Artificially Intelligent Medical Nanosensors for Clinical Decisions

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Patients are often diagnosed too late or wrongly as their disease condition progresses or undergo unnecessary treatment due to an inaccurate diagnosis resulting from the limited ability of conventional methods and the limited perspective of human diagnostics. This talk will focus on a new paradigm for the development of advanced clinical decision-support systems (CDSS) based on medical nanosensors to aid decision-makers and help healthcare systems to improve the way they approach the information, insights, and the surrounding contexts as well as to promote the uptake of personalized medicine on an individualized basis.[1-3] The starting point of this paradigm is the deployment of machine learning to allow for Artificial Intelligence (AI) training by combining multiple datasets from past medical records of hundreds of thousands of patients, to identify patterns of the disease conditions within the big data ocean (Figure 1). The obtained CDSS-enable AI algorithm are then enriched with new data from a range of existing and novel tools for enabling accurate pre-screening and diagnosis while providing the most comprehensive information on the sub-type, stage, grade, and genetic mutations, etc. (Figure 1) Relying on these milestones, wearable sensing devices could enable interactive and evolving clinical decisions that could be used for evidence-based analysis and recommendations as well as for personalized monitoring of disease progress and treatment (Figure 1). Ultimately, the outcome is a detailed health status assessment from multiple viewpoints that is systemic and easy-to-use for clinical purposes, leading to improved diagnostic accuracy, increased effectiveness, and enhanced treatment efficacy. The challenges and future opportunities associated with AI-enabled non-invasive medical nanosensors in clinical decisions will be presented and discussed.

Figure 1. Conceptual diagram artificial intelligence (AI) tools and personalized clinical decision support system (CDSS) for integrating a wide spectrum of data and disease diagnosis.

References

1 Haick, H.; Tang, N. *ACS Nano* **2021**, *15*, 3557–3567.
2 Zheng. Y.; Tang, N.; Omar, R.; Hu, Z.; Duong, T.; Wang, J.; Wu, W.; Haick, H. *Adv. Funct. Mater.* **2021**, *31*, 2105482.
3 Wu, W.; Haick, H. *Adv. Mater.* **2018**, 30, 170502.