

# Royal Free Symposium on Thermal Imaging in Medicine and Biology

Monday 13<sup>th</sup> October 2025,  
Royal Free Hospital, London, UK



**Royal Free London**  
NHS Foundation Trust



European  
Association of  
Thermology

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|---------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| 9:00-9:30     | Registration and coffee                                                                                                       |                                                                                                                               |
| 9:30-9:40     | Introduction from EAT board                                                                                                   |                                                                                                                               |
| 9:40-10:00    | Benefits and challenges of delivering a microvascular service at CDC                                                          | Jeny Anton<br><i>Royal Free London NHS Foundation Trust</i>                                                                   |
| 10:00-10:20   | Thermography of the ear in a case of relapsing polychondritis                                                                 | Audrey Macdonald<br><i>Newcastle upon Tyne Hospitals NHS Foundation Trust</i>                                                 |
| 10:20-10:40   | <i>Coffee break</i>                                                                                                           |                                                                                                                               |
| 10:40-11:00   | Inter-operator audit of thermography of hands between the microvascular team at Royal Free Hospital                           | Georgina Parsons<br><i>Royal Free London NHS Foundation Trust</i>                                                             |
| 11:00-11:20   | Development of a vascular optics and microvascular sensing research cluster and facility – the Coventry university experience | Prof John Allen<br><i>Research Centre for Intelligent Healthcare, Coventry University</i>                                     |
| 11:20-11:40   | Clinical and research applications of thermography                                                                            | Dr Graham Dinsdale<br><i>Salford Royal Hospital, Northern Care alliance NHS Foundation Trust/The University of Manchester</i> |
| 11:40 – 12:00 | Audit: Implementation of Infrared Thermography to Assess the Presence and Severity of Primary Palmar Hyperhidrosis            | Gabriel Santos<br><i>Royal Free London NHS Foundation Trust</i>                                                               |
| 12:00-13:00   | <i>Lunch</i>                                                                                                                  |                                                                                                                               |
| 13:00-13:20   | Clinical and research applications of thermography                                                                            | Dr Andrea Murray<br><i>The University of Manchester/Salford Royal Hospital, Northern Care alliance NHS Foundation Trust</i>   |
| 13:20 – 13:40 | The Thermology International archive: a free resource for thermography research.                                              | Dr Kevin Howell<br><i>Royal Free London NHS Foundation Trust</i>                                                              |
| 13:40 – 14:00 | A new model to explain the skin thermal response to exercise                                                                  | Prof Manuel Sillero-Quintana<br><i>Universidad Politécnica de Madrid</i>                                                      |
| 14:00-14:20   | Foundations for reliable thermometry: old, new and future... aka the changing face of temperature traceability                | <i>Prof Graham Machin</i><br><i>National Physical Laboratory</i>                                                              |
| 14:20 – 15:30 | Current UK practice and standardisation                                                                                       |                                                                                                                               |
| 15:30-16:00   | AOB and closing by EAT board                                                                                                  |                                                                                                                               |
| 18:30         | Dinner at Oliviya for those who would like to attend                                                                          |                                                                                                                               |

## **Benefits and challenges of delivering a microvascular service at CDC.**

Jeny Anton

Royal Free London NHS Foundation Trust.

Historically, the microvascular service at the Royal Free Hospital was run by a single Clinical Scientist for many years. However, the impact of the Covid-19 pandemic combined with the pre-existing shortfall in capacity meant that the waiting list for these specialised tests grew considerably, prompting the need for a new service model.

The introduction of a microvascular service within the Community Diagnostic Centre (CDC) at Finchley Memorial Hospital represented a major step toward decentralising specialist care and improving access to timely capillaroscopy and thermography testing for patients with suspected Raynaud's phenomenon and/or underlying connective tissue diseases.

In this talk, I will share our experience at the Royal Free Hospital in establishing and delivering this unique service model. I will discuss the key benefits, including reduced demand on the tertiary centre and quicker access to diagnostics and treatment for patients. I will also outline the challenges we faced, such as delivering cross-site specialist training, ensuring adequate clinical support, and maintaining consistent service quality in a non-tertiary setting. Our experience highlights both the benefits and the complexities of delivering specialist microvascular diagnostics in a secondary care setting.

## **Thermography of the ear in a case of relapsing polychondritis.**

Audrey Macdonald

Newcastle upon Tyne Hospitals NHS Foundation Trust.

Dr Iain Goff

Consultant Rheumatologist, Northumbria Healthcare NHS Foundation Trust.

A patient was referred with relapsing polychondritis (RP), chronic autoimmune inflammation of cartilage, experiencing persistent symptoms despite potent immunosuppression. Biochemical markers had normalised but thermography in a cool room revealed the symptomatic ear was 8 °C hotter than the contralateral ear. Repeat imaging at 12 months showed 12 °C difference, mirroring the switch in symptomatic side. Temperature comparison of areas which cannot be imaged simultaneously must include a robust assessment of the error in measurement. Thermography using a cooled room protocol has clearly demonstrated active inflammation and corroborated reports of pain where clinical inspection could not be conclusive.

## **Inter-operator audit of thermography of hands between the microvascular team at Royal Free Hospital.**

Georgina Parsons

Royal Free London NHS Foundation Trust.

The Royal Free hospital has a unique situation of having 6 scientists who test, report and interpret thermography of hand and feet assessments, commonly for the assessment of Raynaud's. This presentation will showcase the findings of an audit conducted within the team. Each scientist reported using our local SOP on thermography of hands on 5 patients, with each scientist blind to the reporting of others. The findings presented will be the variability between operators in the hope to open a conversation on the importance of reporting within acceptable limits. Does variation in reporting within the team make a significant impact on patient outcomes?

## **Development of a vascular optics and microvascular sensing research cluster and facility – the Coventry university experience.**

Prof. John Allen

Research Centre for Intelligent Healthcare, Coventry University, UK.

Light is powerful – it gives an early optical assessment window into tissue and microcirculation to probe perfusion, composition, structure and function (e.g. autonomic function/endothelial function).<sup>3,4</sup> Optical measurement technologies currently in the measurement facility include: Thermal Imaging (FLIR A655sc)/Black Body calibration, Nailfold Capillaroscopy (KK Technology) Optical Coherence Tomography (OCT, VivoSight Dx) for skin+microvascular overlay; Non-imaging technologies such as spectrophotometry objective skin colour, tissue oxygen saturation, photoplethysmography (PPG), laser Doppler flowmetry (LDF), beat-to-beat blood pressure and near infrared spectroscopy (NIRS). Bespoke analysis methods are being developed for such vascular optics measurements - including AI-based machine learning and cardiovascular modelling/data synthesis approaches.<sup>5</sup> Many patient groups can be studied as well as assessing potential new biomarkers of healthy vascular ageing/wellbeing. Current projects include utilising thermal imaging in conjunction with other techniques in the development of novel AI-driven sensing methods for assessing patients with Raynaud's, peripheral arterial disease (PAD) and heart disease. This talk will overview CIH, its 'Vascular Optics and Microvascular Sensing' research cluster, the new sensing facility plus an outline of some of the vascular optics projects underway.

## **Clinical and research applications of thermography.**

Dr. Graham Dinsdale

Salford Royal Hospital, Northern Care Alliance NHS Foundation Trust/The University of Manchester.

Severity of Raynaud's phenomenon is assessed at specialist rheumatology tertiary referral centres utilising thermography to measure hand recovery to cold-challenge. We present the results of a retrospective study of 703 patients attending for routine thermography assessment. The aim of this study was to test various hypotheses, including that: 1) post-cold challenge recovery data is related to pre cold-challenge skin temperature, 2) further rewarming after cold challenge is related to pre- and post-cold challenge, 3) longer (e.g. middle fingers would take more time to recover than e.g. little fingers and 4) that pre- and post-cold challenge are affected by age or gender.

## **Audit: implementation of infrared thermography to assess the presence and severity of primary palmar hyperhidrosis.**

Gabriel Santos

Royal Free London NHS Foundation Trust.

This audit explores the clinical utility and feasibility of implementing Infrared Thermography (IRT) as a routine diagnostic tool to assess the presence and severity of primary palmar hyperhidrosis (Hh) in newly referred adults at the Royal Free Vascular Hyperhidrosis Clinic. Patients diagnosed with primary palmar Hh will undergo IRT imaging, and findings will be compared with Hyperhidrosis Disease Severity Scale (HDSS) scores and clinic observations to evaluate diagnostic concordance. The audit will also evaluate operational feasibility and potential impacts on treatment planning. Primary outcome measures include Hh detection rates and Hh severity grading alignment between IRT findings and HDSS scores.

## **Clinical and research applications of thermography.**

Dr. Andrea Murray

The University of Manchester/Salford Royal Hospital, Northern Care alliance NHS Foundation Trust.

Relatively recent technological advances have led to availability of low cost, small thermal cameras, attaching to mobile devices or integrated into pocket size devices. These cameras offer promise for ambulatory monitoring of patients with Raynaud's phenomenon outside of the laboratory. They also offer potential as low-cost devices that could enable out-patient monitoring of Raynaud's in secondary healthcare centres that do not have specialist equipment. We present a study comparing the use of 'mobile' cameras on patients pre and post acclimatisation and compared to standard laboratory cameras to assess feasibility.

## **The Thermology International archive: a free resource for thermography research.**

Dr. Kevin Howell

Royal Free London NHS Foundation Trust.

Prof Kurt Ammer served on the board of the European Association of Thermology for many years, and chaired the Scientific Committee for the EAT Congress. He also edited the journal "Thermology International" which became the official journal of the EAT. Before Kurt's death in 2024, he transferred all rights to the material published in Thermology International to the EAT. We now host this important historical resource of thermology research online as an open-access archive. This presentation will highlight some of the key material in the archive that is freely available to all. Access the archive at: <https://eurothermology.org/ThermologyInt.html>

## **A new model to explain the skin thermal response to exercise.**

Prof. Manuel Sillero-Quintana

Sports Department, Faculty of Physical Activity and Sport Sciences (INEF), Universidad Politécnica de Madrid, Madrid, Spain.

The current interpretation of the thermal response of the human skin recorded by infrared thermography is based on classical Pennes' model and equations, which were developed under resting conditions and considered the heat transfer among the tissues to be almost null. The presentation will propose for discussion a new biphasic model (TermoINEF) with an internal cylinder corresponding to the muscles and their main vessels, surrounded by a hollow cylinder composed of the three layers of the skin. The Tsk response and heat transfer among those cylinders will be analyzed under different circumstances and for exercise. It will be also presented a free tool to generate images and videos in a simple and easy way, to graphically explain the thermal response of the skin to different internal and external stressor factors and to different exercises.

## **Foundations for reliable thermometry: old, new and future... aka The changing face of temperature traceability.**

Prof. Graham Machin

National Physical Laboratory.

In this short talk Professor Machin will speak about the foundation of reliable temperature measurement and how it could change in the next 10+ years. Beginning with the basic concept of traceability to a known reference as the foundation of any reliable measurement, the current reference for temperature, the International Temperature Scale of 1990 (ITS-90), will be introduced. It's linkage to the kelvin definition (as was in place when the ITS-90 was established) will also be described. The 2019 redefinition of the kelvin will be introduced and how that redefinition resulted in a broadening of the concept of traceability for temperature measurement to be not only to the defined scale, but also to encompass direct linkage to the kelvin definition. The talk will conclude with a discussion as to how this more flexible approach to temperature traceability may bring about a paradigm shift in the practice of thermometry resulting in sensors that always give the right temperature, requiring no calibration. These approaches are likely to include in-situ sensor calibration, and the development of practical primary thermometry based on fundamental quantum and photonic phenomena.

