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Photoacoustic, Photothermal, and Diffusion-Wave Sciences in the Twenty-First Century: Triumphs of the Past Set the Trends for the Future

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Abstract A handful of early breakthroughs in photoacoustic science and engineering since its modern-day (scientific) renaissance in the 1970s has defined directions in the development of the photoacoustic, photothermal, and diffusion-wave fields in the past 40 years that have shaped modern day developments and have led to an impressive range of vibrant and unique technologies in the third millennium (technological renaissance). A power-point presentation on the ICPPP-16 opening plenary talk focuses on the historical roots of what I perceive to be some of today's most successful and unique technologies, while readily acknowledging the impossibility to be all inclusive. It can be found under the url: http://cadift.mie.utoronto.ca/History_of_Photoacoustics-Photothermics.ppt. The thematic areas in question include historical reviews selected among the following topics: Piezoelectric photoacoustic microscopy (PAM) which, along with early gas-phase PA spectroscopic studies of biomaterials such as blood haemoglobin and progress in the physics of photon diffusion waves, has led to the modern-day explosion in biomedical photoacoustic imaging technologies with future trends for photoacoustic and ultrasound co-registered imagers; Thermoreflectance, piezoelectric, and gas-phase PA imaging of semiconductors which, along with developments in photocarrier diffusion wave physics, led to photocarrier radiometry, nanolayer diagnostics, carrierographic imaging of optoelectronic materials, and devices with industrial trends in solar cell inspection and control; Photoacoustic gas-phase and infrared radiometric probing and scanning imaging NDE which led to lock-in thermography and have spawned industrial and biomedical technologies; Thermal-wave interferometry and the quest for thermal coherence which led to thermal-wave cavities, the thermal-wave radar, and derivative depth profiling

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technologies, and, very recently, thermal coherence tomography. This review is meant to be a growing public record of work in progress, with new materials in the given thematic areas and other thematic areas being added as more information on the rich history of the field becomes available. Direct inputs to the author by the broader photoacoustic, photothermal, and diffusion-wave community are solicited and strongly encouraged to ensure that all landmark and seminal work that shaped the state of the science and art in the field receives fair and deserving exposure and the historical review becomes truly representative and comprehensive.

Keywords Diffusion waves · History · Photoacoustic · Photothermal · Science · Technology

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