Using a computer model to shed light on early invasive melanoma

WEDNESDAY, JANUARY 29, 2025

Scientists at the University of Waterloo are creating the knowledge base necessary for the early detection of melanoma.

Melanoma, the deadliest form of skin cancer, has increased worldwide in the last decades. Once it metastasizes it becomes very difficult to treat, yet early detection is difficult because the cancer initially grows beneath the visible surface of the skin.

“We tend to think about human skin as being this relatively simple organ covering our body, but it is quite complex, notably from an optical point of view,” said Gladimir Baranoski, a computer science professor and the lead author of the study. “Our computer model, HyLIoS, allows us to simulate the appearance of skin under visible, ultraviolet, and infrared light, enabling us to look for irregularities and early warning signs of melanoma that are difficult to detect with the naked eye.”

Petri Varsa (left) and Gladimir Baranoski in their lab

In new research using HyLIoS, the team observed that angiogenesis – an increase in blood vessels beneath the surface of the skin that has been associated with tumour progression –

consistently correlated with the spectral signature of early invasive melanoma. "We are talking about a tiny change here – an increase in the amount of blood by one or two per cent – in a very thin layer of the skin," said Petri Varsa, a PhD candidate in computer science. "But when we input that to our model our results are more consistent with existing melanoma research."

Baranoski and his team have been modeling the interaction between light and human skin since 2002. A large portion of their work involves evaluating their models in comparison to existing lab measured data from decades of research around the world. "This research is only possible because medical researchers make their data available," Baranoski said. "We are also grateful for the many hours of work contributed by students doing undergraduate research assistantships, who have painstakingly collected valuable data from the existing literature."

The team hopes to further broaden their research to encompass a larger range of skin types; currently, their simulations target lightly-pigmented skin both because of limitations in existing laboratory data and because people with this skin pigmentation are most susceptible to melanoma. "Currently there is no magic bullet or easy, non-invasive solution for the detection of melanoma, particularly in its early stages", Baranoski said. "But we hope noticing and analyzing these patterns can be a building block toward more reliable screening solutions."

The research, "Angiogenesis-elicited spectral responses of early invasive skin melanoma: Implications for the evaluation of lesion progression," was published in the Journal of Biophotonics.