

Dermato-Venereological Research at Lund University

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Lund University is one of northern Europe's largest seats of learning for higher education and research and is ranked among the world's top 100 universities. It was founded in 1666 and is the second oldest Swedish University. The two Divisions of Dermatology and Venereology belong to the Department of Clinical Sciences, Lund and Malmö, respectively. The research is closely linked to translational and basic research at the Biomedical Center, Lund, as well as connected to Clinical Dermatology in Malmö-Lund at Skåne University Hospital. Furthermore, the Dermatological Clinic is involved in interdisciplinary research in collaboration with the Oncology Clinic and the Division of Physics at Lund Institute of Technology. Research within the Unit of Occupational and Environmental Dermatology involves extensive national and international collaboration. This collaboration involves researchers from dermatological and non-dermatological departments on every continent. In total, the merged Lund-Malmö Dermatological Clinic has more than 150 employees, and is headed by Drs Bertil Persson and Åke Svensson. During recent decades research in Lund has focused on pigmentation and melanoma, photodermatology, contact dermatitis, neuropeptides, innate immunity, wound healing, and atopic dermatitis (AD).

Dermatology Lund

The ongoing research projects are led by Niels Bendsøe, MD, PhD (laser spectroscopy), Ola Bergendorff, Associate Professor (contact dermatitis), Ove Bäck, Professor Emeritus (atopic dermatitis), Christer Hansson, Professor Emeritus (contact dermatitis), Artur Schmidtchen, Professor (innate immunity, wound healing), Andreas Sonesson, MD, PhD (atopic dermatitis), and Joanna Wallengren, Associate Professor (neurogenic mechanisms), all of whom are active in the Division of Dermatology and Venereology, Lund.

Research on laser spectroscopy for detection and treatment of tumours

The focus of the laser-based spectroscopy research is on developing clinically useful systems for monitoring tumour spread by laser-induced fluorescence, and subsequent treatment with cancer-targeted light-activated drugs (photodynamic therapy). This will enable cancers to be detected earlier and more precisely. New tumour-targeting compounds are under development.

The goal is to offer patients treatments that are milder and cause less suffering than those that are currently used, and for which the risk of complications and other undesirable effects is lower. This research activity is part of a larger European Union (EU)-sponsored network of excellence.

Research on contact dermatitis

The focus here is on the mechanisms of allergic eczema, which will provide opportunities to develop new diagnostics and treatments. One branch of this research is focused on rubber allergy and allergy to gloves. This project is a collaboration between the departments in Lund and Malmö. New compounds that are formed in the skin from well-known rubber compounds will be identified. The project also includes study of how known allergens are chemically transformed during rubber production, and the allergenicity of the newly formed compounds.

Research on innate immunity

Humans are colonized by a wide variety of bacteria and fungi, and it is estimated that each person carries 1–2 kg of microbes, of which 1–2% are found on the skin. The microorganisms we carry outnumber our own cells. These observations illustrate the importance of controlling and containing our microbial flora. Host defence peptides are important contributors to the body's defences. With resistance to antibiotics increasing, it is essential to develop alternative strategies for preventing both infection and subsequent damaging inflammatory processes. Through our research we aim to develop treatments based on new antimicrobial and immunomodulatory peptides. These peptides target not only bacteria, but also modulate our own immune system. Utilizing the immune system in this way represents a new treatment modality, which is expected to minimize the development of bacterial resistance and provide new opportunities for treatment of inflammation. The research may have implications for the treatment of skin, wound and burn infections, and the prevention of sepsis.

Research on atopic dermatitis

The previous concept of AD as a Th2-disease is expanded by recent studies demonstrating novel inflammatory pathways mediated, for example, by



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Fig. 1. Mikkel Brydegaard from Atomic Physics, Lund at a joint clinical trial for the tumour borders identification in patients at the Division of Dermatology, Lund. A collaboration with the Dermatology and Oncology Clinics in Lund, Division of Atomic Physics in Lund and the Imperial College in London. Photo: Katarina Svanberg, Niels Bendsøe.

Th17-cells, as well as thymic stromal lymphopoietin (TSLP) produced in direct response to microbial challenge. Thus, complex activation patterns that bypass, or complement, classical Th2-dependent pathways are probably active in AD at various stages of the disease. Currently, novel aspects of TSLP function, as well as upregulation in response to microbes are being investigated. In parallel, material from more than 800 patients (database AD Lund) is currently being investigated with respect to clinical parameters, immunoglobulin E (IgE) responses, as well as cytokine levels. It is expected that increased understanding of the dynamics and of the presence of individual phenotypes as well as genotypes in this patient group will lead to better diagnostic options and therapies.

Research on neurogenic mechanisms in skin disease

Neuropeptides in the skin have been a significant focus of research since the early 1980s. In the first projects the occurrence, distribution and pharmacological effects of several neuropeptides in normal and inflamed skin were described. Immunomodulatory effects of substance P (SP), vasoactive intestinal peptide (VIP) and calcitonin gene-related peptide (CGRP) were studied in experimental contact dermatitis. Current research projects focus on pruritus and its treatment, with special reference to neuronal mechanisms.

Dermatology Malmö

The overall aim of the occupational and environmental research is improved diagnostics and prevention of occupational and environmental skin diseases. This research emanates from the needs of the medical service, including problems existing in various groups, such as cardiological patients who have undergone surgical interventions, children and adults undergoing specific immunotherapy because of asthma, certain occupational groups, such as nail technicians, construction workers and metal workers, or a certain type of industry, such as manufacturing of aeroplanes or wind turbines. The research results can often

be transformed rapidly into the medical service as a general, improved diagnostics and prevention, but can also be used specifically as a basis for measures for certain groups of individuals, such as cement workers and within industries. Furthermore, the research results can be used as a basis for legislation within the EU. Examples of such research resulting in European legislation, and for which research results from Malmö have been a part of the basis for the legislation, concern metals, fragrance substances and preservatives. The latest example is the preservative dimethyl fumarate, for which research efforts in Malmö in collaboration with dermatologists from Finland and England have constituted a significant part of the basis that led to European legislation prohibiting the use of dimethyl fumarate in consumer products from spring 2009. In this way hundreds of European citizens with a severe skin disease have had their diseases diagnosed and treated. The research result and the European legislation also mean that many thousands of individuals will be spared the severe skin problems caused by the presence of dimethyl fumarate in consumer products.

Research on contact dermatitis

There are ongoing research projects on metals (four doctoral students). One project investigates the significance of dental gold and skin disease. Contact allergy to aluminium is the topic of two projects concerning the significance of aluminium-based adjuvant in vaccination and specific immunotherapy, as well as diagnostics of aluminium allergy and assessment of clinical relevance. The use of nickel is decreasing and nickel is therefore less present in consumer products, where it has partly been replaced by palladium. The significance of this replacement is the topic of another research project. Plastics represent another major group that has been explored for decades. Two ongoing projects deal with acrylates and isocyanates, and both projects have already resulted in doctoral theses. The process of recruiting more doctoral students within this area has begun. Within the area of fragrances and flavours there are three doctoral projects. One project investigates the significance of the volatility of fragrances for diagnostics and clinical relevance. Plants and spices may contain sesquiterpene lactones or contact sensitizers present in *Myroxylon pereirae*. These sensitizers are present in some foodstuffs and liquors and we are investigating the possible significance of systemic exposure to such sensitizers for hand dermatitis in patients who are hypersensitive to sesquiterpene lactones and *Myroxylon pereirae*, respectively. The hair dye paraphenylenediamine is closely related to certain textile dyes. A doctoral project on textile disperse dyes has been completed recently. Two doctoral projects, on paraphenylenediamine and textile disperse dyes, respectively, are ongoing. The drug ketoprofen can be used topically to relieve pain, but it may also induce photosensitization and subsequent severe photoallergic contact dermatitis. Various aspects of such photodermatitis are being explored in a doctoral project. The preservative formaldehyde is ubiquitous and, in a way, this is the most difficult allergen to manage when detected in a patient. Various aspects of diagnostics



Fig. 2. Investigation of the barrier capacity of various glove materials *in vivo* with a method developed in Malmö.

and clinical relevance are the topic of a doctoral project. One doctoral project studies professional ice hockey players from 26 teams representing Sweden, as a model for possible preventive measures. This project includes questionnaires completed by 600 ice hockey players when they started the 2009 season, followed by intervention for half the players, and a further questionnaire for all 600 players at the end of the 2010 season. More than 100

ice hockey players have also been patch-tested with the baseline series as well as with products from their work environment.

Research on the epidemiology of hand eczema and atopic dermatitis

Epidemiological aspects of hand eczema and atopic dermatitis, respectively, are the subjects of two other doctoral projects. In one planned doctoral project the outcome of our patients with hand dermatitis will be analysed and one randomized group will be subjected to an intervention programme.

Research in venereology (Annika Jonsson)

In cooperation with the Institution of Microbiology where patients with the clinical diagnosis of condyloma are tested for HPV. We investigate which virus is the most common in condyloma acuminata. We also investigate if there is a viral shift after the introduction of vaccines against HPV. Another large project is to determine which diagnostic technique is the most sensitive in diagnosing *Chlamydia trachomatis* and *Mycoplasma genitalium* in women. In a retrospective study in women with the diagnosis of urethritis and/or cervicitis we evaluate the connections with STI:s such as *Neisseria gonorrhoea*, *Chlamydia trachomatis* and *Mycoplasma genitalium*.

Universities of Lund (top) and Malmö (bottom). The white arrows indicate the location of Departments of Dermatology and Venereology.



Facts

There are eight faculties in Lund and additional campuses in the cities of Malmö and Helsingborg. The university offers 274 study programmes and more than 2000 courses, and has approximately 6000 employees, 2800 doctoral students, and a total of 47,000 students.

In Lund, the first Professor of Dermatology and Venereology was Gösta Hagerman, who was appointed in 1949. He was followed by Hans Rorsman (1974–95), Ove Bäck (1995–08), and, currently, Artur Schmidtchen (2010–). The group of researchers at the Department of Dermatology and Venereology in Lund consists of:

- 1 Professor + 2 Professor emeriti
- 3 Associate Professors
- 8 researchers with a doctor's degree of which 6 are MD
- 4 registered PhD students

The group publishes approximately 10–15 original articles per year. Three theses have been published within the research groups during the past 2 years.

In Malmö, the Department of Dermatology and Venereology became a university clinic within the Faculty of Medicine in 1969. Bertil Magnusson was appointed the first professor, followed in 1980 by Halvor Möller. After serving as an adjunct professor since 2000, Magnus Bruze was appointed ordinary professor in occupational dermatology in 2009. The group of researchers at the Department of Dermatology and Venereology in Malmö consists of:

- 1 Professor +1 Professor emeritus
- 9 Associate Professors
- 5 assistant professor
- 15 registered PhD students

This group publishes approximately 25 original articles per year. Three theses have been published within the group during the past 2 years.