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Does Thermology Belong to Complementary Medicine?

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Manuscripts should follow the recommendations of the International Committee of Medical Journal editors (ICMJE)[1] and for reporting health related studies the following standards are highly recommended:

CONSORT-(CONsolidated Standards Of Reporting Trials) for randomised controlled trials with parallel group design [2]

STROBE (STrengthening the Reporting of OBservational Studies in Epidemiology) for case control, cohort and crosssectional studies [3]

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) for systematic reviews and meta-analysis [4]

STARD (STAndards for Reporting of Diagnostic accuracy) for diagnostic tests [5]

CARE (Consensus-based Clinical CAse Reporting Guideline Development) for case or care reports [6]

SPIRIT (Standard Protocol Items: Recommendations for Interventional Trials) for study protocols [7]
SAMPL(Statistical Analysis and Methods in the Published Literature) for statistical reporting. [8]

In general, manuscripts hould be organized as follows: Introduction, methods, results, discussion, acknowledgements, references. A short abstract in English and, if possible, German (translation will be offered) should head the manuscript. Following the abstract, up to 5 key-words should characterize the paper.

Tables, Figures and Legends for illustrations should appear each on an extra sheet of paper.

References should be numbered consecutively in the order in which they are first mentioned in the text. Identify references in text, tables, and legends by Arabic numerals in parentheses.Use the style of the examples below which are based on the formats used by the US National Library of Medicine in Index Medicus (complete list of examples on [1]).

Standard journal article (List the first six authors followed by "et al" if the number exceeds 6).
Luther B, Kreyer I, Dobi I. Die Anus-praeter-Thermographie als Methode zur Früherkennung vaskulärer Komplikationen nach Dünndarmtransplantation. ThermoMed 1990; 6: 115-7.

Chapter in a book
Gautherie M, HaehnelP, Walter JM, Keith L. Long-Term assessment of Breast Cancer Risk by Liquid Crystal Thermal Imaging. In: Gautherie M, Albert E, editors. Biomedical Thermology. New York Alan R.Liss Publ; 1982. p. 279-301.

Before publication proof prints will be mailed to the main author for corrections. Each author will receive the final versionas pdf-file.

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References:

[1] International Committee of Medical Journal Editors. Uniform requirements for manuscripts submitted to biomedical journals. Medical Education 1999; 33; 066-078

[2] www.consort-statement.org

[3]www.strobe-statement.org

[4]www.prisma-statement.org

[5] ww.stard-statement.org

[6] www.care-statement.org

[7] www.spirit-statement.org

[8] www.equator-network.org/wp-content/uploads/2013/03/SAMPL-Guidelines-3-1

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Does thermology belong to complementary medicine?

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With much delay, the publisher Elsevier has included almost all issues of the journal "Thermology international", published between 2013 and 2016, in their database Embase/ Scopus by the end of December 2016 . After distributing this message to the EAT-Board members, one colleague expressed his appreciation of this action that helps to increase the visibility of the official publication organ of the European Association of Thermology. However, he also questioned the adequacy of assigning the journal to the field of "Complementary and Alternative Medicine ".

It is in fact an important question to define the place of thermology in the scientific spectrum. Reviewing the definitions of both thermology and complementary medicine might help to find a correct answer to the above question.

Definition of Thermology

Thermology is built from the ancient Greek words "thermos" = warm, hot and logos=word, speech, reason, thought. As the syllables "-logy" became a synonymous term for science and thus, thermology may be understood as "science of heat". In other words, thermology is a general term for the study of the nature and effects of thermal energy. Francis Ring reported that the term thermology was primarily used in the medical context [1]. The original name of the EAT was European Thermographic Association, ETA. The name adaptation to "European Association of Thermology" in 1978 expressed the interest of the Association in other heat research beyond infrared thermal imaging, and solved the problem of being confused with the Basque organisation ETA, which was particularly important when the second EAT conference was in 1978 organised in Barcelona. However, the database Embase used the term "thermography" synonymously for infrared photography for long time.

It is now commonly agreed that an infrared thermal image or infrared thermogram is the 2-dimensional representation of the temperature distribution on the surface of an object. Medical thermography depicts the temperature distribution of the human body and this information may be used to assist diagnosis or monitor the course of disease signs associated with temperature changes. Medical thermology can be defined as applications of thermal energy (i.e. heat) in medicine for diagnostic and/or therapeutic purposes.

Definition of Complementary Medicine

The following theoretical definition of complementary medicine was proposed by the Office of Alternative Medicine (OAM) expert panel at the Conference on CAM Research methodology in April 1995[2]. **"Complementary and alternative medicine (CAM) is a broad domain of healing resources that encompasses all health systems, modalities, and practices and their accompanying theories and beliefs, other than those intrinsic to the politically dominant health system of a particular society or culture in a given historical perio**d." To overcome the problems of such an exclusive negative definition, Ernst and colleagues provided the following alternative definition **"Complementary medicine is diagnosis, treatment and/or prevention which complements mainstream medicine by contributing to a common whole, by satisfying a demand not met by orthodoxy or by diversifying the conceptual frameworks of medicine"**[3].

A group of researchers at the Center for Integrative Medicine, School of Medicine, University of Maryland developed an operational definition of CAM which allows classification of the field. Based on a classification proposal of the US National Center for Complementary and Alternative Medicine (NCCAM), complementary therapies are allocated to 5 categories which are listed in table 1.

Table 1
Categories of Complementary and Alternative Medicine (from [2])

- Mind-Body Medicine, which uses a variety of techniques to enhance the mind's capacity to affect bodily function and symptoms
- Natural Product Based Therapies, which use substances found in nature to promote health
- Manipulative and Body-Based Practices, which are based on manipulation and/ or movement of parts of the body.
- Energy Medicine, which involves the use of energy fields, either the unconventional use of electromagnetic fields, or manipulation of energy fields that purportedly surround and penetrate the human body.
- Whole Medical Systems, which are complete systems of theory and practice outside the conventional allopathic model.

Energy medicine seems to be a possible category of CAM, to which thermology could be assigned as infrared thermography capture and trace the heat rays emitted from the human body. A clear overlap exists between conventional and complementary medicine in the applications of energy therapies such as ultrasonic, electromagnetic and light treatment.

WHO Family of International Classifications

Health statistics around the world are based on the WHO Family of International Classifications. To this moment, WHO has developed two reference classifications that can be used to describe the health state of a person at a particular point in time. Diseases and other related health problems, such as symptoms and injury, are classified in the International Classification of Diseases, now in its 10th revision (ICD-10)[4] and the 11th revision is currently under review. Functioning and disability are classified separately in the International Classification of Functioning, Disability and Health (ICF)[5]. A third reference classification, the International Classification of Health Interventions (ICHI), is under development and will replace the old, and now outdated International Classification of Procedures in Medicine [6].

International Classification of Diseases (ICD)

Searching through the above health classifications with terms related to thermology might help to define the place of thermal energy in medicine. The ICD refers diseases and other morbid conditions, injury, poisoning and certain other consequences of external causes. It relates also to external cause of diseases and other morbid conditions, covers Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified. Finally, it lists factors influencing health status and contact with health services.

A search in the ICD, obtained codes related to low and high intensities of thermal energy that described various external causes of morbidity and mortality such as exposure to excessive heat (W92) or cold (W93) of man-made origin, exposure to natural heat (X30) or natural cold (X31) and contact with heat and hot substances (X10-X19). High temperature induced injuries such as burns are coded by T20-T25, predominantly systemic effects of heat are described by code T67. Frostbites are labelled by T33-T35, hypothermia due to low environmental temperature is coded b T68 and effects of reduced temperature are described by T68. In newborns, hypothermia is a defined disease entity (P80).

Some haematological diseases are triggered and provoked by environmental temperature and they can be found under the codes D59.1 and D59.6, also a form of urticaria can be elicited by heat or cold (L50.2). Anaesthesia may be followed by hypothermia (T88.5), but can also elicit malignant hyperthermia (T88.3). The most common form of increased core temperature in medicine, fever, is not described by the term "hyperthermia" within the ICD10.

International Classification of Functioning, Disability and Health (ICF

The ICF describes in part 1 body structures and body functions and also personal activity and participation, part 2 covers external contextual factors, providing information on the condition of body, mind and social interaction of an individual person. Temperature appears in the ICF in chapter2 "sensory functions and pain" in subdomain b270 Sensory functions related to temperature and other stimuli and in chapter 5 "Functions of the digestive, metabolic and endocrine systems" where the subdomain b550 lists thermoregulatory functions such as body temperature (b5500), maintenance of body temperature (b5501), and thermoregulatory functions other specified (b5509).

International Classification of Health Interventions (ICHI)

In 1978, the term "thermography" was listed in the International Classification of Medical Procedures (table 2).

Table 2
Applications of thermography as listed in the ICMP

3-62 Thermography
Includes: photographic portrayal of body temperature
Excludes: graphic representation of temperature (1-736)
3-620 Breast
3-621 Deep veins
3-622 Hepatic region
3-623 Other part of trunk
3-624 Bones and joints
3-625 Soft tissues not elsewhere classified Lymph nodes
3-628 Other thermography

The ICHI is available as draft version, not final, updated on regular basis, not approved by WHO and not to be used for coding except for agreed field trials [7]. However, it is important to understand the structure of this classification. Health interventions are classified around three axes: Target, Action and Means, defined as follows:

Target: the entity on which the Action is carried out

Action: a deed done by an actor to a Target during a healthcare intervention

Means: the processes and methods by which the Action is carried out.

Interventions are also related to the three main domains of the ICF:
1. body systems and function
2. activities and participation and
3. contextual factors
   split into environment and health- related behaviour.

Seven variations of thermography appear in the ICHI (Table 3); The first 3 letters of the code structure describe the target, the next 2 letters are reserved for the action and the last 2 letters represent the means. As an explanatory example, the

Table 3
Thermography Codesavailable in the ICHI

Intervention	Code	target	action	means
cerebral thermography	AAA BA BQ	brain	diagnostic imaging	heat
Blood vessel thermography	IZZ BA BQ	Blood vessel, not otherwise specified	diagnostic imaging	heat
Deep vein thermography	IZD BA BQ	veins	diagnostic imaging	heat
breast thermography	LCA BA BQ	nipple, skin of breast	diagnostic imaging	heat
bone thermography	MRB BA BQ	bone	diagnostic imaging	heat
osteoarticular thermography	MRJ BA BQ	joints	diagnostic imaging	heat
muscle thermography	MRM BA BQ	muscles	diagnostic imaging	heat

letter-code for cerebral thermography encodes the action diagnostic imaging (BA) by means of heat (BQ) targeted to the brain (AAA).

Other temperature related interventions are diagnostic assessment, tests and therapeutic training of sensations related to temperature and other stimuli by means of other method, without approach or not otherwise specified.

Measuring and monitoring body temperature are diagnostic interventions targeted to the endocrine system and education about thermoregulatory function and managing thermoregulatory function are classified as therapeutic and managing interventions. Therapeutic applications of heat or cold appear also in the ICHI.

Conclusion

Based on these findings, the role of thermology in medicine could be described as follows: Temperature is an important condition of life which is sensed by defined receptors and the temperature related information is processed by the peripheral and central nerve system. Body temperature is a regulated quantity and the temperature regulation system part of the complex digestive, endocrine and metabolic physiological systems. Deviations from the regulated (deep) body temperature are considered as disease or pathological conditions. With the exception of exposure to or contact with external heat or cold, variations in intensity of skin temperature are not considered as classified signs or symptoms of disease. Thermography can be found in the classifications of medical procedures and health interventions. However, the fields of application are debatable.

As heat transfer from deep body tissues to the skin does not follow anatomical pathways, any medical diagnosis based on skin temperatures is clearly a complementary approach. Correlations between skin temperatures and serum glucose concentration [8], blood lipids [9] or blood lactate [10] must also be considered as an alternative approach to medicine similar as the attempt to image acupuncture meridians by thermography [11]. Also the thermography based prediction of breast cancer development in the future [12] cannot be explained by conventional medicine and must therefore be labelled as complementary medicine.

Medicine was defined as the science and practice of the diagnosis, treatment and prevention of disease [13]. Physicians educated on medical schools and universities are professionals who are priveleged by most health authorities around the world to control, practice and conduct research in medicine. Any medical procedures that are not conducted or delivered on request by a physician is an intervention of complementary medicine. Nowadays, medicine is not the educational background of the majority of authors who publish in the field of medical thermology, engineering science, sport scientists and various health professionals clearly dominate medical doctors.

It can therfore easily understood that this journal appears in the datbase Scopus in the field of complementary and alternative medicine.

However, it is also out of debate, that careful observation and documentation of the effects of thermal energy in medicine is not a complementary procedure as temperature sensing and thermoregulation are integrated parts of human physiology and science-based conventional medicine. For example, there is an growing interest in measuring metabolic rates by direct calorimetry,[14] which was in the first half of the 20th century the only reliable method to diagnose malfunctions of the thyroid glands[15]. It was also emphasised, that at present, no relieable thermometric alternative to calorimetry exist for the estimation of the rate of body heat storage [16].

It will depend on the application of rigorous methods and strict rules for the interpretation of findings wheather medical thermology will considered as part of complementary or conventional medicine in the future.

Call for papers

It is hoped that this point of view is intiating a discussion on the place of thermology in the spectrum of sciences, and particularly on the role in medicine. All readers are invited to contribute to the proposed discussion by submitting short manuscripts (800 to 1500 words) to

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Publication of the contributions to this discussion is planned for the November issue of this journal.

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Infrared Thermographic Assessment in Lower Limb Complex Regional Pain Syndrome Type 1

Review of the paper by Schuhfried O, Herceg M, Reichel-Vacariu G and Paternostro-Sluga T"**Infrared Thermographic Pattern of Lower Limb Complex Regional Pain Syndrome (Type I) and its Correlation with Pain, Disease Duration and Clinical Signs**". Phys Med Rehab Kuror 2016; 26: 288-292

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Summary

Background

Complex Regional Pain Syndrome (CRPS) is clinically associated with pain, sensory, vasomotor, sudomotor/oedematous and motor/trophic changes. The use of infrared thermography in the diagnosis of CRPS has been mostly described for the upper extremity or for both the upper and lower extremity. Therefore, authors form Austria have conducted a retrospective cross-sectional study to assess the absolute side-to-side temperature differences by infrared thermography and whether those differences correlated with pain, sensory, vasomotor, sudomotor/oedematous, motor/trophic changes and disease duration in patients with Type I CRPS.

Methods

The authors conducted the study at the out-patient department of the Clinic of Physical Medicine and Rehabilitation from the Medical University of Vienna and included 36 patients (25 women) with confirmed diagnosis of unilateral type I CRPS, based in the Budapest clinical criteria. Patients were not included in the study during a 2-month period after the triggering event and the following exclusion criteria were defined: previous sympathetic blockade or sympathectomy; peripheral neuropathy in a single extremity isolated to a specific nerve distribution; generalized vascular disease; rheumatoid arthritis; lymphedema or inflammation. Thermographic assessment of the big toe, dorsal foot, ankle and anterior aspect of the lower leg, with the patient in a supine position, was performed with a single image and the arithmetical mean of the absolute side-to-side differences of these regions was calculated. This value was later correlated with pain, disease duration, and clinical signs (sensory, vasomotor, sudomotor/oedematous and motor/trophic).

Results

The authors reported an average absolute side-to-side skin temperature difference of 1.6/1.2ºC (mean/SD) and a moderate positive significant correlation between the skin temperature asymmetry and the presence of vasomotor signs but not with the other clinical measures.

Conclusions

The authors state that infrared thermography offers an objective assessment of vasomotor dysfunction in lower limb CRPS type I patients and that it should be integrated in the clinical evaluation, serving as supplementary tool for the confirmation of the diagnosis.

Commentary

We welcome this opportunity to comment on the article published by Schuhfried, Herceg, Reichel-Vacariu and Paternostro-Sluga [1] as CRPS type I - a disabling condition often associated with regional pain that can be disproportionate or occur in the absence of inciting events - remains poorly understood. The article is well written, easy to understand, presented clear objectives and followed all ethical requirements. The clinical and thermal imaging evaluators were blinded, which is important, however, some issues need to be discussed.

Although a rational for the study was provided, key publications on the topic were not included in the reference list [2, 3]. The authors state that, prior to the investigation, the results of thermal imaging assessment in lower limb CRPS patients have not been formerly evaluated and that the use thermal imaging in the diagnosis of the condition has not been validated against the Budapest criteria. We should refrain to do such strong claims, the authors have not found references on the topic but there could be published papers, which is the case. Both papers from Timothy Conwell and colleagues [2, 3] assessed patients with presumptive CRPS (lower and/or upper limbs) and provided diagnostic accuracy measures for thermal imaging methods and one of them [3] compares thermal imaging methods with the Budapest criteria. To our knowledge, that was the first paper to provide valid diagnostic accuracy measures (sensitivity, specificity, positive predictive value, negative predictive value and area under the curve) of thermal imaging having as reference the Budapest criteria.

The Budapest criteria resulted from the effort of an international consensus group [4] to improve the diagnostic accuracy and reliability of the original IASP criteria and revealed a diagnostic sensitivity of 99% and improved the specificity to 68% (original criteria specificity was 41%) [5]. Conwell and Lind [3] evaluated three methodologies: (1) functional infrared imaging (based in qualitative assessment, black and white distal thermal gradients and cold water functional stress test), (2) quantitative infrared imaging

(based on side-to-side differences in average skin temperatures) and (3) qualitative infrared imaging (based on differences in the colour of symptomatic and asymptomatic regions of interest). In summary, the functional infrared methodology demonstrated high sensitivity (83.9%) and specificity (99.2%) but the quantitative infrared imaging lacked sensitivity (38.7%) and the qualitative infrared imaging lacked specificity (14.4%) but we highly recommend reading the article for full results.

Schuhfried and colleagues [1] based their infrared imaging protocol in a quantitative approach and - regardless the differences between the proposed methodology for side-to-side differences - based on the results of Conwell and Lind [3] we could question this approach. Although a significant correlation was reported, it was only with the presence of vasomotor signs and it was only moderate. Moreover, correlation is not a synonym of causation and it does not constitute a valid accuracy measure. As reported by Conwell and Lind, a quantitative approach is not able to differentiate between patients with a normal somato- autonomic reflex secondary to a peripheral pain generator, with a vascular problem and/or with small fibre neuropathies from patients with CRPS, as all may demonstrate an asymmetrical pattern.

Looking closely to the device specification and infrared imaging protocol, the authors reported the thermal resolution of the device, the acclimation time and the room temperature during assessments but we also advise the report of the image resolution value, the accuracy of the camera, the emissivity settings and the relative humidity conditions during the assessments [6, 7]. It is stated that the patients were positioned in a supine position and the optical focus of the camera was adjusted to be directly on the surface of the dorsal foot at 1 meter. Given the location of the regions of interest - lower leg, ankle, dorsal foot and big toe - the camera was not perpendicular to the measured areas, influencing the temperature recordings [8]. In our opinion these regions of interest should have been assessed in more than one thermogram, allowing the camera to be positioned perpendicularly to the anterior surface of the lower leg in one thermogram and to the dorsal foot in another. A more detailed protocol to assess patients with CRPS has been proposed elsewhere [9].

Another issue is the absence of references to the size of the regions of interest. Although it looks like - and we can only suppose as this is not stated in the article - that the size is equal in the lower leg, ankle and dorsal foot, the region of interest in the big toe is clearly smaller. The authors calculated the side-to-side difference as an arithmetical mean of the differences in the 4 regions of interest but, since the size is different across the regions of interest, they could have considered a more adequate approach. The average skin temperature over the zones could have been calculated as the sum of the product of the mean temperature of each region of interest and the number of pixels of each zone, all divided by the sum of the number of pixels of every region of interest [10]. The values of the symptomatic and asymptomatic sides would then be used to calculate the side-to-side difference. This approach would take in account the size of the regions of interest to determine the asymmetry value. We do not consider that this is a big issue in this study but the size of the regions of interest and its influence in the analysis are factors that researchers should be aware of.

Given the issues discussed in this commentary we do not believe that the conclusions could be drawn from the results provided in the paper. We agree that thermal imaging alone may not be adequate to identify type I CRPS patients and should be integrated in the clinical evaluation, however, to conclude this, a different study design should have been planned.

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Medical Thermology 2016 - a computer-assisted literature survey

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SUMMARY

The literature survey 2016 is based on 592 papers found in Scopus and 35 additional publications detected in the journal "Thermology international "with the keywords "thermography" OR "infrared imaging" OR "thermology" OR "temperature measurement" OR "thermometry" AND "published in 2016" and restricted to "medicine". The papers were analysed with respect to the origin of authors, the language and the publication source. Although the search was restricted to medicine, only 158 papers were related to thermal applications in humans. Similar as in the surveys of previous years, a detailed description is provided of publications related to Raynaud's phenomenon, Complex Regional Pain Syndrome and Breast diseases. Most of the publication activity in breast thermography was in 2016 in Asia and many authors of these papers are not qualified as medical doctors.

KEY WORDS: Thermography, literature search, breast disease, CRPS, Raynaud´s phenomenon

MEDIZINISCHE THERMOLOGIE 2016 - EINE COMPUTER-GESTÜTZTE LITERATURSUCHE

Die Literaturrecherche für 2016 basiert auf 592 Arbeiten, die unter den Schlüsselwörtern "thermography" OR "infrared imaging" OR "thermology" OR "temperature measurement" OR "thermometry" und "veröffentlicht in 2016" und der Einschränkung auf "Medizin" in der Daten Scopus gefunden wurden und auf 35 weiteren Publikationen aus der Zeitschrift "Thermology International". Die Publikation wurden in Bezug auf die Herkunft der Autoren, der Sprache und der Publikationsquelle analysiert. Obwohl die Suche auf Medizin eingeschränkt worden war, betrafen nur 158 Arbeiten thermische Anwendung am Menschen. Ähnlich wie in den Umfragen der vergangenen Jahre, erfolgt eine detaillierte Beschreibung der Publikationen im Zusammenhang mit Raynaud-Phänomen, komplexem regionalen Schmerzsyndrom und Brusterkrankungen. Die deutlichste Publikationstätigkeit über Brust-Thermographie war im Jahr 2016 in Asien zu finden und viele Autoren dieser Arbeiten sind nicht als ÄrztInnen qualifiziert.

SCHLÜSSELWÖRTER: Thermographie, Literatursuche, Brusterkrankungen, komplexes regionales Schmerzsyndrom, Raynaud-Phänomen

Thermology international 2017, 27(1) 11-37

Introduction

This year´s annual survey is again based on a literature search in Scopus, a database that allows access EMBASE and MEDLINE. The aim of this regular annual publication is to survey the publications of 2016 related to thermography and temperature measurements in medicine.

Methods

A search in Scopus with the terms "thermography" or "infrared imaging" or "thermology" or "temperature measurement" or "thermometry" and" year 2016" yielded 5185 hits. Table 1 shows the contribution of each search term to the results. Restriction with the term "medicine" yielded a reduction to 592 hits. All abstracts published in volume 26 of Thermology international and all references to papers published in 2016 from a recent review paper [1] that are not listed in Scopus, were added. After removing doubles, a total of 652 documents remained which appear in the section "References" of this survey. The total list of 652 references will be included in the extended reference collection of "Published papers on Thermology or Temperature Measurement in 2014-2016". The collection of references related to thermology covers now the period from 1989 to 2016. They are available from the webpage of Thermology international at "www.uhlen.at/ Thermology international/ Publications on thermology and temperature measure-

Table 1
Search terms and results

Combination of search terms	Hits
thermography AND “year 2016”	1909
thermography OR AND “year 2016”	2903
thermography OR “infrared imaging” OR thermology AND “year = 2016”	2909
thermography OR “infrared imaging” OR thermology OR“temperature measurement” AND “year = 2016”	3457
Thermography OR “infrared imaging” OR thermology OR “temperature measurement” OR thermometry AND “year = 2016”	5185
Thermography OR “infrared imaging” OR thermology OR “temperature measurement” OR thermometry AND “year = 2016”” AND (medicine)	592

ment/ Volume 5". Volumes 1-5 of this reference collection can be accessed free of charge at "www.uhlen.at/ Thermology international/Archives.

The papers were analysed to show the origin of authors, the language, and the journal and issue number of publication. For further classification, the Citation Report Database at Thompson Institute for Scientific Information (ISI) was searched to obtain the most recent Impact Factor for journals publishing papers related to the search profile in 2016. If a journal was not listed in ISI, the two years' citation index, published by Scimago, was used instead.

Papers were allocated with respect to the subject of the publication using the list of medical fields used in literature survey of the year 2014 [1].

Results

5185 publications were obtained with the search profile. Restriction to "medicine" reduced the number of hits to 592 publications. After adding 21 papers from Thermology international and 14 other references from [1], this survey is based on a total of 651 publications.

Language of publication

All but 28 papers of this database were published in English (95.7%). 18 publications appeared in Portuguese (2.7%) and 6 papers were published in German (0.9%) The language in 2 papers each was Chinese (0.3%) or Persians (0.3 %)

Authors

In total, 3202 authors appeared in 651 publications. 3 authors from Porto appeared as author or co-author in 33 different titles: 1 author was mentioned in 31 papers, the second in rank yielded 21 authorships and the third researcher had his name on 8 publications. 1 author had 11 papers, 2 researchers published 6 papers each, 5 authors were found in 5 papers. The name of 6 authors appeared in 4 papers, 33 authors published each 3 papers and 134 authors had 2 papers.

The EAT secretary Ricardo Vardasca appeared as first author of 17 titles: 9 book chapters [3-11], 1 proceedings chapter [12], 1 short review [13], 1 comment on a publication [14], 1 meeting report [15] and 4 abstracts [16-19] and was co-author in 14 other publications: 1 book editor [20], 7 book chapters [21-28], 2 articles [29,30] 3 abstracts [31-33]. Joaquim Gabriel, Assistant Professor at the Mechanical Engineering Department of the University of Porto, was the editor of the book "Termografia - Imagem Médica e Síndromes Dolorosas"[20] and co-author in 11 chapters of this book [3-5,8, 21-27]. He also appeared as co-author in 2 articles [29,30], 1 proceedings chapter [12], and 6 abstracts [17-19, 31-33]. Aderito Seixas, EAT Board member and researcher at the private University Fernando Pessoa in Porto, published as first author 1 article [31], 1 proceedings chapter [34], 1 comment on a publication [36] and 3 abstracts [32,33,35]. His name appeared as co-author in 1 book chapter [25] and 1 abstract [19].

EAT president Kevin Howell was first author of 1 book review [37] and co-author of 10 other papers: 6 abstracts [38-43], 3 articles [44-46] and 1 proceedings chapter [47]. EAT treasurer Kurt Ammer was the first author of 3 review papers [1,48,49], 1 editorial [50] and 1 extended abstract [51] and co-author of another conference abstract [52].

Maria Soroko from the Institute of Animal Breeding at the Faculty of Biology and Animal Science, Wroclaw University of Environmental and Life Sciences, Poland, published 2 articles [46,47] and 3 abstracts [41-43] related to equine thermography. Jadad Haddadnia, Associate Professor of Medical Engineering at the Hakim Sabzevari University, Iran, was co-author in 5 papers all related to image processing of infrared breast thermograms [53-57].

Dr. C.T.W. "Chrit" Moonen, Professor at the Radiology Department of the University Medical Center Utrecht, an expert in image guided molecular intervention, was co-author in 6 papers that reported thermometry based on magnetic resonance imaging [58-63]. Dennis L. Parker, a medical physicist at the Medical School, University of Utah, is the Mark H. Huntsman endowed Professor in Radiology and Biomedical Informatics, and Director of the Utah Center for Advanced Imaging Research. His name appeared as co-author in 5 publications related to magnetic resonance (MR) thermometry [64-68]. Allison Payne is Research Assistant Professor at Radiology Department, Medical School, University of Utah, and she was co-author in 5 papers related to MR thermometry [66,67] and focused ultrasound [68-70].

Countries, where authors work

Research was performed in 752 institutions located in70 countries (figure 1). 27.8% of these were situated in North America, the majority, i. e. 180 in the United States, 24in Canada and 4 in Mexico. 44.3% of researchers came from European countries, 51 research institutions were in the United Kingdom, 46 in Germany, 30 in the Netherlands and 25 in France. 21,2% of temperature related research was conducted in Asia,42 research sites were situated in China, 35 in Japan, 14 each in India and Turkey and 13 in South Korea. 3.6% of temperature research was performed in South America, 2.3% in Australia or New Zealand, and 0.8 % in Africa (figure 2).

Journals

In total, 364 journals, 2 books and 10 conference proceedings published papers related to the search profile. 1 book, 2 conference proceedings and 6 journals published 7 to 35 papers related to topic of this survey. First in rank was "Thermology international with 35 publications (5 reviews, 3 articles, 1 editorial, 3 comments on publications, 1 book review, 21 conference abstracts, 1 meeting report), followed by "Proceedings of SPIE- Progress in Biomedical Optics and Imaging" with 29 chapters and the journal "PLoS ONE" with 24 papers.

Figure 1
Countries, where thermography research was conducted

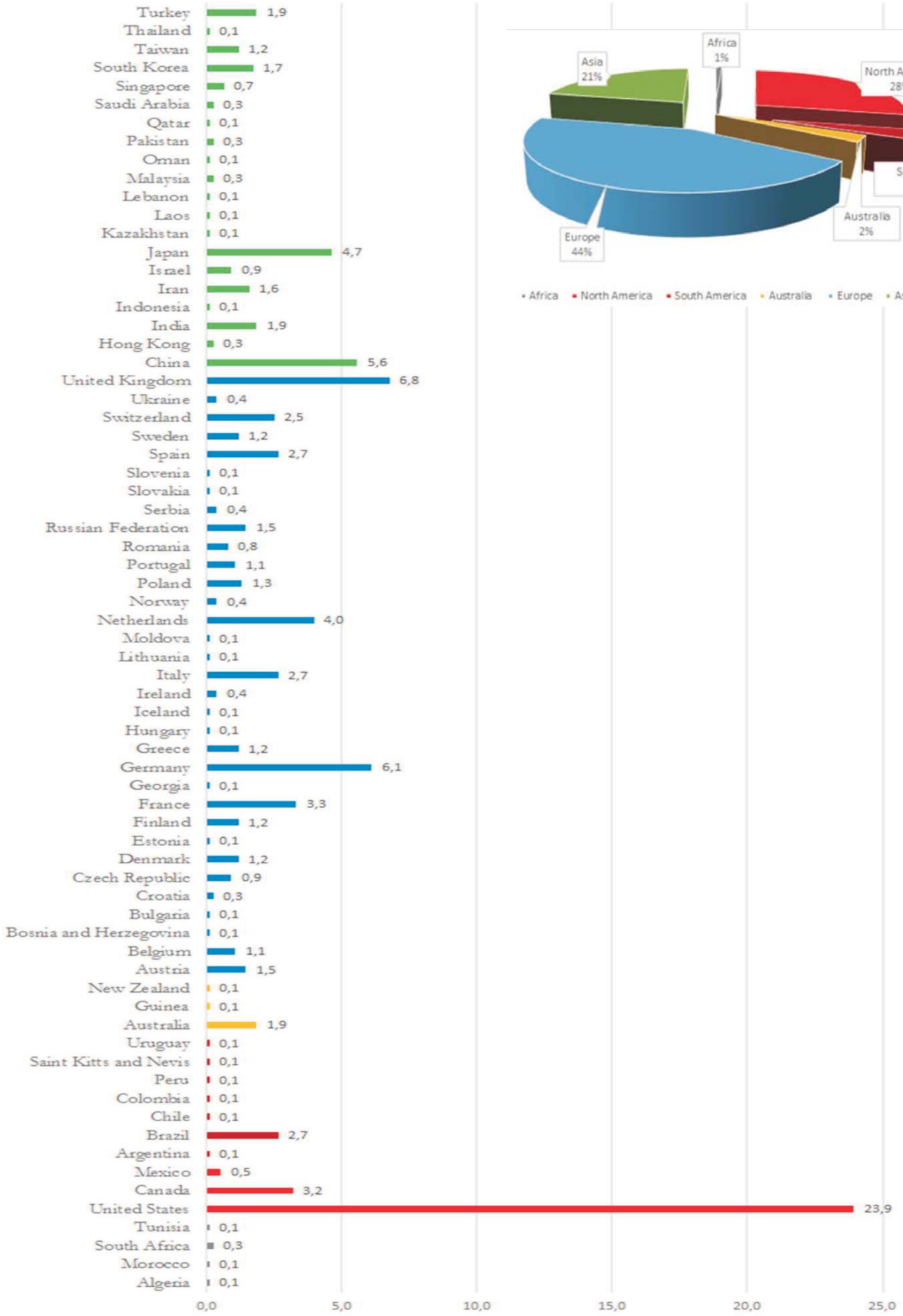

Figure 2
Continents, where authors of thermography papers work

Table 2
Impact factors of journals that published high numbers of thermography papers

Journal	Number of papers	Impact 2015
Thermology international	35	0.56*
Progress in Biomedical Optics and Imaging - Proceedings of SPIE	29	
PLoS ONE	24	3.057
Magnetic Resonance Imaging	20	1.980
TERMOGRAFIA - Imagem Médica e Síndromes Dolorosas	15	
International Journal of Hyperthermia	9	3.361
Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society EMBS; 2016	9	
Journal of Therapeutic Ultrasound	7	n.a.
Physics in Medicine and Biology	7	2.811

* based on Scimago Cites / Doc. (2 years) n.a. = not available

Table 2 lists the journal name, the number of papers of interest and their most recent impact factor. For the "Journal of Therapeutic Ultrasound," founded in 2013 as open access journal and published by BioMed Central, an impact factor is neither available at ISI nor at Scimago. A mean impact factors of 2.354 was calculated for the 5 journals listed.

Type of publication

423 papers were classified as articles, 30 as article in press and 33 as review. 1 short survey, 34 conference abstracts and 74 full length conference papers have been published. The remaining papers were classified as 19 letters, 8 as note or comment, 6 editorials, 18 book chapters and 1 erratum.

Type of study

153 papers have been related to keyword "human". 17 reported findings in normal humans and 13 human experiments. 12 investigations conducted research on human tissue. 46 papers showed the keyword "nonhuman".304 papers have been published with the keyword "animals" and 119 papers were related to "animal tissue". 85 controlled studies, 30 major clinical studies, 11 randomised controlled

Table 3
Research fields, where thermography was applied

Medical field	Reference	Total number of identified papers
Biochemistry	48, 71-120	51
Cancer	1,13,48,53-59,61-64,67,70,120-285	197
Dermatology and Venerology	286-309	42
Genetics	310-313	18
Geriatrics and Gerontology	314-315	10
Immunology and Haematology	316-327	38
Internal Medicine	328-356	62
Medical instrumentation	357-359	12
Microbiology	360-365	15
Neurology and Psychiatry	366-399	59
Obstetrics and Gynecology	69, 400-407	35
Otorhinolaryngology	408-409	2
Paediatrics	410-431	67
Pathology and Forensic Science	432-451	73
Pharmacology and Pharmacy	452-463	65
Physiology and Endocrinology	464-491	174
Public Health and Occupational Medicine	492-494	37
Radiology, Nuclear Medicine and Thermography	68,495-510	168
Rehabilitation and Complementary Medicine	511-512	40
Surgery (including injuries)	513-537	302
Toxicology and Drug Dependence	539-540	14
Papers not allocated to a field	541-652	160

trials, 11 comparative studies, 5 clinical trials and 7 case reports have been included in the list of references. 14 studies have been labelled a prospective and 8 as retrospective. 31 clinical articles were detected. 10 papers were found with the keyword "sensitivity and specificity" and 7 publications showed the keyword "predictive value". "Reproducibility" was a keyword in 10 papers and "reproducibility of results" was addressed in 8 articles.

Medical publications

As in previous surveys, papers were allocated to a keyword that roughly describe a distinct field of medicine. Usually, allocations to more than just one field are made. Table 3 shows the allocations to fields of medicine. Surgery and Injury was the most frequent allocated speciality of medicine. Cancer, Physiology and Endocrinology and Radiology & Nuclear Medicine & Thermography, were the next in frequency of allocation, followed by Pathology and Forensic Science, Paediatrics, Pharmacology and Pharmacy, Internal Medicine, Neurology & Psychiatry, Biochemistry, Dermatology and Venerology Rehabilitation & Complementary Medicine and Public Health. A high number of papers was missed during the allocation process and therefore 112 articles were not automatically allocated to a field.

120 papers were found for “breast” or “breast cancer”, 20 publications for “Raynaud´s phenomenon”, “complex regional pain syndrome” was keyword of 12 papers. The search term "thermography" retrieved 208 papers, fever appeared in 52 publications, the term "hyperthermia" had 102 hits and "hypothermia" found 46 papers.

CRPS

A search in the database with the keywords "complex regional pain syndrome" or "CRPS" identified 11 articles and 1 letter [546], but only 7 of these reported findings closely related to complex regional pain syndrome. A case report from South Korea diagnosed a patient with lumbar disc herniation as CRPS [374] neglecting the request of the diagnostic IASP-Budapest criteria that "no other diagnosis explain the symptoms and signs better" [653]. One article provided a general overview on epidemiology; pathophysiological models, diagnostics and therapy of CRPS following distal fractures of the radius: [168].

A retrospective study conducted at the University Department of Physical Medicine and Rehabilitation in Vienna, Austria, reported an average side-to-side- difference of mean temperature of the anterior lower leg and dorsal foot of 1.6 ±1.2 °C in a group of patients suffering from CRPS type 1, located at the lower extremity [387]. The temperature difference was correlated to the diagnostic signs for diagnosing CRPS as described in the IASP-Budapest criteria and significant correlation between temperature measurements and vasomotor signs was found.

Another retrospective study from South Korea collected data from 296 patients, diagnosed as CRPS at 3 university hospital pain centres [369]. A skin temperature difference between bilateral limbs of 1°C or less was seen in 131 patients. The magnitude of temperature difference between corresponding body regions was not significantly different between patients with pain present up to 3, 6, 12 or more than12 months. The authors conclude from their data, that the absolute difference in skin temperature between the bilateral limbs of patients with CRPS did not appear to be useful as a diagnostic criterion for the disease. However, the Budapest criteria [653] do not request temperature difference as obligatory sign for diagnosing CRPS as skin colour changes or asymmetry of skin colour or temperature asymmetry (>1°C) are equally accepted as objective signs of vasomotor disturbance. In addition, patients must display at least one sign at time of evaluation in two or more of the following categories: sensory, vasomotor, sudomotor/oedema, motor/trophic. Consequently, the diagnosis of CRPS can be based on one out of three combinations of sign categories that do not include vasomotor changes. Taking this into account, it is not unexpected that diagnosing CRPS based on temperature measurement failed.

An observational study from Rohtak, India [524] reported the effect of an ultrasound guided stellate ganglion block with a lateral approach at C 7 level. The small sample included 13 patients with CRPS and 7 patients with other causes of chronic upper limb pain. Successful ganglion block was monitored by temperature measurement at the axilla, not at the hand. The statistically significant rise in axillary temperature after the block was sustained for 2 weeks. Complete pain relief was observed in two patients for 2 months and one patient was totally free of pain for 1 month, but their pain recurred in the remaining time of observation. The other seventeen patients had partial pain relief throughout the study period.

Raynaud`s phenomenon (RP]

18 papers and 2 conference abstracts [38,40] were found with the key word "Raynaud´s phenomenon", but 11 [2, 71, 119, 135, 193, 300, 338, 351, 438, 451, 478] papers were not relevant for the topic including an article on the contribution of infrared thermography in the assessment of infantile haemangiomas [135].A retrospective case note review of patients with systemic sclerosis (SSc) undergoing thermography and who were followed up to about 3 years, found a higher risk for developing digital ulcers and an increased odds ratio for death in patients with abnormal thermography [585]. Another article investigated skin thickness by optical coherence tomography and high-frequency ultrasound and perfusion with dual-wavelength laser Doppler imaging and thermography in non-affected skin or skin affected by localised scleroderma (morphea) [300]. A topical review was primarily focused on capillaroscopy in systemic sclerosis, mentioning only one study that related capillaroscopic findings with the results of thermal and laser Doppler imaging [351].

Other articles not-relevant for Raynaud´s phenomenon reported effects of fermented green tea on finger tempera-

ture in patients suffering from cold hypersensitivity investigated in a randomised controlled study [296] and, a study [428] that compared traditional physical examination of hands/feet by healthcare professionals with the results of a hand-held infrared device in 12 individuals (aged 4-25 years; 5 with disorders affecting peripheral skin temperature). 1 review article reported temperature measurements performed at the palmar surface of the human hand [48] and 1 article reported different rewarming patterns after mild cold challenge in healthy young men [478]. A study from Russia investigated microcirculation at the distal phalanx of the middle finger by laser Doppler flowmetry and contact thermometry in a group of patients with various rheumatic diseases [451]. Measurements were made before and after immersion in water baths at 25 and 42 °C and simultaneous occlusion with a cuff, located at the upper arm and inflated to a pressure of 200-220 mmHg for 3 min. Three types of response to the tests have been identified which can roughly be described as hot, warm and cold hands.

The annual literature survey 2015 includes a section related to cold challenge and Raynaud´s phenomenon, respectively [48]. A study from Japan reported the mean temperature, recovery rate and disparity (coefficient of variation) of the nail fold temperatures in Raynaud´s patients and healthy controls prior and immediately, 3, 5, 10, 15, 20 and 30 min after immersion in 10°C water for 10 s [342]. The authors found that nail fold temperature disparity was significantly higher in patients with Raynaud`s phenomenon than in the controls at all time points of investigation, with the largest difference between the groups at 5 min after immersion. ROC curve analysis revealed that the disparity, followed by baseline temperature differentiated patients and controls at best. However, as the coefficient of variation is only meaningful for data obtained from a ratio scale such as the Kelvin scale, the diagnostic power of temperature disparity may have been overestimated.

Researchers from Bath, England, compared symptom characteristics and objective assessment of digital microvascular function using infrared thermography in 43 patients with fibromyalgia syndrome (reporting Raynaud´s phenomenon symptoms) and 85 subjects suffering from primary Raynaud´s phenomenon [463]. There were no differences in RP symptom characteristics between patients with fibromyalgia syndrome and patients with primary Raynaud´s phenomenon. In contrast, patients with FMS had higher baseline temperature of the digits (32.1 vs. 29.0 °C), dorsum (31.9 vs. 30.2 °C) and thermal gradient (temperature of digits minus temperature of dorsum; +0.0 vs.?0.9 °C) compared with primary RP.

A prospective observational study used thermal imaging, conducted prior and after a cold challenge, as outcome measure in the assessment of the therapeutic effects of botulinum toxin A in 10 Japanese patients with Raynaud's phenomenon secondary to systemic sclerosis [299]. Skin temperature recovery after cold water stimulation at 4 weeks after injection was significantly improved compared with that before injection. Improvement of clinical symptoms was also described in a British study, applying botulinum toxin via a dorsal approach in 20 patients with Raynaud's phenomenon secondary to systemic sclerosis [40]. Infrared thermography was also applied in a study investigating the effect of ambrisentan on peripheral circulation in patients with systemic sclerosis [307].

Breast cancer

Out of 120 hits labelled with the key words "breast" or "breast cancer" only 26 papers were dedicated to thermometry or thermal imaging of the female breast [13, 48, 53-57, 86, 111, 122, 125, 160, 172, 181, 182, 187, 194, 195, 203, 204, 221, 232, 240, 242, 250,255,277] and 2 articles related to monitoring thermotherapy for breast disease [190, 219].

Some "false positive" hits of this literature search were related to near-infrared (NIR) imaging which is based on the use of substances that emit fluorescence in the NIR region (650-900 nm). This technique was successfully applied for the detection of breast cancer cells in animal models [94,189, 280], for the identification of lymph nodes affected by metastasis in breast cancer [255] and other cancer forms of different locations [91, 111, 129, 171, 176, 188, 249, 272]. 2 papers reported breast tumour imaging due to an array of exciting antennas [122,195].

The annual literature survey for 2015 contains a section that reviewed the literature published in 2015 related to breast thermography [48]. A review article on clinical applications of infrared thermography in plastic surgery did not include papers on breast thermography, but provided a slightly positive opinion on the value of infrared based diagnosis of breast disease [181]. Based mainly on historical papers, a short review described the role of thermal imaging in breast cancer detection [13]. A historical review positioned thermography in the beginning of the evolution of breast cancer imaging [160].

A review article from India expressed the opinion that thermography is beneficial in early diagnosis of breast cancer compared to other imaging techniques such as mammography, ultrasound, thermography and magnetic resonance imaging [242]. The authors also recommend computer aided detection(CAD) as a fast, reliable, and cost-effective second opinion to support medical doctors with the diagnostic management of breast cancer. Authors from Iran also overestimate the potential of CAD in breast cancer diagnosis based on thermal imaging [55]. However, the closing remark of their paper points in the right direction "Considering the progress of this technology and increasing the patient's requests for a screening method with low price and no ionization can be a potential for choosing thermography as a breast imaging method. This technology needs accurate clinical evaluation and it is unlikely that thermography can be a part of breast screening, detecting

etc., in future." Some papers were dedicated to either computer models for the detection of breast tumours with thermal imaging [125,172] or to software for automatic segmentation and evaluation of breast thermograms based on feature extraction from thermal images [53, 86, 187,194, 203, 250].

A position paper on screening for breast cancer by the European Society of Breast Imaging (EUSOBI) and 30 national breast radiology bodies [240] states that "screening with thermography or other optical tools as alternatives to mammography is discouraged." Facing a rapid technological change in breast imaging and the associated reassessments of what constitutes optimal patient care over the past decade provided the rationale for re-publishing a collection of articles previously published in the Journal of the American College of Radiology [654]. This collection starts with an article, first published in 2013, on the "ACR Appropriateness Criteria Breast Cancer Screening "[204]. This article states that insufficient evidence exists to support the use of other imaging modalities, such as thermography, breast-specific gamma imaging, positron emission mammography, and optical imaging, for breast cancer screening. A paper from Australia reports the effects of a successful campaign of the Cancer Council Western Australia against consumer directed marketing for thermography and other techniques as an effective diagnostic tool for breast cancer [182].

Diagnostic accuracy of thermography for breast cancer was topic of 3 clinical studies. A study from Iran investigated 60 women by physical examination, thermography, ultrasound imaging and biopsies was published in two versions [54, 57]. Besides the vague description of findings in ultrasound imaging and the poor quality of the provided thermograms, the lack of definition of true positive and true negative cases does not allow to understand the reported figures of accuracy or sensitivity.

Another study, conducted in Teheran, Iran, calculated diagnostic sensitivity and specificity and positive predictive value (PPV) and negative predictive value (NPV) of mammography or thermography in relation to the gold standard histology of biopsies in 132 patients in the age between 24 and 75 years [221]. The median age of all patients was 49.5 ± 10.3 years (range). The sensitivity, specificity, PPV and NPV for mammography were 80.5%, 73.3%, 85.4%, and 66.0%, respectively, whereas for thermography the figures were 81.6%, 57.8%, 78.9%, and 61.9%, respectively. The authors conclude that at present time thermography cannot substitute mammography for the diagnosis of breast cancer.

Authors from India reported an observational study in 65 patients with proven breast carcinoma based on fine needle aspiration cytology or biopsies. All patients underwent mammography and infrared thermal imaging. Thermography detected tumours in 60 patients (92.3%), while mammography identified suspicious lesions in 62 out of the 65 patients (95.4%). Thermography detected malignancy in all 3 cases in which conventional mammography missed it. However, restricting the cohort to confirmed breast cancer cases is severe weakness of the study design, because it does not allow the calculation of diagnostic specificity which is the rate of true negative and false positive cases and therefore the rate of overdiagnosis by thermography cannot be obtained.

An observational cohort study from Taiwan investigated the association of preoperative findings from infrared breast imaging with the mortality in 143 breast cancer patients [277]. A temperature difference greater than 2°C between the tumour site and the corresponding site of the non-affected breast was associated with an increased disease-specific mortality hazard ratio of 2.57.

Discussion

The search profile of this year´s survey is almost identical to that of the literature review for the year 2014 [2]. As mentioned previously [2], the application of search filters provided in Scopus resulted in a rather inaccurate allocation of papers to distinct fields of medicine. This became particularly obvious in publications on breast diseases where only 26 out of 56 papers related to thermography were correctly identified, but 98 other papers non-relevant for temperature measurement or thermal imaging in breast disease were found.

Only 153 documents were related to humans. Many authors of papers on breast thermography are not qualified as medical doctors. Applied scientists in the field of physics or information technology predominate the authorship. Such a development supports the fact, that medical thermology is perceived as part of complementary medicine [655].

The focus of detailed description of papers is temperature measurement in the three clinical fields i.e. complex regional pain syndrome, Raynaud`s phenomenon and Breast diseases. The value of thermal imaging for diagnosing CRPS is still under investigation [369,387]. Although standards for evaluation of thermograms from patients with Raynaud´s phenomenon are not yet established, temperature measure- ments have been used as outcome measure in clinical trials investigating the therapeutic effect of botulinum toxin A in patients with Raynaud's phenomenon secondary to systemic sclerosis [40, 299].

In Europe, North America and Australia, there is a persistent negative view on thermography as a valid technique for screening or early diagnosis of breast cancer [182, 204, 240]. Research activity in breast thermography was often detected in Asian countries such as Iran [53-57, 194, 221], India [187, 203, 232, 242] and Taiwan [273]. However, many of these studies suffer from high risk of bias and shortcomings in methodology, evaluation and reporting of results. Studies related to computer models or analysis based on feature extraction from medical images lack comparison with clinical data.

4.3 percent of the papers reviewed in this article were not published in English, which is a slightly smaller portion of non-English publications than in last years' survey. Only four other languages -Portuguese, German, Chinese and Persian, appeared in the non-English publications.

Compared to 2014, there was a shift in publication productivity from Australia (minus 3.4%), Africa (minus 1.3%), Asia (minus 1.1%) and North America (minus 0.2%) towards Europe (plus 6%). The proportion of Asian research institutions changed slightly in 2016. 25.3% of research was conducted in China, 21.1% in Japan, 8.4% each in India and Turkey, 7.8 % in South Korea and 7.3 % in Iran. Publications from Australia & New Zealand and countries in Africa and South America are decreasing in numbers and comprise together 3.1% of all articles included. The output of publications from South America remained on 3.6%,

A decrease was observed in both, the absolute maximum number of papers related to thermology published in a single journal and the number of journals publishing more than 7 thermology papers. The average impact factor of journals with most of thermology articles was 2.354 points which is 0.482 points less than in 2014, but by 0.349 points more than 2015.

In conclusion, this years' literature survey was based on a literature search in Scopus and focussed on temperature measurements related to medicine, particularly applications for complex regional pain syndrome, Raynaud´s phenomenon and breast diseases. Surgery, Cancer, Physiology & Endocrinology, and Radiology were frequently identified fields of temperature measurement in medicine. Papers reporting clinical data are rare, and publications in bioengineering and applied science are more prevalent than papers related to clinical thermology,

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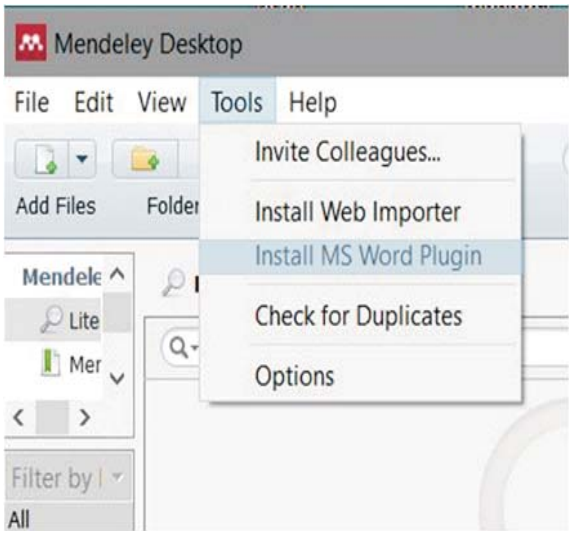
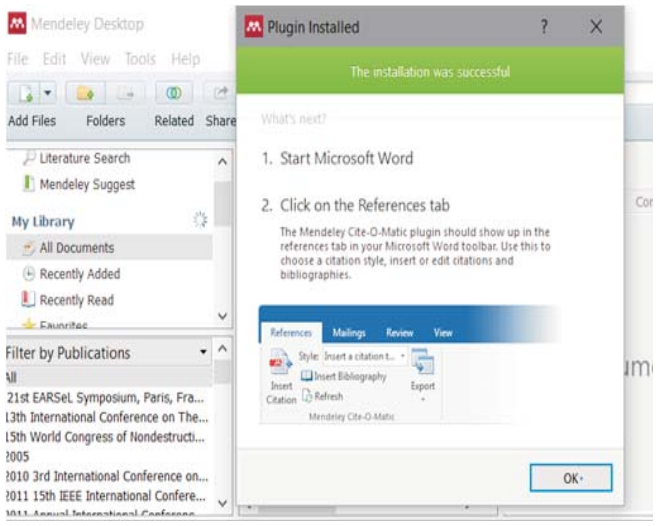
News in Thermology

Mendeley reference tool for "Thermology international"

For authors using Mendeley, Thermology International provides the output style supporting the format of article in-text citations and reference lists. Using the word processor plug-in from Mendeley, authors only need to select the appropriate journal template when writing their article and citations and references will be automatically formatted in Thermology International's style.

First, activate in Mendeley the tool "Install MS Word Plugin. A window will pop up telling you how to continue

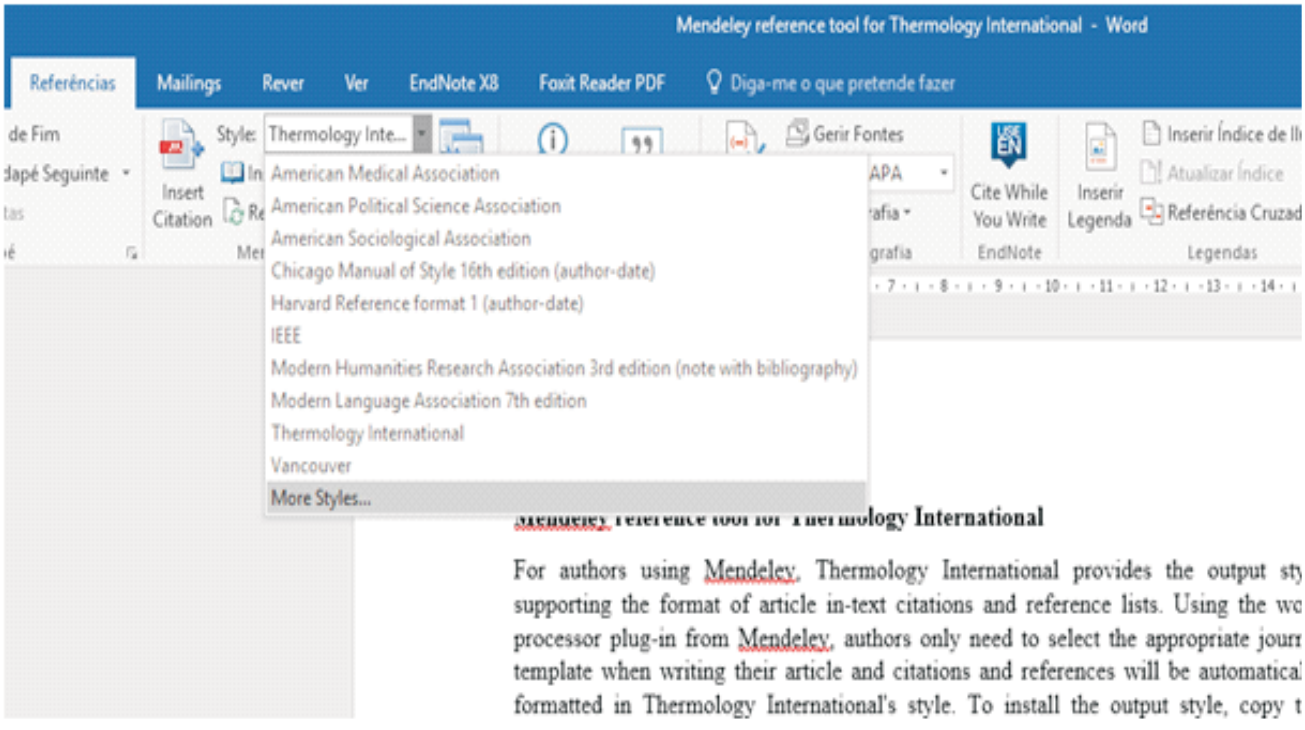




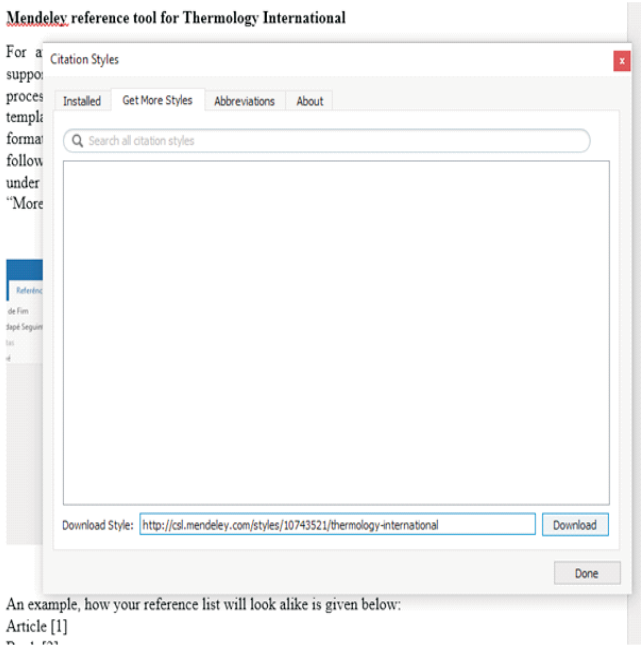
To install the output style, copy the following URL

http://csl.mendeley.com/styles/10743521/thermology-international

and, under the "References" tab in Word, select the down arrow in the style options select "More Styles", as shown in the picture below.



In the "Citation Styles" menu paste the copied URL and press "Download" and press "Done".



Now, after selecting the down arrow in the style options in the "References" tab in Word, it will be possible to select "thermology International" as output style for Mendeley.

An example, how your reference list will look alike is given below:

Article [1]

Book [2]

Book Chapter [3]

Internet resource [4]

Thesis [5]

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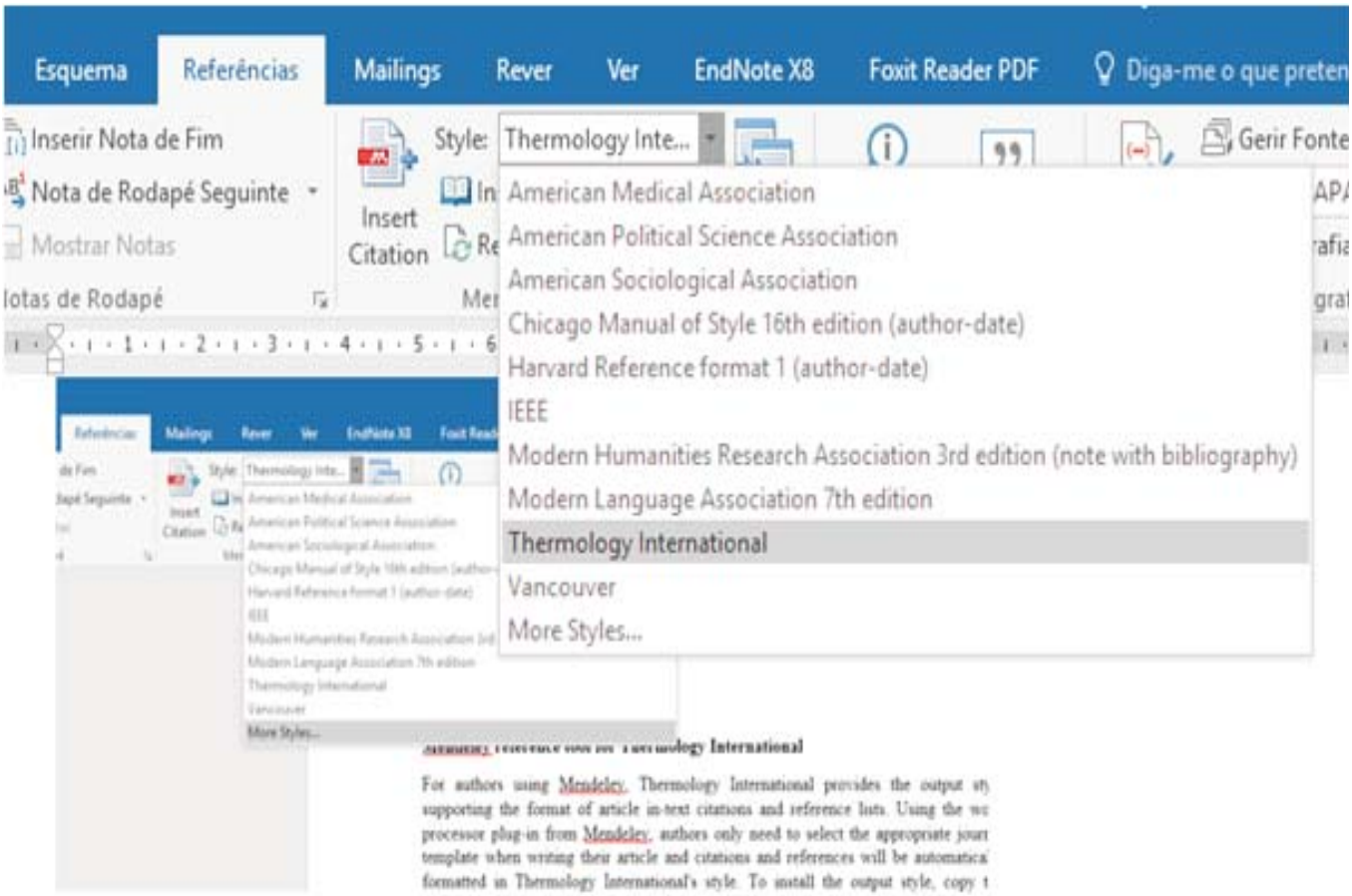
Aderito Seixas, Porto



Call for Papers Infrared Thermal Imaging in Biomedicine

A Thematic Session will be organised within VipIMAGE 2017, VI ECCOMAS Thematic Conference on Computational Vision and Medical Image Processing, held in Porto, Portugal, 18-20 October 2017

www.fe.up.pt/vipimage,
web.fe.up.pt/~vipimage/nav/conference/sessions.htm

Description

Infrared Thermal Imaging is an innocuous technique which allows to study live organisms' physiology in realtime.

The organizers of this thematic session encourage researchers to submit papers to one of the main topics indicated below, describing original work, including methods, techniques, applications, systems, tools or general survey papers, reporting research results and/or indicating future directions. Accepted papers will be presented at the conference by one of the authors. Acceptance will be based on quality, relevance and originality.

Topics of interest include (but are not restricted to):

- Botany
- Camera technology
- Dentistry
- Dermatology
- Endocrinology
- Fever screening
- Forensic and evidence medicine
- Integrative medicine
- Oncology
- Orthopaedics
- Paediatrics
- Physiotherapy
- Rheumatology
- Sports medicine
- Surgery
- Temperature measurement
- Thermal image processing
- Thermal physiology
- Vascular medicine
- Veterinary medicine

Publication

The proceedings book will be published by Springer under the book series "Lecture Notes in Computational Vision and Biomechanics" and indexed by Elsevier Scopus.

A special issue of the Taylor & Francis international journal "Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization", indexed in ISI Thomson Reuters, Elsevier Scopus and dblp, will be published. All authors of works presented in VipIMAGE 2017 will be invited to submit an extended version to the special issue.

Important dates

- Submission of extended abstracts: March 15, 2017
- Authors Notification: April 15, 2017
- Final Papers (not compulsive): June 15, 2017

Organizers

Ricardo Vardasca, Joaquim Gabriel

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Rua Dr. Roberto Frias S/N, 4200-465 Porto, Portugal

Emails: rvardasca@fe.up.pt, jgabriel@fe.up.pt

The new European Association of Thermology website and domain name: www.eurothermology.org

The board has decided in previous meetings that the E.A.T. needed to have an update in design and features offered to the members. Other goals were the reduction of the website associated costs and enforcement of the security. The mission was assigned to Dr. Ricardo Vardasca (E.A.T. Secretary).

The previous website was hosted in Norway, had 3 domain names (europeanthermology.com, europeanthermology.org and europeanthermology.net) and used CPanel as content management service, which was good in 2010, but a bit limited in 2016. For the new developments three content management systems were considered: Drupal, Joomla and WordPress, which are the most widely used in the Internet today. Taking into account the security, robustness and features offered the decision went for Drupal, which is the system used for example for the support of White House and Warner Bros in the US.

Firstly, for the new website, it was thought to transfer only one or two domain names, reducing the associated costs, the hosting selection was a friend of Dr. Ricardo Vardasca (E.A.T. secretary), who as a small company in Portugal that provides that service, it allowed a significant reduction in the hosting cost of 60%. Unfortunately, the domain name transfer was not possible due to difficulties caused by the previous contracted company and it was decided to register a new domain name, which was voted by the E.A.T. board and eurothermology.org was selected.

The new website, apart from the new domain name and modern design, has at the moment all the information present in the previous website. An important addition is the slideshow in the default page, that allows us to highlight the main events or news. Other important development is the contact form to facilitate the communication with the E.A.T. board. The new system allows also to add .pdf files to the web pages. It is prepared to have in the future a personalised authenticated member area and a common interest repository of information.

2017

April 9th-13th, 2017
Thermosense: Thermal Infrared Applications XXXIX in Anaheim, California, USA

Venue: Anaheim Convention Center

Conference Chair:
Paolo Bison, Consiglio Nazionale delle Ricerche (Italy)

Conference Co-Chair:
Douglas Burleigh, La Jolla Cove Consulting (United States)

This conference is no longer accepting submissions.

Thermal/infrared related papers are solicited in the areas listed below, and are also welcome in other areas.

Aerospace Applications
Automotive Industry
Building Applications
Calibration
Detection of Gas and Other Leaks
Environmental and Agricultural Monitoring
Fiber Optics for Infrared
Fire Analysis and Detection
Food Processing and Handling
Infrastructure

IR Image Fusion Applications
Manufacturing and Processing Industries
Infrared Nondestructive Testing (IR NDT) and Materials Evaluation
Medical
o health screening and diagnostics
o veterinary applications

Power Generation and Distribution
Research and Development
Remote Sensing and Security
Standards, Certifications and Guidelines

Further information:

https://spie.org/SIC/conferencedetails/thermosense

April 21st-23rd, 2017
XXI National Congress of the Polish Association of Thermology in Zakopane, Poland

ABSTRACT DEADLINE March 15th 2015

Contact : a.jung@spencer.com.pl

INTERNATIONAL SCIENTIFIC COMMITTEE

Dr.Kevin Howell Ph.D (UK)
Prof.Kurt Ammer MD,Ph.D (AUT)
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Prof.Antoni Nowakowski Ph.D,Eng (Poland)
Dr.Janusz Zuber MD,Ph.D (Poland)
Prof.Armand Cholewka Ph.D, Eng (Poland)

Registration by e-mail is required before March 15th to ensure hotel reservation.

Accommodation (2 nights) / meals, welcome dinner 120 E per person (participant, accompaning person) will be paid in cash/credit card on arrival in hotel reception.

PROGRAMME AT A GLANCE.

21st April, Friday - 7 p.m.

Welcome Dinner (HYRNY Hotel)

22nd April, Saturday

9.00 - 11.00 Session I
11.00 - 11.20 Coffee break
11.20 -13.00 Session II
13.00 - 14.15 Lunch
14.30 - 16.00 Session III
16.00 - 16.15 Coffee break

16.15 - 18.00 EAT board meeting

July 2nd-6th, 2017
2nd Asian Conference on Quantitative InfraRed Thermography in Daejeon, Korea

Venue: Interciti Hotel, 92 Oncheon Ro, Yuseong-gu Daejeon, 34189, Rep of Korea

Important Dates

Abstrac submission deadline: February 28, 2017
Abstract acceptance notification: April 15, 2017
Full paper submission deadline: May 30, 2017

Furter information
www.qirtasia2017.com

Contact : Prof Wontae Kim

Div. of Mechanical & Automotive Engineering Kongju National University, Cheonan,Chungnam, 30080, Rep of Korea, Email: kwr@kongju.ac.kr

July 17th - 19th, 2017
13th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics (HEFAT2017) in Portoroz, Slovenia

28 February 2017:
Deadline for submission of online abstracts
31 March 2017: Deadline for submission of full papers

Conference website: http://edas.info/web/hefat2017/

Abstract submission information:
https://edas.info/web/hefat2017/cfp.html

September 15th -17th, 2017
AAT Annual Meeting
in Greenville, South Carolina, USA

A Pre-Meeting Physicians Member Certification Course will occur on September 15th

The 2017 AAT Annual Scientific Session will be held on September 16th & 17th.

Further information
American Academy of Thermology
500 Duvall Drive
Greenville, SC 29607
info@aathermology.org
website: http://aathermology.org/annual-session-program/

September 27th - 29th, 2017
14th AITA 2017 (International Workshop on Advanced Infrared Technology and Applications) in Québec City, Canada

Conference venue: Université Laval

In the 14th AITA edition, special emphasis will be given to the following topics:

Advanced technology and materials
Smart and fiber-optic sensors
Thermo-fluid dynamics

Biomedical applications

Environmental monitoring
Aerospace and industrial applications
Nanophotonics and Nanotechnologies
Astronomy and Earth observation
Non-destructive tests and evaluation
Systems and applications for the cultural heritage
Image processing and data analysis
Near-, mid-, and far infrared systems

Important Dates
Extended abstract submission: May 31st, 2017
Notification of acceptance: June 15th, 2017
Revised extended abstract submission: August 1st, 2017

Information: http://aita2017.gel.ulaval.ca/home/

AITA Secretariat
e-mail: quebec@gel.ulaval.ca

18th-20th October 2017
VipIMAGE2017,
VI ECCOMAS Thematic Conference on Computational Vision and Medical Image Processing in Porto, Portugal

Thematic Session on
Infrared Thermal Imaging in Biomedicine

Topics of interest include (but are not restricted to):

- Botany
- Camera technology
- Dentistry
- Dermatology
- Endocrinology
- Fever screening
- Forensic and evidence medicine
- Integrative medicine
- Oncology
- Orthopaedics
- Paediatrics
- Physiotherapy
- Rheumatology
- Sports medicine
- Surgery
- Temperature measurement
- Thermal image processing
- Thermal physiology
- Vascular medicine
- Veterinary medicine

Important dates

o Submission of extended abstracts: March 15, 2017

o Authors Notification: April 15, 2017

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Further information
Www.fe.up.pt/vipimage
Web.fe.up.pt/~vipimage/nav/conference/sessions.htm

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NPL
National Physical Laboratory

FIRST ANNOUNCEMENT

14th European Association of Thermology Congress

"Thermology in Medicine:
Clinical Thermometry and Thermal imaging"

4th – 7th July 2018

National Physical Laboratory, Teddington, London

United Kingdom

LONDON 2018

XIV E.A.T. Congress, 4-7 July NPL National Physical Laboratory

www.eurothermology.org

The EAT and the National Physical Laboratory are delighted to invite you to participate in the XIV EAT Congress in Teddington, London, United Kingdom from 4th to 7th July 2018.

The European Association of Thermology exists to promote, support and disseminate research in thermometry and thermal imaging in the fields of human and veterinary medicine and biology. We do this through our peer-reviewed journal Thermology International, regional seminars around Europe, and our flagship Congress, which takes place every three years.

Following on from the most recent meetings in Porto (2012) and Madrid (2015), the Congress heads back to northern Europe for 2018 to the National Physical Laboratory (NPL) in the United Kingdom.

The EAT Board looks forward to welcoming you to NPL's world class conference facilities in the summer of 2018.

Dr. Kevin Howell
EAT President
Chair, 2018 EAT Congress Organising Committee

VENUE.

The National Physical Laboratory (NPL) is the United Kingdom's National Measurement Institute and is located in Teddington, south west London, approximately 30 minutes by taxi from Heathrow Airport and a 30 minute train journey from London Waterloo. www.npl.co.uk/location.

LONDON 2018
XIV E.A.T. Congress, 4-7 July NPL

XIV EAT CONGRESS 4th – 7th July 2018, NPL.

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Dieter Taubert (GER)
Rod Thomas (GBR)
Ricardo Vardasca (POR)

KEY DATES.

Abstract submission will open online on 31st July 2017, and authors will be notified of acceptance for oral or poster presentation by 29th January 2018.

December 2016. Publication of the First Announcement.

July 2017. Publication of the "Call for Abstracts" document.

31st July 2017. Opening of abstract submission and registration.

29th November 2017. Abstract submission deadline

29th January 2018. Acceptance notification to authors.

26th February 2018. End of Early Registration and deadline for registration of presenting authors.

LONDON 2018
XIV E.A.T. Congress, 4-7 July NPL

XIV EAT CONGRESS 4th – 7th July 2018, NPL.

REGISTRATION FEES (*)

	Early Registration (Until 26 FEB 2018)	Late Registration (After 26 FEB 2018)
EAT MEMBER	£200	£250
Non-Member	£250	£300
Student (**)	£170	£220

(*) Further information about the registration process will be provided in the "Call for abstracts" document. Registration includes access to all congress sessions, congress lunch and coffee breaks, the Congress Dinner, and a guided visit to the historic Hampton Court Palace on 7th July.

ACCOMMODATION

There are a number of hotels within walking distance of the National Physical Laboratory and Teddington railway station, and even more choice within a 15 –minute radius by train, taxi or bus. Further information about local hotels can be found at http://www.npl.co.uk/contact-us/local-hotels. Early booking in 2018 is advisable!

ACCOMPANYING PERSONS

With central London just 30 minutes away by rail, Teddington is an excellent base for accompanying persons to enjoy the capital city of the UK without the need for an organised tour. All accompanying persons will be invited to join the Congress Dinner and social programme upon payment of the appropriate fee.