
Allergy and indoor allergen avoidance measures



European
Centre for
Allergy
Research
Foundation

Foreword: Philips

There has been a significant increase in allergic and respiratory diseases in industrialised countries in recent decades. Europe has the highest prevalence of allergic rhinitis in the world, with around one in four individuals suffering from the disease. Pollution is an allergy trigger that's hard to avoid. Poor air quality can worsen allergy symptoms in some people; it may also play a part in causing respiratory diseases.

It is a common belief that when indoors, one is safe from harmful pollutants. In fact, many allergy triggers exist in the home, from pollen that enters buildings through open windows and ventilation systems to additional sources of indoor pollutants such as dust mites, pet hair and mould. Confined indoor spaces may cause the concentration of pollutants to rise to unacceptable levels. Indeed, some pollutants may be 2–5 times (and sometimes even 100 times) more concentrated inside than outside buildings. Reducing indoor air pollution may have a significant positive impact on many people's lives.

At Philips, an important goal of ours is to help people with allergic and respiratory diseases better manage their condition. We have a proven track record in respiratory care and are building on our heritage of being a world leader in healthcare technology. We believe there is always a way to make life better and are continuously innovating technologies to make a difference for those who are impacted by their living environment.

Knowing and understanding our consumers' needs is at the centre of what we do. We aim to offer products and integrated solutions that satisfy our consumers and address challenges they face by listening to and collaborating with scientists, doctors, engineers and organisations such as European Centre for Allergy Research Foundation (ECARF). Together with ECARF, we hereby present this publication that explains the importance of indoor air quality and offers practical advice on how to reduce the risk of allergy triggers at home. The text can be found on ECARF's website (www.ecarf.org) and is based on a solid review of scientific literature. We would like to express our sincere gratitude to ECARF with whom we share the same goal of helping people manage respiratory symptoms and improving their quality of life.



Roy Jakobs

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Foreword: ECARF

Around 100 million Europeans suffer from pollen allergies – the most widespread allergic disease. In Germany, 30% of all adults have at least one allergy. For some, the allergy is an acute and unpleasant episode that quickly subsides. For others, it means adapting to a completely new way of life.

As a non-profit organisation based in Berlin, the mission of the European Centre for Allergy Research Foundation (ECARF) is to improve health care for people with allergies at the local, national and European level by funding medical research and educating all those whose lives are affected by allergies – parents, children, educators and caregivers.

To achieve our goals, we work with allergists and dermatologists across Europe, providing country-specific support and offering advice on allergy-friendly products and services. An independent advisory panel of 15 leading international scientists and technicians has developed criteria to evaluate different product groups, including consumer goods such as cosmetics, laundry and cleaning products, textiles, home appliances, and services such as those offered by hotels and restaurants. The ECARF Seal of Quality, present in over 30 countries, uses these criteria to certify products and services that offer special advantages by simplifying the everyday lives of allergy sufferers. The criteria are regularly updated to reflect the latest scientific findings. A product receives the ECARF Seal of Quality when it can be proven through external audits or studies that the criteria have been fulfilled.

Many Philips air purifiers and vacuum cleaners have been awarded the ECARF Seal of Quality. ECARF has been working with Philips for several years. The company supports the mission of ECARF to improve the lives of people affected by allergies. We believe that allergen avoidance is an essential part of effective allergy management. We hope that the following information will help us achieve our goal of building specific knowledge, eliminating doubts and enabling allergy sufferers to take charge and lead active lives.



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Allergies:

Facts and figures

An allergy is an immune system error leading to chronic inflammation at the sites on the body that come into contact with the environment. Allergies are made worse by the living conditions in modern industrialised countries. Increased hygiene, environmental pollution, climate change and resulting changes in vegetation, and globalisation of the food market are only some of the factors involved in the spread of allergies. The most common allergic disease is allergic rhinitis due to pollen (hay-fever), followed by asthma, atopic dermatitis and contact allergies.

Allergic rhinitis is commonly referred to as hay fever. The term is not entirely precise, since hay fever is actually a condition in which allergic reactions are triggered by pollens, while allergic rhinitis can also be triggered by other substances, such as animal hair, house dust mites or mould.

Allergic rhinitis is an inflammatory disease that causes symptoms such as sneezing, itchy nose, difficulty breathing and/or runny nose (medical term: increased nasal discharge). It is a reaction to allergy-triggering airborne substances (medical term: aeroallergens) and, depending on the allergen, can cause seasonal or year-round symptoms.

The disease commonly occurs in all age groups. It usually begins in childhood and remains for life. According to the World Health Organization (WHO), around 400 million people worldwide had allergic rhinitis in 2007. Prevalence was highest in Europe with around one in four Europeans suffering from the disease. Many people – around 40% of the total population – become predisposed to allergies over time due to exposure of the mucous membranes to allergens (medical term: sensitisation). But not all sensitised people will experience actual allergy symptoms. This is referred to in medical terms as a latent allergy.

Experts believe that external factors such as tobacco smoke and environmental pollution in addition to hereditary factors could play a role in the development of the disease. There is currently no available research that explains why some people develop allergies while others develop only a latent allergy or none at all. Allergic rhinitis triggers include seasonal allergens such as pollen from trees, grasses or weeds, mould spores, and year-round substances such as house dust mites and animal hair.

When allergic rhinitis is not treated correctly, it often leads to what is called the 'allergic march' – a progression to allergic asthma. Various studies have demonstrated that the annual costs for a patient with chronic asthma and concomitant allergic rhinitis are on average six times higher than the costs for allergic rhinitis alone. Experts have calculated that Europe could save €84 billion per year if allergies were treated properly.

The next sections describe the most important triggers of allergic rhinitis, their symptoms and recommended allergen avoidance measures.



Dust mite allergies

House dust mites are barely visible to the naked eye. They measure just 0.1 to 0.5 mm and are actually harmless – they do not bite, nor do they transmit disease. But for people with a predisposition to allergies, they can become a problem.

Triggers

The allergenic effect is actually due to certain proteins in the droppings of house dust mites (including the proteins Der p1 and Der p2). The droppings dry out, break down, and get mixed into house dust, which also contains the shed skin and faeces of the mites. When the dust is breathed in, allergic reactions can develop.

The immune system then generates IgE antibodies in reaction to the proteins, which are actually harmless. These antibodies bind to the body's defence cells, known as mast cells, which then release anti-inflammatory substances such as histamine.

Histamine and other messenger substances stimulate the glands to release secretions and irritate the nerves, causing itching, sneezing and vasodilation that leads to redness and swelling of the mucous membranes.

Places where house dust mites live

House dust mites are found in every home and are not a sign of poor hygiene. They prefer warm, damp, dark places. Mites thrive at a humidity of 70 to 80% and temperatures above 25°C. They are not present in dry climate areas, even in dusty conditions. They need a damp environment to survive, since they take moisture

from the air rather than drinking. They feed mainly on the dead skin shed from humans and animals. Their genus name 'Dermatophagoides' comes from the Greek, meaning 'skin eaters'. In homes, they prefer bedrooms and the interiors and surfaces of mattresses, blankets and pillows. These places provide them with optimal living conditions. Humans release moisture into the air while sleeping and shed a lot of dead skin. Mites can also be found in the kitchen, where cooking activity creates a warm and damp environment. Mite allergens are found in dust-filled textiles in the highest concentrations; these include upholstered furniture, carpets, curtains and plush toys as well as beds. Allergen levels are at their highest between May and October, the peak breeding season of house dust mites. Most of the mites die during the winter, but the allergen-containing dust is stirred up by heating systems. This often causes the symptoms experienced by affected patients year-round to worsen during the winter.

Symptoms

The allergy becomes particularly troublesome at night or in the morning with symptoms such as a runny or mostly blocked nose. Other symptoms include sneezing and sometimes itchy, watery eyes.

Constant exposure to allergens may lead to chronic inflammation of the nasal mucosa, which may in turn lead to nasal turbinate hypertrophy. This leaves patients unable to breathe through their nose, and they then end up breathing through their mouth (which may lead to more frequent infections in the ear, nose and throat area).

A hypersensitive reaction can also occur in the bronchial mucosa after some time, causing bronchial asthma. Symptoms include coughing (at night), difficulty breathing, and wheezing.



Dust mite allergies

In rare cases, the skin is affected (itching, redness and hives). A house dust mite allergy can also trigger an atopic dermatitis flare-up.

In some cases, people with a house dust mite allergy also experience an allergic reaction after eating crustaceans such as prawns, crabs or lobsters. Like mites, these animals belong to the phylum Arthropoda and contain proteins similar to those found in mites (Der p10). The sensitised immune system considers the crustacean proteins as 'dangerous' and triggers an allergic reaction. Such cross-reactions may also occur after eating molluscs such as mussels or snails. Allergic reactions to storage mites occur less often. This type of mite can be found in the damp walls of pantries or in the hay inside stalls or pet cages.

Allergen avoidance measures

The most important therapeutic measure is to reduce allergen exposure by reducing the number of house dust mites in the environment.

The **bedroom** in particular should be kept cool and dry. The optimal air humidity is 45 – 55% (this can be measured with a hygrometer), and the optimal room temperature is 18°C. To reduce humidity, it is recommended to air out rooms briefly several times a day and not to keep houseplants in the bedroom (this also reduces mould levels).

The **mattress** should also be well ventilated (not placed directly on the floor; a mattress on a bedframe is better than a storage bed) and made up with special bedding that does not allow mite allergens to penetrate. Double beds with twin mattresses must have encasings on both mattresses.

The **bedding** should be aired out every morning. (Cotton) Bedding should be laundered every one to two weeks at

60°C. Pillows and blankets should be washed at the same temperature every three months. If the materials do not allow for this, encasings can be used.

There is no consensus as to whether **carpets** should be removed. If there is floor heating under the (short-pile) carpet, using it reduces the moisture level in the floor and consequently reduces the number of mites. Carpets collect dust particles that would otherwise swirl around on smooth floor surfaces. However, it is very difficult to remove mite particles with a standard vacuum cleaner. Smooth floor surfaces (wood, tile, linoleum) are therefore the better choice if they are regularly vacuum cleaned and damp mopped.

Vacuum cleaning increases the concentration of airborne mites. Therefore people with a dust mite allergy should ask non-allergic individuals to perform this task, or wear a protective mask while doing so. It is also advisable to equip the **vacuum cleaner** with a **HEPA filter**, a particulate filter that traps extremely fine particles. But they are not of much use if the vacuum cleaner is not sealed and dust escapes out of the cracks.

It is also recommended to wash the **textiles** in the room regularly (curtains should be washed at 60°C if possible) and to keep them to a minimum (no decorative pillows, no upholstered bedframes or furniture; choose furniture with smooth surfaces such as leather or wood). **Plush toys** should not be placed in the bed; as an alternative, they can be washed regularly at 60°C. If this is not possible, they can also be placed in the freezer for 12 hours. This kills the mites, but the toys must then be washed (at the appropriate temperature) in order to remove the allergens.

Pets should not be allowed in the bedroom because the skin flakes they shed are additional food to the mites.

Pollen allergies

Many people react to the pollen of more than one flowering plant species and suffer from symptoms not only in the spring, but also in the summer or virtually all year round. Over the years, researchers have observed that the pollen season has shifted forward by several days and continues on a bit longer in the autumn. If the climate is mild, the last grass or weed pollens can still be airborne in November, while the first hazel pollens appear as early as December. The effects of pollen allergy are underestimated. In addition to sneezing, runny nose and itchy eyes, many people cannot work to their full capacity during pollen season; they sleep poorly and are exhausted.

Prevalence

Around 12 million people in Germany suffer from hay fever (14.8%). Scientists at the Robert Koch Institute have arrived at this estimate through an analysis of interviews with 8,000 adults who were asked what their physicians said.

Hay fever typically appears before age 25, usually in children between eight and 16 years of age. These days, more and more people over 50 are developing pollen allergies for the first time.

Triggers

The allergy is caused by pollen, often from wind-pollinated plants. Pollen consists of individual pollen grains that contain the male gamete. Insect-pollinated plants produce less pollen than wind-pollinated plants, which need to release a lot of pollen in order to ensure pollination. This lightweight dust can travel hundreds of kilometres. The windier it is, the more widely the pollen is spread, and the higher the concentration. Rain drives pollen towards the ground, which then causes fewer symptoms (although storms can make symptoms worse). In some people, it takes only a few pollen grains to trigger a severe allergic reaction. For example, six rye pollen grains per cubic metre of air are enough to provoke an allergic reaction in people who are sensitised. (For comparison, a single ear of rye produces several million pollen grains.)

The main allergy triggering pollens come from trees, grasses and weeds.

Trees: The pollen of early flowering species such as birch, hazel, alder and ash are particularly allergenic. Birch pollen allergy is especially common.

Grasses: The Poaceae, commonly called 'grasses', are mainly responsible for triggering grass pollen allergies.

Weeds: Mugwort and ragweed are highly allergenic.

Pollen contains water-soluble proteins that are released when they come into contact with the mucosa. In allergic individuals, the immune system generates IgE antibodies in reaction to the proteins, which are actually harmless. These antibodies bind to the body's defence cells, known as mast cells, which then release anti-inflammatory substances such as histamine.

Pollen allergies

Histamine and other messenger substances stimulate the glands to release secretions and irritate the nerves, causing itching, sneezing and vasodilation that leads to redness and swelling of the mucous membranes.

Symptoms

Symptoms occur mostly in the areas that come into direct contact with the pollen allergens: the mucous membranes of the nose, eyes and mouth. These symptoms may include:

Nose: runny nose with watery mucous, nasal congestion, itchy nose, sneezing

Eyes: conjunctival redness, itching, tearing

Mouth/throat: burning, itching

Ears: itchy ear canals

Lungs: dry cough (especially at night), wheezing, difficulty breathing (asthma)

Skin: worsening of atopic dermatitis, in rare cases hives, redness

General symptoms: fatigue, disrupted sleep, headache

People who are allergic to pollen are often also allergic to certain foods. For example, raw apples or hazelnuts may trigger itching in the throat or swelling in the mouth in someone who is allergic to birch pollen. This is referred to as pollen food syndrome, which can develop because the proteins in some foods are similar to certain pollen proteins. In people with hay fever, the sensitised immune system perceives not only the pollen but also certain fruits, vegetables, nuts or spices as a threat and triggers an allergic reaction.

Allergen avoidance measures

The most important measure in treating an allergy is to avoid the allergen. This can only be achieved to a certain

degree for hay fever. Carpets, furniture, curtains, (bed) linens tend to trap pollen and allergens. The best solution is to minimise the pollen count in your living area by airing it out properly and regularly cleaning or washing all washable textiles. Allergy sufferers should not have dust traps such as dried flowers or wall hangings in their homes. If you have a pollen allergy, it is better to shower and wash your hair in the evening. Leave your street clothes outside the bedroom. Remember that handbags, hairbands and other accessories also collect pollen. In addition, pollen forecast data can help to avoid pollen exposures or to take appropriate preventive measures.

Carefully measured pollen counts and reliable forecasts make it easier for allergy sufferers to cope with the disease and receive the appropriate medical treatment. For the most precise pollen count forecast possible, a network of pollen counting stations is required. Pollen traps at these stations provide the current pollen count by trapping airborne pollen, identifying and counting it. The pollen count from one day and a comparison with various data, including the latest weather forecast, produce the forecast for the next day. The non-profit foundation Deutscher Polleninformations-dienst runs the biggest network of pollen counting stations in Germany. The foundation forwards the data to the Deutscher Wetterdienst (DWD – German Weather Service), which generates the forecasts. The latest forecast can be consulted online at www.dwd.de/pollenflug.²

Pet allergies



Around 38% of all households in Germany – and around 58% of families with children – have a pet. Dogs, cats, mice and other pets keep their owners active; they provide solace in difficult times and help develop social contacts. Unfortunately, like house dust mites, they are one of the most common triggers of indoor allergies.

Prevalence

In scientific terms, it is difficult to determine the number of people with animal hair allergies. One of the reasons is because blood and skin tests only show whether the body has developed an allergic predisposition to a certain allergen. At this time, these tests cannot confirm or predict whether a patient will actually develop symptoms.

In order to estimate the prevalence with any certainty, elaborate studies would be required in which the study participants would be directly exposed to the allergen. Even though there are no current findings as to how many people experience symptoms due to contact with animal hair, there is a series of studies investigating how many people have a predisposition to develop an allergy. A study conducted on 3,000 patients across Europe revealed that this predisposition, or sensitisation, varies widely depending on the region. Scandinavian countries have the most people with animal hair sensitisation (56% in Denmark compared to only 16% in Austria). One recent study of a random sample of 7,000 people in Germany revealed that around 10% of the population is sensitised to animal hair.

Triggers

The first animal hair allergen, Fel d 1, was identified in 1991. This is the main allergen in cats (*Felis domesticus*) and is produced in the animal's sebaceous, salivary and anal glands. Whenever the cat cleans itself, the allergen is spread onto its fur. All cat species – long-haired and short-haired, from tigers to lions – produce this allergen.

Most 'animal hair allergens' are not part of the animal's hair in the strict sense. It is often the small skin particles or substances found in bodily fluids (urine, saliva, sperm) that trigger allergies in humans. The trigger substances are needed for the animals to function; some are required for their sense of smell, others for the immune system and social behaviour.

Since each animal is a carrier of different allergens and each individual has a different sensitisation pattern, there are no truly 'allergy friendly' pet species. The vast majority of people who are allergic to cats react to all cat species. On the other hand, people who are allergic to dogs may be able to tolerate individual dog species or just female dogs, depending on the sensitisation of the patient. However, this can only be revealed through a comprehensive diagnostic procedure.

Some animal hair allergens are similar to proteins from other animals. This is why, in very rare cases, allergy symptoms can develop in people who are sensitive to a specific cat allergen (Fel d 2) after eating pork. Referred to as 'pork-cat syndrome', this occurs when substances in pork are considered dangerous by the immune system of an individual with a cat hair allergy. Since this substance is heat sensitive, pork-cat syndrome usually only occurs after raw or partially cooked pork is consumed.

Pet allergies



Although cats and dogs are the most common allergy triggers, horses, cows, rabbits, hamsters, guinea pigs, rats and mice can also provoke allergy symptoms. Animal hair allergies affect livestock holders, people without pets, and people who work closely with animals, such as veterinarians, zookeepers and farmers.

Symptoms

Animal hair allergies principally affect the breathing and the skin, with symptoms such as itching, redness, conjunctivitis or hives. They can also trigger or worsen an atopic dermatitis flare-up. If the allergens are breathed in, they can trigger allergic rhinitis or asthma symptoms in sensitised people.

Allergen avoidance measures

A pet owner may be faced with a tough decision. But an important step in the treatment of allergies is to create an allergen-free environment, which will help prevent allergy symptoms from worsening over the long term and also keep the allergy from spreading to the lower respiratory tract. This sometimes means having to part with a beloved pet.



Mould allergies

Prevalence

There is currently no precise information about the prevalence of mould allergies in Germany or the world. This is due in part to the fact that the available skin and blood tests used by doctors to reveal an allergic disposition to mould sometimes deliver contradictory results. It has been scientifically demonstrated that people with other respiratory allergies, especially those who suffer from allergic asthma, have a higher risk of reacting to mould.

Triggers

At the beginning of the 18th century, Sir Floyd made the connection between asthma symptoms and mould long before the term 'allergy' even existed. Mould is an organism with a thread-like structure that releases spores in order to reproduce. It spreads in places where damp, organic material is present. Around 107 allergens from 43 different types of mould have been identified so far. The four moulds most frequently associated with allergy symptoms are:

Alternaria
Cladosporium
Penicillium
Aspergillus

Mould can be found in the atmosphere and in all damp places. Cellars, damp walls, bathrooms, old upholstery, carpets, potting soil, rubbish bins and shower curtains are common sites for mould growth. Regular ventilation and cleaning can help prevent mould formation. One might assume that mould is mainly a problem in old houses, but unfortunately this is not the case. The energy efficiency standards of new buildings have resulted in an optimal indoor climate for mould growth.

Some researchers believe that climate change promotes a higher concentration of airborne spores. For years, experts have observed increasing carbon dioxide (CO₂) levels in the air, which is one of the causes of global warming. One study demonstrated that *Alternaria* moulds release more spores when CO₂ levels in the air are higher, and that these spores are even more allergenic than they are at lower CO₂ levels.

Symptoms

Mould allergy symptoms often affect the airways and can include nasal congestion and itching, sneezing, coughing, and difficulty breathing. Exposure to mould often aggravates existing asthma symptoms. It can also trigger an atopic eczema flare-up or other skin rashes in people who are sensitised. Although rare, gastrointestinal symptoms may occur after eating spoiled food or foods that have been prepared using mould cultures (blue cheese, for example).

Mould allergy in childhood

Various studies indicate an increased risk of mould allergy in children who grow up in a damp, mouldy environment. This is especially the case for families already predisposed to allergies. It is not known whether the risk can be reduced or an allergy can even be prevented by consistently avoiding mould in early childhood. Although there is no precise information regarding prevalence, experts believe that children suffer more frequently from mould allergies than adults. One study on *Alternaria* moulds demonstrated that antibodies in the blood in early childhood eventually reach a maximum level and then decrease again over time.

Allergen avoidance measures

High humidity is one of the ideal growth conditions for mould.

In addition, air conditioning systems aid the spread of mould inside buildings. Once a room has been attacked by mould, extensive measures may be needed to get rid of it (drainage, reconstruction).

It is therefore important to take the following measures to prevent mould from spreading in the first place:

Air out rooms regularly, even during the winter. Shock and transverse ventilation help achieve optimal circulation and heat balance.

Very damp rooms in particular (bathroom, kitchen, basement) should be aired out regularly.

Avoid using indoor fountains and humidifiers on radiators and limit the number of houseplants.

As soon as you notice any mould growth, immediately replace the affected object – for example, shower curtain or wallpaper (this should not be done by a person who is allergic to mould).

Regularly inspect the walls behind furniture and radiators for mildew stains.

Move furniture away from walls. This allows the air to circulate between the wall and the furniture, preventing moisture build-up.

Do not leave kitchen waste lying about and take out the rubbish often.

Consume food when it is as fresh as possible and avoid storing it for longer periods.

Carry out maintenance on your air conditioning system according to the manufacturer's instructions (both car and home) and also make sure that the air conditioning at your workplace is regularly inspected.

Equip your vacuum cleaner with special filters that prevent the redistribution of spores.

Avoidance challenges and support from household devices

The avoidance of allergens is an important part of allergy therapy (medical term: abstention). Allergic individuals must avoid exposure to the trigger substance. Depending on the disease, there are various measures that should be taken. (see preceding sections for detailed information).

Depending on the allergy, it can be very difficult to avoid exposure to the allergen. For example, it is hard for people with a birch pollen allergy to avoid exposure to pollen in Germany in the spring. It is also nearly impossible to completely avoid house mites in everyday situations, since they are present not only in the home but also at the cinema, on the seats of public transportation, and in carpets at friends' houses. The energy efficiency standards of new buildings have resulted in an optimal indoor climate for mites.

Depending on the severity of the symptoms, it can be helpful for patients to spend some time in a mite-free climate zone, such as the Alps, until their lung function and asthma symptoms improve. Pollen allergy sufferers can visit regions with low pollen counts during the peak pollen season (for example, they can travel to southern Europe to get away from birch pollen).

In addition, some household devices can help reducing indoor allergen exposures. As an example, air purifiers can remove allergens from the air indoors to a significant degree so that the symptoms experienced by people

with hay fever or allergic asthma can be noticeably alleviated. ECARF certifies allergy-friendly air purifiers that are able to achieve a measurable improvement in air quality for the given room size through normal everyday use. The criteria for allergy friendly air purifiers underlie the assumption that less exposure to allergens is generally beneficial and depict the currently highest technical standards. The ECARF Seal of Quality certifies air purifiers as allergy friendly if they are able to archive a significant reduction of airborne pollutants.³

A recent study demonstrated the efficacy of air cleaners to help reducing allergy symptoms in an indoor environment. In this study, four participants with allergic rhinitis to grass pollen were exposed for 90 minutes to an atmosphere of 4,000 grass pollen/m³. The presence of a Philips AC4012 air purifier resulted in the complete prevention of symptoms in the nose, eyes, and bronchia.⁴

Furthermore, special vacuum cleaners can broadly eliminate allergens from floors, surfaces and the indoor air, significantly reducing allergy symptoms in people with hay fever or allergic asthma. ECARF certifies allergy-friendly vacuum cleaners that, with normal everyday use, are able to achieve a measurable reduction in the allergen load in indoor areas and securely trap the removed allergens. The ECARF Seal is awarded if the criteria are fulfilled. The criteria underlie the assumption that less exposure to allergens is generally beneficial and depict the currently highest technical standard. Many Philips air purifiers and vacuum cleaners received the ECARF Seal of Quality. Those awarded are listed at the ECARF website.⁵