



FLIR thermal imaging cameras help determine the functionality of anti-allergy medicine

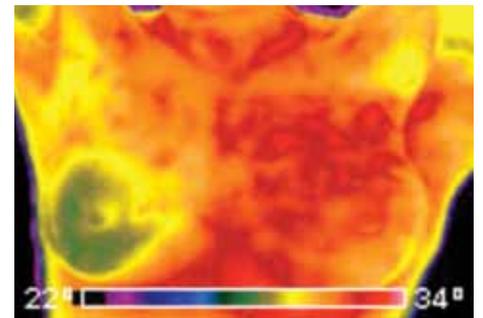
Ongoing research at Charité Berlin enhanced with thermal imaging cameras

Thermography using FLIR thermal imaging cameras is one of the most efficient techniques for the study of skin temperature. It is an accurate, quantifiable, non-contact, non-invasive, diagnostic technique that allows the examiner to visualize and quantify changes in skin surface temperature using high performance thermal imaging cameras.

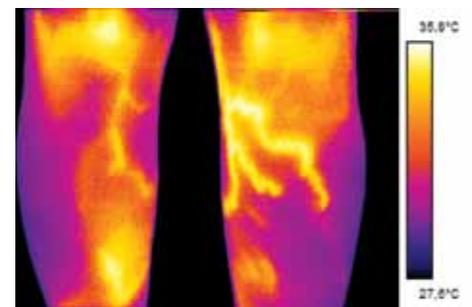
One of the leading medical institutes that use a thermal imaging camera from FLIR is the Allergy Center of the university hospital Charité Berlin. For several ongoing studies of wheal and flare reactions in the skin the research team of Professor Marcus Maurer at the Allergie-Centrum-Charité, the allergy center of Charité - Universitätsmedizin Berlin uses a FLIR thermal imaging camera to accurately measure the body's temperature after it is exposed to certain triggers. "It really is a great tool to objectify the body's response", explains assistant physician and clinical trial investigator Elena Ardelean.

FLIR thermal cameras are the leading choice in clinical, veterinarian and research medicine as they have proven to be highly accurate, reliable and easy to use. Thermal imaging cameras are a sensitive diagnostic tool for a multitude of clinical and experimental situations, ranging from breast cancer screening to open heart surgery.

Thermography is based on the analysis of skin surface temperatures as a reflection of normal or abnormal human physiology using a high performance thermal imaging cameras. The camera generates images with thermal data in real time. In a fraction of a second, a large area of the human body can be imaged and dynamic responses to stimuli can be documented quite easily.



A thermography examination shows an abnormal temperature difference, possibly indicating breast cancer in the left breast.



These varicose veins very clearly show up on the thermal image.

Safe and effective

Thirty years of clinical use and more than 8,000 peer-reviewed studies in the medical literature have established the use of thermal imaging cameras as a safe and





Elena Ardelean, assistant physician at the Allergie-Centrum-Charité, the allergy center of Charité - Universitätsmedizin Berlin.

effective method to examine the human body. It is completely non-invasive, and as such it does not require the use of radiation or other potentially harmful elements.

Medical research has shown thermography to be a useful tool in research as well as being helpful in the diagnosis of breast cancer, nervous system disorders, metabolic disorders, neck and back problems, pain syndromes, arthritis, vascular disorders, and soft tissue injuries among others.

Nobel Prize winners

At the clinical research center of Charité

Berlin a thermal imaging camera from FLIR Systems is used in a number of different studies. The scientists and physicians of Charité are engaged in state-of-the-art research, patient care and education. It extends over four campuses with more than 100 clinics and institutes bundled under 17 Charité Centers. The Charité also has an international reputation for excellence in training. More than half of the German Nobel Prize winners in medicine and physiology come from the Charité.

Studying wheal and flare reactions

The Allergie-Centrum-Charité uses a thermal imaging camera for studies of medical conditions that include wheal and flare reactions within the symptoms. "There are different allergic and non-allergic reactions that cause the release of histamine stored in mast cells in the skin in certain body locations", explains Ardelean. "Histamine is an important mast cell mediator involved in immune responses. As part of an immune response to allergens, histamine is released from its stores in mast cells. Histamine triggers the inflammatory response, which means that it increases the permeability of the capillaries followed by



Flares show up clearly on the thermal image.

tissue edema and itch due to the action on peripheral sensitive nerves.

"When the mast cells in the skin release histamine as result of an allergic reaction, that part of the skin will develop a wheal and flare reaction", continues Ardelean. "The reaction usually occurs in three stages, beginning with the reddening of a patch of skin, followed by development of a flare surrounding the initial mark, as the histamine causes the blood vessels to dilate, allowing the blood to flow towards that area. Finally a wheal – a raised and itchy



This thermal image shows a cold urticaria patient's arm before a wheal and flare reaction is triggered.



A cooling element that has been cooled down to 4°C is applied to the skin.



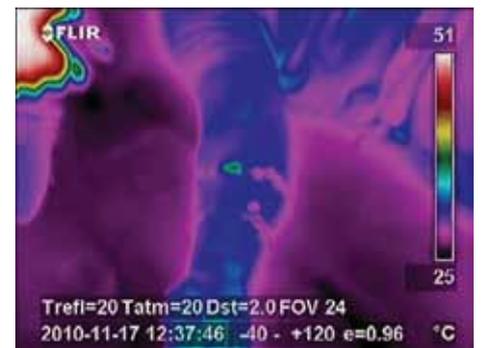
The patch of skin where the cooling element was applied show up as a cold spot.



The skin heats up and the cold spot disappears.



Soon it becomes a hot spot due to the wheal and flare reaction



In this thermal image the wheal and flare reaction clearly shows up as a hot spot.



Cold urticaria: In this case a cooling element at 4°C is used to trigger a wheal and flare reaction.

area of skin – forms at the site as fluid leaks into the skin from affected capillaries. The itching feeling is caused by the response of the nerves in the skin to the high levels of histamine and other mast cell mediators.”

Spontaneous urticaria and mastocytosis
More specifically the thermal imaging camera is used in studies of chronic spontaneous urticaria and mastocytosis.

FLIR SC660



Resolution thermal image:
640 x 480 pixels

<30 mK sensitivity, accuracy +/-
1% of reading

Wide range of lenses

Extended measurement functions

Advanced Laser Pointer

Sequence recording in camera

Built-in GPS

Contrast Optimizer

Ardelean is mainly involved in the research on chronic spontaneous urticaria. “There are many different types of urticaria, or hives. One of the main symptoms of urticaria is the previously described wheal and flare reaction. These symptoms can sometimes develop completely spontaneously. In these ‘out of the blue’ cases we speak of acute or chronic spontaneous urticaria. During an attack of acute or spontaneous urticaria, the skin reddens and wheals appear—the typical symptoms of urticaria.”

The wheals are accompanied by a strong itch and sometimes by a burning and pain in the skin as well. “Some patients also experience angioedema (deep swelling of the skin), which frequently occurs in the area of the face or in the hands and feet. Serious cases of urticaria can lead to an elevated body temperature or fever, headaches, diarrhea, shortness of breathing and swallowing problems, joint pain and tiredness and exhaustion.”

One out of four people

Acute spontaneous urticaria is quite common as one out of four people will be affected over the course of their lives. “And it’s very difficult to identify the reason for why this happens, as usually we cannot reproduce the symptoms on command because we do not know which of the many possible causes triggers it. And the symptoms usually disappear without a trace within 2 – 24 hours, so when the patient reaches a doctor quite often the wheals have already disappeared.”

For up to 10% of all patients with a spontaneous urticaria, the symptoms occur for longer than 6 weeks. One then speaks of a spontaneous chronic urticaria, or simply chronic urticaria. “These are the patients that I’m currently working with. When one of my patients with spontaneous chronic urticaria develops wheals and flares, I try to record and analyse the development of the symptoms using a thermal imaging camera from FLIR.

The flare reaction stands out very clearly as a hot spot on the thermal image, due to the elevated temperature.”



The thermal imaging camera from FLIR is plugged into the laptop through a FireWire connection.

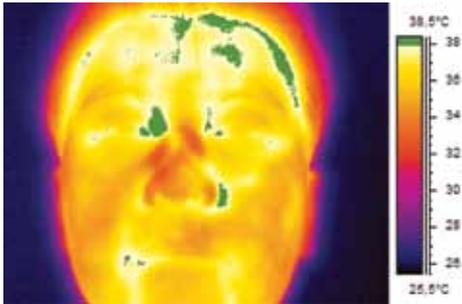


With the software FLIR ships with the camera the measured data can easily be analyzed.

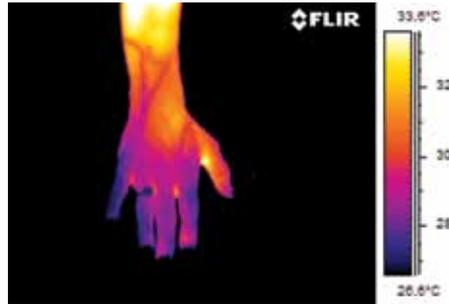
State-of-the-art thermal imaging system

The FLIR ThermoCAM S65 thermal imaging camera that is used at the Allergie-Centrum-Charité is an outdated model that has recently been replaced by the FLIR SC660 thermal imaging camera. This new state-of-the-art thermal imaging camera has been designed especially for scientific research. It combines higher resolution and sensitivity with the most advanced feature set available on portable thermal imaging cameras, like features such as Multifunction Video Capture, Built-in GPS, FLIR Thermal Fusion and Picture-in-picture, to name a few.

One of the goals of the tests Ardelean performs is to look how antihistamines modulate the development of the symptoms, both in duration and intensity of the wheal and flare reaction. “I therefore compared the wheal and flare reactions of an untreated patient with the wheal and flare reactions of that same patient after she/he has been treated with antihistamines”, explains Ardelean. “In this stage of the research it is too early to present any definite results, but it seems to be a trend that with increasing antihistamine dosis the symptoms are lower in intensity and shorter in duration.”



The color alarm in the thermal image of this man clearly shows the parts of the head with a temperature higher than 38°C, indicating an elevated body temperature due to fever.



This thermal image clearly shows insufficient blood circulation in the patient's hand.

The importance of thermal imaging

According to Ardelean the thermal imaging camera from FLIR Systems plays an important part in her research. "It really is a perfect way to accurately measure the temperature of the wheal and flare reaction and to monitor the development of the temperature over time. This really helps to objectify the body's reaction, allowing for a scientific comparison between the results with and without the antihistamine."

Easy to use

Ardelean admits that handling the camera seemed a bit daunting at first. "I was not used to using this type of equipment and I was

worried it would be difficult to handle, but I must say that both the thermal imaging camera and the ResearchIR software that came with it are very easy to use. Even though this type of equipment was new to me I was able to learn the basics and start collecting research data very quickly."

Another medical condition we conduct research on is mastocytosis. "That's a group of rare disorders caused by the presence of too many mast cells in a person's body. In this research we mainly focus on patients who have mastocytosis of the skin. Due to the presence of an abundance of mast cells certain triggers can cause a wheal and flare reaction that is similar to the urticaria symptoms."

From cold spot to hot spot in minutes

Ardelean's current studies are in cold urticaria. "In this case we use a cooling element that has been cooled down to 4°C to trigger the wheal and flare response", continues Ardelean. "In the thermal image you can see the cold spot left behind by the cooling element. After the cold provocation the skin site quickly heats up and develops a hot spot, allowing us to accurately measure both the duration and intensity of the wheal and flare reaction."

In this research, however, no antihistamine is administered. "In this case we want to find out what the chemical reaction is in the skin, so we flush the skin with neutral moisture and collect the drainage every five minutes for about half an hour. We repeat this procedure with and without triggering a wheal and flare reaction and then we determine the mediator in the collected samples, so we can see if there are correlations between their concentrations and the wheal and flare reaction."



Ardelean found the thermal imaging camera and the software that came with it very easy to use.



Skin microdialysis: Where the trigger has been applied the skin is flushed with a buffer solution to capture the mediators released in the skin.



Fluid samples are collected every 5 minutes for a period of half an hour and put on ice for future analysis.

Thermal imaging camera helps us to understand the disease

"These studies will allow us to better understand what is actually happening with these diseases and enable a better treatment of these diseases in the future. The thermal imaging camera from FLIR Systems at the Allergie-Centrum-Charité helps to make that possible", concludes Ardelean.

For more information about thermal imaging cameras or about this application, please contact:

FLIR Commercial Systems B.V.
 Charles Petitweg 21
 4847 NW Breda - Netherlands
 Phone : +31 (0) 765 79 41 94
 Fax : +31 (0) 765 79 41 99
 e-mail : flir@flir.com
 www.flir.com