs. Filariform larva was twice as high in Chinese cabbage than in lettuce and young radishes. Studies showed that washing vegetables significantly reduced the rate of filariform larvae. The mean number of ascarid egg/200 g of vegetable was 7.5 in young radishes, 3.1 in lettuce and 0.5 in Chinese cabbages.--J. L. S.

51631. LEBEDEVA, N. S. (All-Union Res. Inst. Railroad Hyg., Moscow, USSR.) O vozmozhnosti ispol'zovaniya fekal'nogo enterokokka v kachestve sanitarno-pokazatel'nogo mikroorganizma v mestakh massovykh skoplenii lyudei. [Possibility of using fecal enterococci as a sanitary indicator at places of mass gatherings of people.] *GIG SANIT* 3(1): 115-116. 1972.--Isolation of fecal enterococci from surfaces, e.g., waiting-room benches, seats in railroad-car compartments, drinking points in the station and cars, H₂O faucets and toilet seats, revealed epidemiologically hazardous objects.--M. D. S.

51632. SAVCHENKO, L. P., F. I. BUTS and L. M. POPOVA. (Rostov Res. Inst. Med. Parasitol., Rostov-on-Don, USSR.) Svratitel'naya otsenka effektivnosti nekotorykh sanitarno-gig'ienologicheskikh metodov issledovaniya pochvy. [Comparative evaluation of the effectiveness of some sanitary-helminthological methods for soil studies.] *MEB PARAZITOL PARAZIT BOLEZN* 41(3): 363-364. 1972.--Soil from microfoet of intensive ascariasis and trichocephalosis was tested by 3 methods: Vasilakili and Hefter's, Hefter and Rodionov's, and Lugina's. The 1st required special apparatus and plankton filters, the 2nd required only an electric centrifuge, the 3rd required a plastic plate in addition to the centrifuge. The tests

were positive in 30, 44 and 53% of the cases respectively. The greatest number of eggs was found by the 2nd method. No final preference could be established.--N. L. G.

51633. MANGI, RICHARD J. (Dep. Intern. Med., Yale Univ. Sch. Med., New Haven, Conn. 06510, USA.) and VINCENT T. ANDRIOLE. Contaminated stethoscopes: A potential source of nosocomial infections. *YALE J BIOL MED* 45(6): 606-604. 1972[recd. 1973].--Stethoscopes used by hospital personnel were evaluated as a potential source of pathogenic bacteria which might be responsible for bacterial spread to, and colonization of, hospital patients. The significant decline in bacterial colony count following simple swabbing of the head of a stethoscope with 70% alcohol indicates a solution to this potential danger. Organisms isolated were *Staphylococcus epidermidis*, *St. aureus*, *Escherichia coli*, *Erwinia*, *Serratia*, *Klebsiella*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, diptheroid species, *Bacillus* spp., α -*Streptococcus*, molds, streptomycetes, *Enterobacter* A and *Enterobacter* B.--J. E. F.

DISINFECTION AND VECTOR CONTROL (includes Pesticides)

See also: Disinfection, Disinfectants and Sterilization
Ecology (Environmental Biology) - Animal, Wildlife Management-Aquatic, Terrestrial
Economic Entomology (includes Chelicerata) - Animal Pests, Chemical and Physical Control, General; Apparatus
Food and Industrial Microbiology
Invertebrate, Comparative and Experimental Morphology, Physiology and Pathology
Parasitology (includes Ecto- and Endoparasites)
Pest Control, General (includes Plants and Animals); Pesticides; Herbicides
Public Health - Communicable Diseases, Disease Vectors, Epizootiology, Sewage Disposal and Sanitary Measures
Toxicology - Food, Food Residues, Additives and Preservatives

51634. NELSON, CARL L. and ALAN SETH GREENWALD. (Dep. Orthop. Surg., Cleve. Clin., 9500 Euclid Ave., Cleveland, Ohio 44106, USA.) Clean air and total hip arthroplasty. *CLEVE CLIN Q* 39(3): 101-107. Illus. 1972.--There is little data to prove that clean air systems in operating rooms reduce infection. The system does reliably reduce bacterial contamination at the wound site. The absolute relationship between bacterial contamination and infection rate remains unanswered. The clean air system combined with rigid attention to tissue technique, careful preparation of the patient, control of activity in the operating room and insistence on reliable housekeeping has produced an infection rate of 5 deep wound infections in more than 1000 total hip replacement arthroplasties.--F. W.

ENVIRONMENTAL HEALTH

AIR, WATER AND SOIL POLLUTION

See also: Allergy
Ecology (Environmental Biology) - Bioclimatology and Biometeorology, Limnology, Oceanography
Economic Entomology (includes Chelicerata) - Chemical and Physical Control, General; Apparatus
Pest Control, General (includes Plants and Animals); Pesticides; Herbicides
Soil Microbiology
Soil Science
Toxicology

51635. JERNELOV, ARNE (Swed. Water Air Pollut. Res. Lab., 400 00 Gothenburg, Swed.), RUTGER ROSENBERG and SOREN JENSEN. Biological effects and physical properties in the marine environment of aliphatic chlorinated by-products from vinyl chloride production. *WATER RES* 6(10): 1181-1191. Illus. 1972.--A mixture of short-chained aliphatic hydrocarbons, the so called EDC-tar, is formed as a byproduct from vinyl chloride production in quantities of about 75,000 tons annum⁻¹ in Northern Europe. Most of this is dumped into the sea. In 1970, concentrations of EDC-tar from the North Sea were as high as 10% of that causing acute toxic effects on marine organisms. The behavior of some components of the EDC-tar in the marine environment was studied. Dumped into the sea, EDC-tar has a tendency to disperse and to adhere to particles. Acute toxicity of these Cl-C components, evaluated by LC50 48 hr tests, was about 2.5-9 ppm for some marine animals. Accumulation factors of between 10 and 3 x 10³ were estimated for animals presented to EDC-contaminated sea water. Accumulation in cod fed with EDC-contaminated shrimp was higher in liver than in muscle. Excretion was rapid when feeding was discontinued, and the biological half-lives of the Cl-C compounds were a few weeks. Sublethal EDC-concentrations produced disorders in growth in the polychaete *Ophryotrocha labronica* and

reduced swimming ability in the barnacle *Balanus balanoides*. In *Allium cepa*, c-mitotic effects of EDC-tar were observed.

Übersichten

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Über die sogenannte Vinylchlorid-Krankheit

Seitdem 1958 erste Mitteilungen über gesundheitliche Schäden bei Arbeitern der Vinylchlorid(VC)-herstellenden Industrie (10) und 1963 über solche bei Arbeitern der Polyvinylchlorid(PVC)-herstellenden Industrie (25) bekannt wurden, ist die Aufmerksamkeit durch weitere Berichte mehrfach auf diesen Zweig der chemischen Industrie gelenkt worden (3, 4, 7, 8, 12, 28). Es handelt sich dabei um ein in den Haut- und Knochenveränderungen sklerodermie-ähnliches, in Ätiologie und Pathogenese ungeklärtes Krankheitsbild, als dessen Leitsymptome bisher Raynaud-Syndrom, knotige bis flächenhafte derbe Hautveränderungen und bandförmige Osteolysen der Fingerendphalangen galten.

Über erste Beobachtungen dieses Krankheitsbildes in Deutschland konnten wir 1972 berichten (15, 16, 17). Da das klinische Bild zunächst an eine Sonderform der progressiven Sklerodermie erinnerte, unterzogen wir alle Arbeiter einer sorgfältigen internen Untersuchung, um zu klären, ob auch hier eine viszerale Beteiligung vorhanden ist. Über die bis Ende 1972 vorliegenden Ergebnisse, die für die Beurteilung der Krankheit neue Aspekte eröffnen und – wie wir glauben – auch der weiteren Forschung neue Anregung geben dürften, haben wir kürzlich ausführlich berichtet (18). Hier sollen die wesentlichsten Gesichtspunkte zusammenfassend dargestellt werden.

S. Jühe, C.-E. Lange, G. Stein und G. Veltman

Universitäts-Hautklinik Bonn (Direktor: Prof. Dr. Leinbrock)

Die von April bis Dezember 1972 untersuchten 13 Arbeiter waren 29 bis 52 Jahre alt (Durchschnittsalter 39 Jahre) und mindestens 2, längstens 18 Jahre (durchschnittlich 7 Jahre) in einem PVC-herstellenden Betrieb an wechselnden Arbeitsplätzen, überwiegend jedoch als Autoklavenreiniger tätig. Erste Krankheitssymptome traten bei elf Patienten 1½ bis 3½ Jahre, bei zwei Patienten 7 und 11 Jahre nach Beschäftigungsbeginn auf.

Symptome und Befunde

Von den *anamnestischen Angaben* sind als häufigste Erstsymptome vermehrte Kälteempfindlichkeit an Händen und Füßen, Taubheitsgefühl und Kribbelparästhesien zu nennen. Außerdem wurden Druckschmerz in einzelnen Fingerkuppen, Verdickung der Fingerendglieder und Nagellockerung sowie Allgemeinbeschwerden wie starke Müdigkeit, Verlangsamung und Vergeßlichkeit, synkopenartiges Schwindelgefühl, Übelkeit am Arbeitsplatz, vermehrtes Schwitzen und Oberbauchbeschwerden angegeben.

Eine wesentliche Rolle kommt den *Hautveränderungen* in der Diagnostik des Krankheitsbildes zu: Sieben Patienten wiesen trommelschlegelartig verdickte Fingerendphalangen auf (kolbige Auftreibung und Verkürzung; Uhrglasnägel, Verkürzung der Nagelplatte). Bei acht

Patienten sahen wir sklerodermie-ähnliche Hautveränderungen: kleinknotige oder mehr plattenartige, sehr derbe, relativ scharf abgegrenzte, meist etwas über das Hautniveau erhabene Infiltrate an den Handstreckseiten, im distalen Drittel der Unterarmbeugeseite und im Wangenbereich. Drei Patienten hatten keine klinischen Hautveränderungen.

Relativ uniform war der *histologische Befund* der von allen Patienten entnommenen Probeexzisionen (rechte oder linke Hand). Neben Hyperorthokeratose und Epidermisatrophie waren eine Erweiterung und Vermehrung der Kapillaren in der oberen Cutis, eine Vermehrung, Verbreiterung und Homogenisierung der kollagenen Bündel und eine deutliche Rarefizierung und Fragmentation der elastischen Fasern nachweisbar. Bei den Patienten ohne klinische Hautveränderungen ließen sich die gleichen Befunde an der Epidermis und an den Gefäßen in der oberen Cutis nachweisen. Die histologischen Veränderungen an der Epidermis und dem kollagenen Bindegewebe erinnern an das ödematöse bis infiltrative Stadium der progressiven Sklerodermie. Ihr gegenüber ermöglichen aber die teils ganz erhebliche Schädigung der elastischen Fasern und die Gefäßveränderungen eine eindeutige Abgrenzung.

Durchblutungsstörungen sind bisher das häufigste Symptom: Neun der 13 Patienten klagten darüber, acht von ihnen gaben diese Beschwerden sogar als Erstsymptom an. Dabei reicht die Beschwerdeskala von verstärkter Kälteempfindlichkeit und Akrozyanose bis hin zum Raynaud-Syndrom (vier Patienten). Die Durchblutungsstörungen konnten mit Hilfe von Temperaturmessung, Bestimmung der Wiedererwärmungszeit nach Kälteexposition, Kapillarmikroskopie und Arm-Hand-Arteriographie objektiviert werden. Ozillographie und Plethysmographie ergaben bei keinem Untersuchten einen sicher pathologischen Befund, so daß man wohl folgern kann, daß die Ursache für die Durchblutungsstörungen in der Peripherie und nicht im Bereich der großen Gefäße zu suchen ist. Diese Überlegung wird gestützt durch die angiographischen und kapillarmikroskopischen Befunde: Bei vier Patienten mit Kälteempfindlichkeit waren am Nagelfalz ampullenartige Erweiterungen der Kapillaren nachweisbar, wie sie beim Raynaud-Syndrom beschrieben wurden (14). Alle sieben arteriographierten Patienten wiesen pathologische Gefäßbilder auf. Die Veränderungen reichten von leichter Einengung der *Ar. digitales primarias proprias et communes* mit vereinzelt segmentär lokalisierten bis zu hochgradigen Stenosen und segmentären Verschlüssen, zum Teil sogar Füllungsausfall der Arterien auf der gesamten Fingerlänge und deutlicher Stenosierung auch der Hohlhandbögen. Nach den bisherigen Untersuchungen scheint eine direkte Beziehung zwischen der Expositionsdauer und dem Ausmaß der Gefäßschädigung zu bestehen.

Auffälligster *röntgenologischer Befund* dieser Krankheit sind bandförmige Osteolysen zwischen Processus unguicularis und Phalangenschaft an einzelnen oder allen Fingern bei sechs Untersuchten. Zusätzlich konnten bei sechs Patienten Fragmentationen und Randdefekte der Processus unguiculares festgestellt werden. Auch bei den

Knochenveränderungen lassen sich verschiedene Schweregrade unterscheiden: In leichteren Fällen ist nur eine schmale lytische Zone sichtbar, in fortgeschrittenem Stadium ist der Phalangenschaft fast völlig zerstört, der Processus unguicularis sitzt der Basis der Phalanx haubenförmig auf. Eine völlige Restitution des Knochens ist nach den bisherigen Befunden nicht zu erwarten (23, 24). Bemerkenswerterweise besteht eine feste Korrelation von Akroosteolysen und kolbiger Auftreibung der Endphalangen. Somit sind die »Trommelschlegelfinger« Ausdruck des lytischen Knochenprozesses und nicht Symptom einer internen Erkrankung.

Die Untersuchung des *blutbildenden Systems und der Blutgerinnung* ließ uns auf einen bemerkenswerten Befund aufmerksam werden: Alle 13 Patienten wiesen eine leichte bis erhebliche Thrombopenie auf. Die Thrombozytenwerte lagen wiederholt zwischen 30 000 und 119 000/µl (untere Normgrenze 150 000/µl). Die zur Klärung dieses Befundes bei sechs Patienten vorgenommene Sternalpunktion ergab in keinem Fall Hinweise auf eine Störung der Thrombozytopoese, eine Osteomyelofibrose oder -sklerose. Die übrigen Untersuchungen zeigten bis auf eine leichte Retikulozytose bei acht Patienten (zwischen 16 und 26‰) und eine leichte Leukopenie bei fünf Patienten (2350 bis 3950 Leukozyten/µl) keine wesentlichen Normabweichungen. Retikulozytose und Leukopenie dürften durch die bei zwölf Patienten nachgewiesene Splenomegalie bedingt sein. Nicht zu deuten ist bisher die Thrombopenie, obwohl zu vermuten ist, daß es sich um eine Umsatzstörung oder einen verstärkten Abbau in der Peripherie handelt.

Bei der Erhebung der Anamnese war bemerkenswert, daß drei Patienten rezidivierende Schmerzen im linken Oberbauch angaben und ein Patient über Schmerzen im rechten Oberbauch und Völlegefühl berichtete, frühere Erkrankungen von *Leber und Milz*; langfristige Medikamenteneinnahme oder starker Alkoholgenuß jedoch nicht eruierbar war. Allerdings fanden sich bei drei Patienten ohne sklerodermie-artige Hautveränderungen und Akroosteolysen anamnestisch Hinweise auf eine chronische Lebererkrankung (Ösophagusvarizenblutung, splenorenale Anastomose; portaler Hypertonus: Ösophagusvarizen, Splenomegalie). Die Bromsulfalein-Retention war deutlich erhöht, dagegen waren die Werte für die Serum-Transaminasen und -Phosphatasen im wesentlichen unauffällig. Diese Diskrepanz ließ sich auch bei den übrigen zehn Patienten nachweisen. Bei vier Patienten bestanden Ösophagusvarizen, bei zwölf war szintigraphisch eine Splenomegalie nachweisbar. Die laparoskopischen und leberbiopsischen Befunde, die uns bis Ende 1972 von fünf Patienten zur Verfügung standen, zeigen eine auffällige Übereinstimmung: Leberoberfläche fein oder deutlich gewellt, Kapselfibrose, vermehrte Blut- und Lymphgefäßzeichnung, histologisch eine leichte bis deutliche Fibrosierung der Portalfelder und Einzelzellnekrosen, leichte grobtropfige Verfettung. Diese Befunde, die wir inzwischen weiter absichern konnten (19), lassen uns folgende Vermutung aussprechen: Außer leichten toxischen Veränderungen an den Leberzellen kommt es durch Bindegewebsvermehrung in den portalen Feldern zu dif-

fusen Durchblutungsstörungen in der Leber und in fortgeschrittenen Stadien zu einem intrahepatischen Block (wohl wegen des Hindernisses in Höhe der portalen Felder am ehesten als präsinusoidaler Block denkbar) mit Ösophagusvarizen. Ob die Splenomegalie nur sekundär bedingt ist oder ob diesem Befund auch primär toxische Veränderungen zugrunde liegen, bleibt noch zu klären.

Bei Überprüfung der Lungenfunktion (Anamnese, Röntgenuntersuchung, Ruhespirometrie, Ganzkörperplethysmographie, Blutgasanalyse) zeigten sich bei neun Patienten Hinweise auf vorwiegend restriktive Veränderungen, bei acht Patienten bestand eine Partialinsuffizienz. Ob diese Störungen darauf zurückzuführen sind, daß sich an der Lunge ähnliche Veränderungen abspielen wie am kollagenen und elastischen Bindegewebe der Haut, also eine beginnende diffuse Lungenfibrose zugrunde liegt, müssen weitere Untersuchungen zeigen.

Der auslösende Faktor

Es handelt sich um ein beruflich bedingtes Krankheitsbild, dessen führende Symptome (nach der Häufigkeit geordnet) Thrombopenie, Splenomegalie, ein toxischer Leberschaden, Ventilationsstörungen, Durchblutungsstörungen, Haut- und Knochenveränderungen sind. Dieser Symptomkomplex ist keinem bisher bekannten Syndrom zuzuordnen. Ätiologie und Pathogenese sind ungeklärt.

Gelingt es, durch Vergleich des bisher aus der Literatur Bekannten mit unseren Ergebnissen einen gewissen Einblick in Ätiologie und Pathogenese zu gewinnen? Was ist als auslösender Faktor denkbar?

Flüssiges Vinylchlorid polymerisiert nach Zugabe von Wasser und zahlreichen, nach den Eigenschaften des gewünschten Kunststoffes unterschiedlichen Additiven bei gleichzeitiger Druck- und Temperatursteigerung zu Polyvinylchlorid. Unabhängig von der Art der Zusatzstoffe wurden in verschiedenen Ländern bei Autoklavenreinigern ein Raynaud-Syndrom und Akroosteolysen festgestellt. Diese Symptome schienen so kennzeichnend, daß sie in den letzten Jahren zur Krankheitsbezeichnung »berufsbedingte Akroosteolyse« führten und zur Diagnosestellung gefordert wurden (28). Es ist nicht anzunehmen, daß die nach Herstellungsland und -verfahren verschiedenen Additive eine wesentliche Rolle spielen, wenn auch durch ein bedingtes Kombinationschäden nicht ausgeschlossen werden können. Damit rückt das Vinylchlorid, die mengenmäßig am stärksten vertretene Substanz, in den Mittelpunkt des Interesses. Das Monomer Vinylchlorid wird zunächst über ein geschlossenes System in die Autoklaven gepumpt. Möglichkeiten des Gasaustrittes – und damit der Inhalation – bestehen jedoch innerhalb des Produktionsprozesses an mehreren Stellen:

1. Undichtigkeiten am Autoklaven (Zu- und Ableitungen) während der Polymerisation und beim Rückgewinnungsverfahren;
2. beim Ablassen und Öffnen der Autoklaven sowie beim Trocknungsprozeß des fertigen Polyvinylchlorids. Das Restgas besteht zu 90% aus Vinylchlorid (6) und

führt bei den Arbeitern häufig zu bleierner Müdigkeit und kurzzeitiger Desorientiertheit;

3. aus den in den Polymerisatniederschlägen der Reaktorenwand enthaltenen Kavernen (5).

Vom technischen Ablauf her bestünde also durchaus die Möglichkeit, daß Vinylchlorid das hier erörterte Krankheitsbild auslöst.

Über die Wirkungen des Vinylchlorids auf den menschlichen und tierischen Organismus ist bereits einiges gesichert. Seine narkotische Wirkung ist seit langem bekannt (22). Über angioneurotische Störungen bis hin zum Raynaud-Syndrom bei Arbeitern der Vinylchloridherstellenden Industrie wurde seit 1958 wiederholt berichtet (1, 10, 21). Vereinzelt finden sich in der Literatur Hinweise auf Intoxikationen mit Vinylchlorid, wobei reversibles Schwindelgefühl, leichte bis ausgeprägte Benommenheit, Desorientiertheit, Hauterscheinungen wie bei einer Verbrennung zweiten Grades und verminderte Blutgerinnung als Symptome festgestellt wurden (6, 9, 11). Ein Arbeiter starb an den Vergiftungsfolgen.

Tierexperimentell konnten als Folge einer akuten Intoxikation mit Vinylchlorid Lungenödem, Blutstauung in Lunge, Leber und Niere sowie eine verminderte Blutgerinnung nachgewiesen werden (20). In Langzeitversuchen ließen sich an der Leber zentrolobuläre Degeneration und Nekrosen mit schaumiger Vakuolisierung sowie periportale zellige Infiltration erzeugen (26). Jüngst wurde über Haut-, Lungen- und Knochentumoren und Störungen im Knochenaufbau berichtet (27). Diese tierexperimentellen Befunde führten dann 1970 erneut zu einer Senkung des MAK-(maximale Arbeitsplatzkonzentration-)Wertes auf nun 100 ppm (13). Über regelmäßige Gaskonzentrationsmessungen am Arbeitsplatz ist uns bisher nichts bekanntgeworden.

Die im Rahmen der geschilderten Krankheit angeführten Symptome: Raynaud-Syndrom, toxische Leberveränderungen, Störungen im Knochenaufbau und prä-narkotisches Syndrom, sind also durch Vinylchlorid auslösbar, so daß wir in Kenntnis der Arbeitsplatzverhältnisse den dringenden Verdacht äußern, daß langfristige Vinylchlorid-Exposition zumindest eine, wenn nicht sogar die krankheitsauslösende Ursache ist. Weil außerdem das Krankheitsbild durch Mitbeteiligung zahlreicher Organe den Charakter einer Systemkrankheit erhält und die Bezeichnung »berufsbedingte Akroosteolyse« nur auf ein für die Prognose sicher nicht entscheidendes Symptom hinweist, haben wir die Bezeichnung »sogenannte Vinylchlorid-Krankheit« vorgeschlagen.

Pathogenese

Die Pathogenese ist nach wie vor ungeklärt. Aufbauend auf unseren Befunden sprechen wir aber die Vermutung aus, daß der Krankheit als pathogenetisches Prinzip im weitesten Sinne eine Störung am Bindegewebe oder Gefäßbindegewebe zugrunde liegt. Für die Auffassung, daß das toxische Agens nicht nur per inhalationem, sondern auch perkutan wirksam wird, spricht die Tatsache, daß nur unbedeckte Hauptpartien sklerodermie-artige Umwandlung zeigen und daß die bandförmigen Osteolysen

nur an den Fingerendphalangen gefunden wurden. Sowohl sklerodermie-artige Hautveränderungen als auch Osteolysen sahen wir nur bei Arbeitern, die langfristig mit der Autoklavenreinigung beschäftigt waren, was vielleicht dadurch erklärt wird, daß in Nähe der Autoklavenwand 600–1000 ppm Vinylchlorid gemessen werden konnten (5). Als Hinweis auf eine zugrunde liegende Störung am Bindegewebe sahen wir die qualitativen und quantitativen Veränderungen des kollagenen und elastischen Bindegewebes der Haut, die Vermehrung kollagener Fasern in den portalen Feldern der Leber, die kapillarmikroskopisch und histologisch in der oberen Cutis sichtbare Vermehrung und Erweiterung der Kapillaren ebenso an wie die klinisch, angiographisch und thermographisch nachweisbaren peripheren Durchblutungsstörungen. Auch die Veränderungen am Knochen (Osteolysen als Folge trophischer Störung durch Schädigung der Vasa nutricia) und der Lunge (restriktive und obstruktive Ventilationsstörungen) könnten gleichsinnig gedeutet werden. Die Prognose der Krankheit – in der Literatur bisher recht optimistisch beurteilt – scheint uns im Hinblick auf Thrombopenie, Splenomegalie und portale Hypertension ernst, und auch hinsichtlich der Knochenveränderungen sollte sie nach unseren Beobachtungen mit Zurückhaltung gestellt werden.

Konsequenzen für die Praxis

Trias Systemkrankheit, ernste Prognose und relativ hohe Morbidität (nach unseren Erhebungen bisher sicher mehr als 10%) überwiegend junger Männer veranlaßt uns, folgende Forderungen aufzustellen:

1. Durchführung epidemiologischer und präventivmedizinischer Untersuchungsreihen. Dabei reicht es unserer Ansicht nach nicht mehr aus, nur nach Raynaud-Syndrom, knotigen Hautveränderungen und bandförmigen Osteolysen zu fahnden, da diese Symptome – so charakteristisch sie sind – schon den fortgeschrittenen Erkrankungsgrad kennzeichnen. Vielmehr sollten außerdem in regelmäßigen Zeitabständen bei allen Angehörigen der PVC-herstellenden Industrie Kontrollen der Thrombozytenzahl durchgeführt werden, um Arbeiter mit einer konstanten Thrombopenie – sie scheint das erste objektivierbare Symptom zu sein – aus diesem Industriezweig herauszunehmen, ehe sich weitere schwerwiegende interne Befunde hinzugesellen.
2. Keine Einstellung von Arbeitern mit Leberkrankheiten oder Durchblutungsstörungen.
3. Regelmäßige Gaskonzentrationsmessungen an verschiedenen Arbeitsplätzen, um Überschreitungen des MAK-Wertes zu vermeiden. Verfahrenstechnische Verbesserungen mit dem Ziel weitestgehender Automatisierung und Verbesserung der Belüftungsverhältnisse, um die Möglichkeiten einer Inhalation von Gasen auf ein Mindestmaß zu reduzieren.
4. Entschädigung schon erkrankter Arbeiter und Anerkennung der Krankheit als entschädigungspflichtige Berufskrankheit durch Aufnahme in die Liste zur BKVO.

5. Tierexperimentelle Untersuchungen mit Vinylchlorid unter besonderer Berücksichtigung von Haut, Knochen, Lunge, Leber und Milz.

Literatur

- (1) Angheliescu, F., M. Otoi, E. Dobrinescu, L. Hagiparaschiv-Dossios, G. Dobrinescu, V. Ganea: Consideratii clinico-patogenice asupra fenomenului Raynaud la muncitorii din industria policlorurii de vinil. Med. interna (Buc.) 21 (1969), 473.
- (2) Basalaev, A. V., A. N. Vazin, A. G. Kochetkov: On the pathogenesis of changes developing due to a long-term exposure to the effect of vinylchloride. Gig. Tr. prof. Zabol. 16 (1972), 24.
- (3) Chatelain, A., P. Motillon: Un syndrome d'acro-ostéolyse d'origine professionnelle et de constation nouvelle en France. J. Radiol. Electrol. 48 (1967), 277.
- (4) Cordier, J. M., C. Fievez, M. J. Lefevre, A. Sevrin: Acroostéolyse et lésions cutanées associées chez deux ouvriers affectés au nettoyage d'autoclaves. Cah. Méd. Travail 4 (1966), 3.
- (5) Cook, W. A., P. M. Giever, B. D. Dinman, H. J. Magnuson: Occupational acroostéolysis. II. An industrial hygiene study. Arch. environm. Hlth 22 (1971), 74.
- (6) Danziger, H.: Accidental poisoning by vinyl chloride. Canad. med. Assoc. J. 82 (1960), 828.
- (7) Dinman, B. D., W. A. Cook, W. M. Whitehouse, H. J. Magnuson: Occupational acroostéolysis. I. An epidemiological study. Arch. environm. Hlth 22 (1971), 61.
- (8) Dodson, V. N., B. D. Dinman, W. M. Whitehouse, A. N. M. Nasr, H. J. Magnuson: Occupational acroostéolysis. III. A clinical study. Arch. environm. Hlth 22 (1971), 83.
- (9) Dublin, L. J., R. J. Vane: Occupational hazards and diagnostic science. Bulletin No. 582 (1933), Bulletin No. 41 (1941), U.S.A. Dept. Labor; zitiert in: Danziger (6).
- (10) Filatova, V. S., L. J. Balakhonova, E. S. Gronsberg: Hygienic conditions in the production of vinyl chloride. Gig. Tr. prof. Zabol 1 (1958), 6; zitiert in Public Health Engin. Abstr. 40 (1960) No. 4, p. 6.
- (11) Harris, D. K.: Health problems in the manufacture and use of plastics. Brit. J. industr. Med. 10 (1953), 255; zitiert in: Malten, K. E., R. L. Zielhuis (ed.): Industrial Toxicology and Dermatology in the Production and Processing of Plastics (Elsevier: Amsterdam 1964), 143.
- (12) Harris, D. K., W. G. F. Adams: Acro-ostéolysis occurring in men engaged in the polymerisation of vinyl chloride. Brit. med. J. 1967/3, 712.
- (13) Henschler, H. (Hrsg.): Gesundheitsschädliche Arbeitsstoffe. Toxikologisch-arbeitsmedizinische Begründung von MAK-Werten (Verlag Chemie: Weinheim 1972).
- (14) Jacoby, H.: Periphere Durchblutungskrankheiten im Spiegel der Mikro-

- zirkulation. Forschungsberichte des Landes Nordrhein-Westfalen, Nr. 1585 (Westdeutscher Verlag: Köln 1966).
- (15) Jühe, S., G. Veltman: Zur Klinik der sog. Vinylchlorid-Krankheit I. Internationales Symposium der Werksärzte der chemischen Industrie, 27. 4. 1972.
- (16) Jühe S., C.-E. Lange: Sklerodermie-artige Hautveränderungen, Raynaud-Syndrom und Akroostéolysen bei Arbeitern der PVC-herstellenden Industrie. Dtsch. med. Wschr. 97 (1972), 1922.
- (17) Jühe S., C.-E. Lange, G. Stein, G. Veltman: Zur Klinik der sog. Vinylchlorid-Krankheit. Jahrestagung Deutsche Gesellschaft für Arbeitsmedizin, 26. 10. 1972.
- (18) Lange, C.-E., S. Jühe, G. Stein, G. Veltman: Die sog. Vinylchlorid-Krankheit – eine berufsbedingte System-sklerose? Int. Arch. Arbeitsmed., im Druck.
- (19) Lange, C.-E., S. Jühe, H. J. Marsteller, R. Müller, G. Veltman: Leberschäden im Rahmen der sog. Vinylchlorid-Krankheit. Jahrestagung Deutsche Gesellschaft für Arbeitsmedizin 18. 5. 1973.
- (20) Mastromatteo, E., A. M. Fisher, H. Christie, H. Danziger: Acute inhalation toxicity of vinyl chloride to laboratory animals. Amer. industr. Hyg. Ass. J. 21 (1960) 394; zitiert in: Malten, K. E., R. L. Zielhuis (ed.): Industrial Toxicology and Dermatology in the Production and Processing of Plastics (Elsevier: Amsterdam 1964).
- (21) O'Conner, R. B.: A new occupational disease is born. J. occup. Med. 12 (1970), 234.
- (22) Peoples, A. S., C. D. Leake: The anesthetic action of vinyl chloride. J. Pharmacol. exp. Ther. 48 (1933), 284.
- (23) Stein, G., S. Jühe, C.-E. Lange, G. Veltman: Bandförmige Osteolysen in den Endphalangen des Handskeletts. Fortschr. Röntgenstr. 118 (1973), 60.
- (24) Stein, G., S. Jühe, C.-E. Lange, G. Veltman: Skelettveränderungen bei der sog. Vinylchlorid-Krankheit. Röntgenpraxis, im Druck.
- (25) Suciu, I., J. Drejman, M. Valaskai: Contributii la studiul imbolnavirilor produse de clorura de vinil. Med. interna (Buc.) 15 (1963), 967.
- (26) Torkelson, T. R., F. Oyen, V. K. Rowe: The toxicity of vinyl chloride as determined by repeated exposure to laboratory animals. Amer. industr. Hyg. Ass. J. 22 (1961), 339; zitiert in: Malten, K. E., R. L. Zielhuis (ed.): Industrial Toxicology and Dermatology in the Production and Processing of Plastics (Elsevier: Amsterdam 1964).
- (27) Viola, P. L., A. Bigotti, A. Caputo: Oncogenic response of rat skin, lungs, and bones to vinyl chloride. Cancer Res. 31 (1971), 516.
- (28) Wilson, R. H., W. E. McCormick, C. F. Tarum, J. L. Creech: Occupational acroostéolysis. J. Amer. med. Ass. 201 (1967), 577.

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