

**Response to the letter to the Editor commenting on "Towards more relevance in forensic science research and development" by Weyermann et al.**

Dear author(s),

Thank you for your letter commenting on our paper "Towards more relevance in forensic science research and development". Several points raised in your letter confirm the need for more relevance and transdisciplinarity in forensic science research, and we are happy that such discussions can be shared with other scientists within the forensic community.

Your statement that "a 40-year transition from invention or discovery to practical application is extremely long" is of course true. However, as suggested in our paper, it may not only reflect a lack of innovation but also a well implemented technique that can answer all the perceived needs ("fit for purpose"). While forensic science research and development needs to remain versatile and adaptable to the evolution of criminality [1], it should not only focus on new tools, but also on problems. Thus, well implemented methods (such as filtered light examination or other optical approaches) often remain very performant to examine forensic traces and should not be discarded for fancy tools that do not bring added value, according to the saying "do not kill a fly with a sledgehammer".

Regarding the author's hypothesis that "...better designing R&D to serve practice not only requires intimate and fundamental knowledge of practice (which the authors advocate for), but also robust interdisciplinary foundations in basic sciences.", we entirely agree with the observation that transdisciplinarity is necessary to solve real life complex problems. However, the question of interdisciplinarity can be viewed under different prisms: from the point of view of the forensic generalist or the specialist from other core disciplines. This is a well-known argument that was previously discussed in the literature [2-4]. While both are important, forensic science research should be lead if not by forensic scientists (including those in academia), at least in collaboration with them [5]. Unfortunately, this is rarely the case and may explain why most research labelled as forensic find little application in forensic practice.

The example used to illustrate the need for robust interdisciplinary foundations in basic sciences in the letter focuses on the omission of two papers [6, 7] in the latest Interpol review on gunshot residue [8]. It is an interesting example, as it may illustrate well a key message of our paper. Indeed, these two articles were published in journals that are not linked to forensic science. One paper does not even contain the word "gunshot residue" in the title, abstract or keywords making it extremely difficult to find when searching databases [7]. While "firearm propellant gas" can be well understood, it will simply not be returned by typical keywords algorithms in the field of gunshot or firearm discharge residue. Regarding the treated subject, they are of course of fundamental interest to understand blood pattern analysis and gunshot residue transfer. However, gunshot residue production and transfer is influenced by many different factors in real cases [9]. Thus, practical translation of such fundamental concepts remains extremely difficult. We would like to suggest that the authors of these two papers work in collaboration with gunshot residue experts to translate their findings in a forensic science perspective. Such a translation should then be published in a forensic journal to have a real impact on the field and be accounted for in future forensic reviews.

Finally, the observation that "The hesitance (of forensic experts) to navigate the unfamiliar terrains of emerging technologies, or to re-evaluate previously held stances, might inadvertently slow the adoption

of innovative forensic methods.” goes entirely in the direction of our article as specified in the sentence “Indeed, a specialist trained on SEM-EDX may not be able or motivated to operate another instrument such as LIBS or LC-MS/MS (technical issue).” Thus, we agree that habits and specialisation hamper the implementation of innovation in practice. This may also be true of managers, as implementing new technologies, poses risks and costs resources. It is not entirely compatible with heavy quality management, court requirements and business objectives. Moreover, such observation may even be true of academic research in which scientists struggle to investigate problems and test methods that are outside their field of expertise (with the risks of lowering their scientific impact factors, rather than increasing their impact on forensic practice). Despite those difficulties, the need to remain flexible and constantly evolve is crucial in forensic science research and development [1]. We agree that forensic scientists should be proactive rather than reactive to such changes, and that practitioners and academics should work more actively together to design useful research.

We hope this answers your questions and feed the discussion to design together a path forward for forensic science.

Best regards,  
Céline, Sheila, Pierre and Claude

## References

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