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## Forensic Science Understanding by Police Managers: New Opportunities to Re-think Its Involvement in Policing

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### 0 Police Management and Policing

1 Police management is defined as a set of individual, collective and organ-  
2 isational practices with the aim of producing useful knowledge to ensure  
3 the satisfaction of staff members and the performance of the organisation

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4 in terms of cohesion and policing (Roberg, Kuykendall, & Novak, 2002).  
5 To attain those goals, modern law enforcement agencies are increasingly  
6 moving towards a more proactive approach to address offending, disorder  
7 and crime. Consequently, it seems that community policing, problem-  
8 oriented policing and intelligence-led policing are gradually becoming  
9 standard ways of administering the police—at least in its organisational  
10 rhetoric (National Academies of Sciences, Engineering and Medicine,  
11 2017). As “[a] number of writers have drawn attention to the increased  
12 reliance on science and technology for the successful performance of  
13 contemporary policing” (Ludwig, Fraser, & Williams, 2012, p. 53) we  
14 postulate that forensic science has a role to play in these modern forms of  
15 policing. Therefore, the understanding of forensic science contributions  
16 among police senior managers ought to be questioned.

17 In charge of policy, they act as strategic planners who define short-,  
18 medium- and long-term goals and objectives in order to meet expecta-  
19 tations and needs of their stakeholders (state, counties, cities) and other  
20 partners such as community groups. They are also in charge of the finan-  
21 cial, material and human resources allocation within the organisation  
22 they lead (Aepli, Ribaux, & Summerfield, 2011; Lynch & Lynch, 2005).  
23 Police managers therefore certainly have powers and responsibilities that  
24 influence the quality and use of forensic science (Guéniat, 2017). Indeed,  
25 they assign tasks and objectives to crime scene units and crime labs  
26 and define the conditions that guide their involvement and standards.  
27 A recent publication revealed the underestimation by police managers  
28 of the scope and possibilities of forensic science, hence limiting its  
29 exploitation and potential involvement in law enforcement and policing

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30 (Mousseau, Baechler, & Crispino, 2019). Although limited to the Cana-  
31 dian Province of Quebec, this study does not “identify specific reasons  
32 why such a perception from police leaders would be exclusive to Quebec”  
33 (p. 530).

34 Indeed, those results are in line with the findings of previous studies  
35 over the last decades in the United Kingdom, which indicated that crime  
36 scene examiners were essentially considered (including by themselves)  
37 as “technical assistants” in charge of collecting evidence (Ludwig et al.,  
38 2012; Williams, 2004). For Quebec police senior managers, crime scene  
39 units are viewed essentially as support units for criminal investigations.  
40 They therefore tend to associate forensic science to a reactive (i.e. on  
41 request) and somewhat auxiliary process initiated by the commission  
42 of crimes and other types of incidents requiring investigation (e.g. car  
43 accidents). Many police managers admitted having neither tight relation-  
44 ships with forensic laboratories or research institutions, nor dedicated  
45 protocols or standards to assess the performance of their crime scene  
46 units (Mousseau, 2019).

47 In the eyes of police managers, forensic science appears to be a comple-  
48 mentary and powerful resource to the work of investigators, but mainly  
49 dedicated to court, focused on the exclusion of bystanders and the iden-  
50 tification of suspects, who could not be identified by other so-called  
51 conventional investigation methods. However, according to a body of  
52 research, only a small ratio of criminal cases is solved with the help  
53 of forensic science, which plays a minimal role in resolving homi-  
54 cide and even burglary cases in the United States, England, Australia,  
55 France and Quebec. Rather, human sources (witnesses, informants) and  
56 police activities (patrol intervention, surveillance) seem to be the factors  
57 contributing to the elucidation of homicide cases (Baskin & Sommers,  
58 2010; Brodeur, 2010; McEwen & Regoeczi, 2015).

59 In the police managers view, forensic science is strongly associated with  
60 supporting the Court decision-making process. In this context, they seem  
61 to ignore governmental and academic controversies about the imple-  
62 mentation and practices of forensic science (Margot, 2011; NAS, 2009;  
63 PCAST, 2016; Roux, Crispino, & Ribaux, 2012). The contribution of  
64 forensic science in the investigative process is found limited over the past

65 decades, despite abilities to answer and raise questions about a perpe-  
66 trated crime (Bitzer et al., 2017; Jackson, Jones, Booth, Champod, &  
67 Evett, 2006; Kruse, 2015), and the potential to link cases through traces,  
68 the best example being burglary series (Bond, 2007; Coupe & Griffiths,  
69 1996). To process traces is not a guarantee of investigative and judicial  
70 success per se. Beside that, the efficiency of forensic science can also be  
71 challenged since few traces are collected from crime scenes (e.g. physical  
72 evidence is collected in less than a third of the assault and burglary cases  
73 reported to the police), and only a tinier fraction ends up into court.  
74 Obviously, many traces remain unexploited and sleep in investigative files  
75 or databases, whereas these traces hold relevant information on prolific  
76 offenders, criminal activity and new threats (Laurin, 2012; Robertson,  
77 2012; Strom & Hickman, 2010).

78 Traces, as weak signals, constitute many missed opportunities to elicit  
79 forensic intelligence useful to support policing (Raymond & Julian,  
80 2015), as will be discussed below. In this regard, managerial (e.g. quality  
81 management) and academic efforts (cognitive science, analytics, forensic  
82 interpretation) miss out more often than not the potential contribu-  
83 tion of forensic science to policing since their main focus is on a better  
84 support of justice decisions. Although traces are available to be used in a  
85 greater scheme of inferences than systems are able to figure out (Ribaux,  
86 Roux, & Crispino, 2017), operational practitioners are able to deploy  
87 abundant and imaginative schemes that may take them into account, but  
88 they are not necessarily solicited and remain under the radar of academic  
89 studies.

90 It must be acknowledged that this problem is not limited to forensic  
91 science. It is systemic inside the complex policing system, difficult  
92 to frame itself coherently through various and different organisations  
93 that compose the security and justice apparatus (Brodeur & Shearing,  
94 2005). For instance, databases expansion, including their interconnec-  
95 tion upgrade, cannot alone provide a more efficient impact on security,  
96 if the efficiency criterion is strictly limited to the jurisdictional answer in  
97 court (Jeuniaux et al., 2015; Ribaux & Hicks, 2013).

## Forensic Science as a Provider of Policing Intelligence: Some Examples

Forensic intelligence is “the accurate, timely and useful product of logically processing forensic case data” (Ribaux et al., 2003, p. 49). This concept relies on the analogy that similar criminal activities will leave traces that are likely to be—at least partly—similar, while distinct activities will mostly produce distinct traces. This systematic comparison of traces can contribute to the study of crime patterns and serial crimes (Ribaux, Baylon, Lock, et al., 2010; Ribaux, Baylon, Roux, et al., 2010; Ribaux, Walsh, & Margot, 2006).

Using forensic science in an intelligence perspective is beneficial for supporting decision-making at strategic, operational and tactical levels for law enforcement agencies (Bell, 2006; Ribaux, 2014; Ribaux et al., 2017). It even becomes useful at a macroscopic level as a tool for managers and researchers through the development of scientific knowledge. Since traces are, by definition, dependent on the criminal activities at their origin, using them in a criminological perspective creates knowledge on “forms of crime, modus operandi, typologies of crime situations and problems” (Free translation) (Baechler, 2018, p. 143). Forensic science can contribute to the understanding of particular crime systems, criminal trajectories and the evolution of certain offending behaviours, including new criminal trend detection (crime epidemiology), thus becoming an interesting tool for the detection of innovations used by offenders and for resource allocation (Rossy, Décarry-Héту, Delémont, & Mulone, 2017).

Roux, Talbot-Wright, Robertson, Crispino, and Ribaux (2015) pointed out that forensic science should focus on the trace and its potential contribution to security and policing rather than on the specialisation of laboratory techniques and the mere presentation of evidence to the Court. In order to remedy the widespread underutilisation of traces, forensic science should be extended to a proactive role of detection and resolution of problems faced by law enforcement agencies and other actors in the field of security. These problems here refer to disrupting criminal activities which, by their frequency or their gravity, threaten social order and the security of the community (Goldstein, 1990).

The scientific literature is also increasingly recognising that traces can be exploited in a proactive perspective of operational and strategic intelligence, by participating in the definition of problems and objectives, in the resource prioritisation and allocation, as well as in the development of standards and strategies regarding crime prevention (Bruenisholz et al., 2016; Ribaux et al., 2017).

For example, Fortin (2014) was interested in digital traces not to identify offenders, but to better understand child pornography cyber behaviours as a whole in order to propose an optimisation of tools to fight against predators. He developed a method based on digital traces to decipher the interactions of criminals on the Web. It is interesting to note that this approach is fundamentally similar to the one already implemented by using physical, biological and image traces to assess the social and economic structure of crime, the mobility and interaction of criminal groups and the emergence of new trends (Rossy, Ioset, Dessimoz, & Ribaux, 2013).

This approach relying on the use of traces to gain knowledge about a “criminal ecology” is indeed experiencing some success in:

- understanding the structure and extent of criminal networks as well as distribution routes through the analysis of seized illicit drugs specimens (Esseiva et al., 2007; Morelato et al., 2013; Ouellet & Morselli, 2013);
- identifying prolific authors through the comparison of shoemarks helping to decide where and when to allocate investigative resources (Ribaux et al., 2003; Rossy et al., 2013);
- detecting links between forged and counterfeit documents revealing the activity of criminal networks, such as human trafficking rings, and inviting to focus on the traffickers instead of the victims (Baechler & Margot, 2016; Baechler, Ribaux, & Margot, 2012);
- refuting criminological and police hypothesis of watertight separations between street gangs, when firearms traces support the sharing of weapons between gangs (Braga & Pierce, 2004; Hannam, 2010);
- mitigating methodological biases in the evaluation of spatial patterns of serial offenders’ criminal activity through the use of DNA evidence

167 for intelligence purpose (Lammers, 2013; Lammers, Bernasco, &  
168 Elffers, 2012; Palmbach, Blom, Hoynes, Primorac, & Gaboury, 2014).

169 This perception of social reality by traces does not interest only investiga-  
170 tors or social researchers (through the emerging interdisciplinary concept  
171 of traceology [Rossy et al., 2017]), but also authorities in charge of  
172 policing, including economy, public health and prevention, as illustrated  
173 by four last examples:

- 174 ● The assessment of the legal response to public health and economic  
175 harm caused by counterfeit medicines concluded that the legal  
176 measures were not applicable. The establishment of forensic moni-  
177 toring was proposed, which initiated the mobilisation of the Swiss  
178 agencies and relevant international agencies (Dégardin, Roggo, &  
179 Margot, 2014).
- 180 ● The estimation of drug addiction habits and the identification of new  
181 substances using wastewater analysis provided also an assessment of the  
182 effectiveness of police operations, all aimed at optimising the resources  
183 of prevention and control available (Been, Esseiva, & Delémont,  
184 2016).
- 185 ● The assessment of the doping trade magnitude through the study of  
186 online doping market on biological markers and digital traces high-  
187 lighted the problem being more significant than what was perceived  
188 by the laboratories in charge of security and health problems (Marclay,  
189 Mangin, Margot, & Saugy, 2013; Pineau et al., 2016).
- 190 ● The call for awareness-raising among European web hosts about their  
191 responsibility in the area of counterfeits through the combined anal-  
192 ysis of physical and chemical traces arising from the production of  
193 watches (on the watches themselves) as well as digital traces linked to  
194 distribution websites, which led to favourable developments to protect  
195 this art craft (Hochholdinger, Marvin, Arnoux, Esseiva, & Delémont,  
196 2019).

197 The common key to these strategies lies naturally in the identification of  
198 patterns. However, the detection and recognition of these patterns can  
199 hardly occur without the transformation of a reactive criminal justice

200 strategy into a proactive security approach. This transformation, in turn,  
201 makes it possible to anticipate the means to be implemented in face of  
202 criminal innovations. Such a paradigm shift has certainly some conse-  
203 quences on traditional policing, addressing also communities, public  
204 health, industry or commerce.

205 The adoption of such a proactive forensic pathway on serial crime and  
206 prolific offenders could look locked by operational or even “pathological”  
207 obstacles in law enforcement agencies (Sheptycki, 2004), but forensic  
208 data beholds interesting qualities for democratic rights (Grossrieder &  
209 Ribaux, 2017). For instance, there is no need of coercive measures (house  
210 search, arrest, etc.) to collect traces available in public area or at victims’  
211 homes at their request. The use of forensic data for crime understanding  
212 and policing has an undeniable potential. But this use must be well  
213 regulated and ethically justified to avoid being perceived—rightly or  
214 wrongly—as an expansion of governmental intervention and surveillance  
215 (Dahl & Sætnan, 2009).

## 216 **Back to Quebec Practice with Some Positive** 217 **Forecast**

218 The tendency to focus on a low diversity of traces, typically DNA and  
219 fingerprints, which emerges from the police senior managers’ interviews  
220 conducted by Mousseau et al. (2019), is consistent with the more general  
221 lack of knowledge of the concept of forensic intelligence (Crispino,  
222 Rossy, Ribaux, & Roux, 2015).

223 However, three interviewees (over 18) attributed to forensic science  
224 a proactive role similar to the concepts on which forensic intelligence is  
225 based. They suggested that forensic science might be useful in identifying  
226 a particular modus operandi, in detecting a crime series, in discover-  
227 ing new techniques used by offenders and in acquiring knowledge  
228 on offenders’ habits. Practically, these police managers would ask their  
229 crime scene officers to intervene more frequently and systematically on  
230 different cases where links are anticipated, i.e. when those cases could be  
231 connected to the activity of a serial offender. Still, their primary ratio-  
232 nale for such strategies remains first and foremost built on other types of



233 information and intelligence than forensic science, based for instance on  
234 the analysis of spatiotemporal and digital data. It should thus be noted  
235 that these three interviewees only very briefly mentioned this extension  
236 of the role of forensic science, appearing rather as the result of a thought  
237 emerging from the ongoing interview than an entrenched perception  
238 (Mousseau et al., 2019).

239 Nevertheless, such an opening suggests that basic and/or continuing  
240 training dedicated to the various roles of forensic science and to the  
241 possibilities offered by the discipline should be developed to supplement  
242 the knowledge of police decision-makers. To maximise the scope of their  
243 reflections on this subject, success story examples showcasing the useful-  
244 ness to policing might be privileged, including ones in the proactive  
245 fight against volume crimes, as such as burglaries, car thefts, etc. only  
246 potentially serial.

247 With proper forensic science training and, why not, a forensic scien-  
248 tist attached at the right level of command, police senior managers could  
249 have a leading role in supporting and extending the use of forensic  
250 science for criminal intelligence and more generally policing.

## 251 Conclusion

252 The present analysis, corroborated by a survey of Quebec police  
253 managers, supports that police managers as well as some other practi-  
254 tioners and researchers do not perceive the full potential of traces in a  
255 holistic approach. Indeed, by concentrating their attention mainly, if not  
256 exclusively, on the ability of forensic science to serve justice, they tend  
257 to restrict forensic science to a set of scientific disciplines used in a labo-  
258 ratory context, without a clear understanding and a real reflection of its  
259 potential within a broader security challenge (Crispino, Ribaux, Houck,  
260 & Margot, 2011; Kelty, Julian, & Ross, 2013; Pietro, Kammrath, &  
261 De Forest, 2018). They thus seem little informed about the demon-  
262 strated usefulness of traces in a proactive perspective that goes beyond  
263 the investigation of singular cases, and in the knowledge acquisition on  
264 volume crimes. Further, most police forces have been struggling with  
265 the challenges caused by the digital transformation of society. In this

266 context, forensic intelligence provides an additional avenue to exploit the  
267 large variety of commonly encountered digital traces. As a result, forensic  
268 intelligence may provide a framework to police organisations to design  
269 and integrate policing strategies, methods and tools that are adapted to  
270 an increasingly digitalised society (see Ribaux et al., Chapter 11).

271 Reducing forensic science to an ancillary service to the justice system  
272 deprives police managers of an effective perception tool complementary  
273 to their traditional methods of policing, to unveil actual or emergent  
274 threats on their fellow citizens, and rationalise the allocation of resources  
275 to remedy them.

## 276 References

- 277 Aepli, P., Ribaux, O., & Summerfield, E. (2011). *Decision making in policing: Operations and management* (1st ed.). Lausanne: EPFL Press.
- 278
- 279 Baechler, S. (2018). Science forensique et innovations criminelles: Opportu-  
280 nité méthodologique ou jeu du chat et de la souris? In D. Décary-Héту &  
281 M. Bérubé (Éds.), *Délinquance et Innovation* (pp. 139–158). Montreal: Les  
282 Presses de l'Université de Montréal.
- 283 Baechler, S., & Margot, P. (2016). Understanding crime and fostering security  
284 using forensic science: The example of turning false identity documents into  
285 forensic intelligence. *Security Journal*, 29(4), 618–639. <https://doi.org/10.1057/sj.2015.26>.
- 286
- 287 Baechler, S., Ribaux, O., & Margot, P. (2012). Toward a novel forensic intel-  
288 ligence model: Systematic profiling of false identity documents. *Forensic  
289 Science Policy & Management: An International Journal*, 3(2), 70–84. <https://doi.org/10.1080/19409044.2012.744120>.
- 290
- 291 Baskin, D., & Sommers, I. (2010). The influence of forensic evidence on the  
292 case outcomes of homicide incidents. *Journal of Criminal Justice*, 38(6),  
293 1141–1149. <https://doi.org/10.1016/j.jcrimjus.2010.09.002>.
- 294 Been, F., Esseiva, P., & Delémont, O. (2016). Analysis of illicit drugs  
295 in wastewater—Is there an added value for law enforcement? *Forensic  
296 Science International*, 266, 215–221. <https://doi.org/10.1016/j.forsciint.2016.05.032>.
- 297
- 298 Bell, C. (2006). Concepts and possibilities in forensic intelligence. *Forensic  
299 Science International*, 162(1–3), 38–43. <https://doi.org/10.1016/j.forsciint.2006.06.030>.
- 300

- 301 Bitzer, S., Heudt, L., Barret, A., George, L., Van Dijk, K., Gason, F., & Renard,  
302 B. (2017). The introduction of forensic advisors in Belgium and their role  
303 in the criminal justice system. *Science & Justice*. [https://doi.org/10.1016/j.  
304 scijus.2017.11.002](https://doi.org/10.1016/j.scijus.2017.11.002).
- 305 Bond, J. W. (2007). Value of DNA evidence in detecting crime. *Journal*  
306 *of Forensic Sciences*, 52(1), 128–136. [https://doi.org/10.1111/j.1556-4029.  
307 2006.00323.x](https://doi.org/10.1111/j.1556-4029.2006.00323.x).
- 308 Braga, A. A., & Pierce, G. L. (2004). Linking crime guns: The impact of  
309 ballistics imaging technology on the productivity of the Boston Police  
310 Department's Ballistics Unit. *Journal of Forensic Sciences*, 49(4), 1–6. [https://  
311 doi.org/10.1520/JFS2003205](https://doi.org/10.1520/JFS2003205).
- 312 Brodeur, J.-P. (2010). *The policing web*. New York: Oxford University Press.
- 313 Brodeur, J.-P., & Shearing, C. (2005). Configuring security and justice. *Euro-*  
314 *pean Journal of Criminology*, 2(4), 379–406. [https://doi.org/10.1177/147  
315 7370805056055](https://doi.org/10.1177/1477370805056055).
- 316 Bruenisholz, E., Prakash, S., Ross, A., Morelato, M., O'Malley, T., Raymond,  
317 M. A., ... Walsh, S. (2016). The intelligent use of forensic data: An  
318 introduction to the principles. *Forensic Science Policy & Management: An*  
319 *International Journal*, 7(1–2), 21–29. [https://doi.org/10.1080/19409044.  
320 2015.1084405](https://doi.org/10.1080/19409044.2015.1084405).
- 321 Coupe, T., & Griffiths, M. (1996). *Solving residential Burglary*. London: Home  
322 Office, Police Research Group.
- 323 Crispino, F., Ribaux, O., Houck, M., & Margot, P. (2011). Forensic science—  
324 A true science? *Australian Journal of Forensic Sciences*, 43(2–3), 157–176.  
325 <https://doi.org/10.1080/00450618.2011.555416>.
- 326 Crispino, F., Rossy, Q., Ribaux, O., & Roux, C. (2015). Education and  
327 training in forensic intelligence: A new challenge. *Australian Journal of*  
328 *Forensic Sciences*, 47(1), 49–60.
- 329 Dahl, J. Y., & Sættnan, A. R. (2009). “It all happened so slowly”—On control-  
330 ling function creep in forensic DNA databases. *International Journal of*  
331 *Law, Crime and Justice*, 37(3), 83–103. [https://doi.org/10.1016/j.ijlcrj.2009.  
332 04.002](https://doi.org/10.1016/j.ijlcrj.2009.04.002).
- 333 Dégardin, K., Roggo, Y., & Margot, P. (2014). Understanding and fighting  
334 the medicine counterfeit market. *Journal of Pharmaceutical and Biomedical*  
335 *Analysis*, 87, 167–175. <https://doi.org/10.1016/j.jpba.2013.01.009>.
- 336 Esseiva, P., Ioset, S., Anglada, F., Gasté, L., Ribaux, O., Margot, P., ... Ottinger,  
337 E. (2007). Forensic drug Intelligence: An important tool in law enforce-  
338 ment. *Forensic Science International*, 167(2), 247–254. [https://doi.org/10.  
339 1016/j.forsciint.2006.06.032](https://doi.org/10.1016/j.forsciint.2006.06.032).

- 340 Fortin, F. (2014). *C'est ma collection mais c'est bien plus que ça: Analyse*  
341 *des processus de collecte et de l'évolution des images dans les collections de*  
342 *pornographie juvénile*. Thèse de doctorat. Université de Montréal.
- 343 Goldstein, H. (1990). *Problem-oriented policing*. New York: McGraw-Hill.
- 344 Grossrieder, L., & Ribaux, O. (2017). Towards forensic whistleblowing? From  
345 traces to intelligence. *Policing: A Journal of Policy and Practice*, 13(2), 80–93.  
346 <https://doi.org/10.1093/police/pax039>.
- 347 Guéniat, O. (2017). In vestige @ and police management? *Policing: A Journal*  
348 *of Policy and Practice*, 13(1), 35–46. <https://doi.org/10.1093/police/pax044>.
- 349 Hannam, A. G. (2010). Trends in converted firearms in England & Wales as  
350 identified by the National Firearms Forensic Intelligence Database (NFFID)  
351 between September 2003 and September 2008. *Journal of Forensic Sciences*,  
352 55(3), 757–766. <https://doi.org/10.1111/j.1556-4029.2009.01293.x>.
- 353 Hochholdinger, S., Marvin, L., Arnoux, M., Esseiva, P., & Delémont,  
354 O. (2019). Elemental analysis for profiling counterfeit watches. *Forensic*  
355 *Science International*, 298, 177–185. [https://doi.org/10.1016/j.forsciint.](https://doi.org/10.1016/j.forsciint.2019.03.006)  
356 [2019.03.006](https://doi.org/10.1016/j.forsciint.2019.03.006).
- 357 Jackson, G., Jones, S., Booth, G., Champod, C., & Evett, I. W. (2006). The  
358 nature of forensic science opinion—A possible framework to guide thinking  
359 and practice in investigation and in court proceedings. *Science & Justice*,  
360 46(1), 33–44.
- 361 Jeuniaux, P., Renard, B., Dubocage, L., Steuve, S., Stappers, C., Gallala, I., ...  
362 Vanvooren, V. (2015). Managing forensic DNA records in a divided world:  
363 The Belgian case. *Records Management Journal*, 25(3), 269–287. [https://doi.](https://doi.org/10.1108/RMJ-05-2015-0018)  
364 [org/10.1108/RMJ-05-2015-0018](https://doi.org/10.1108/RMJ-05-2015-0018).
- 365 Kelty, S. F., Julian, R., & Ross, A. (2013). Dismantling the justice silos:  
366 Avoiding the pitfalls and reaping the benefits of information-sharing  
367 between forensic science, medicine and law. *Forensic Science International*,  
368 230(1–3), 8–15. <https://doi.org/10.1016/j.forsciint.2012.10.032>.
- 369 Kruse, C. (2015). *The social life of forensic evidence*. Oakland: University of  
370 California Press. [https://www.ucpress.edu/book/9780520288393/the-social-](https://www.ucpress.edu/book/9780520288393/the-social-life-of-forensic-evidence)  
371 [life-of-forensic-evidence](https://www.ucpress.edu/book/9780520288393/the-social-life-of-forensic-evidence).
- 372 Lammers, M. (2013). Are arrested and non-arrested serial offenders different? A  
373 test of spatial offending patterns using DNA found at crime scenes. *Journal*  
374 *of Research in Crime and Delinquency*, 51(2), 143–167. [https://doi.org/10.](https://doi.org/10.1177/0022427813504097)  
375 [1177/0022427813504097](https://doi.org/10.1177/0022427813504097).
- 376 Lammers, M., Bernasco, W., & Elffers, H. (2012). How long do offenders  
377 escape arrest? Using DNA traces to analyse when serial offenders are caught:

- 378 How long do offenders escape arrest? *Journal of Investigative Psychology and*  
379 *Offender Profiling*, 9(1), 13–29. <https://doi.org/10.1002/jip.1353>.
- 380 Laurin, J. E. (2012). Remapping the path forward: Toward a systemic view of  
381 forensic science reform and oversight. *Texas Law Review*, 91, 1051–1118.
- 382 Ludwig, A., Fraser, J., & Williams, R. (2012). Crime scene examiners and  
383 volume crime investigations: An empirical study of perception and practice.  
384 *Forensic Science Policy & Management: An International Journal*, 3(2), 53–61.  
385 <https://doi.org/10.1080/19409044.2012.728680>.
- 386 Lynch, R. G., & Lynch, S. R. (2005). *The police manager* (6th ed.). Philadel-  
387 phia, PA: Matthew Bender & Company.
- 388 Marclay, F., Mangin, P., Margot, P., & Saugy, M. (2013). Perspectives for  
389 forensic intelligence in anti-doping: Thinking outside of the box. *Forensic*  
390 *Science International*, 229(1), 133–144. [https://doi.org/10.1016/j.forsciint.](https://doi.org/10.1016/j.forsciint.2013.04.009)  
391 [2013.04.009](https://doi.org/10.1016/j.forsciint.2013.04.009).
- 392 Margot, P. (2011). Forensic science on trial—What is the law of the land?  
393 *Australian Journal of Forensic Sciences*, 43(2–3), 89–103. [https://doi.org/10.](https://doi.org/10.1080/00450618.2011.555418)  
394 [1080/00450618.2011.555418](https://doi.org/10.1080/00450618.2011.555418).
- 395 McEwen, T., & Regoezi, W. (2015). Forensic evidence in homicide investi-  
396 gations and prosecutions. *Journal of Forensic Sciences*, 60(5), 1188–1198.  
397 <https://doi.org/10.1111/1556-4029.12787>.
- 398 Morelato, M., Beavis, A., Tahtouh, M., Ribaux, O., Kirkbride, P., & Roux,  
399 C. (2013). The use of forensic case data in intelligence-led policing: The  
400 example of drug profiling. *Forensic Science International*, 226(1–3), 1–9.  
401 <https://doi.org/10.1016/j.forsciint.2013.01.003>.
- 402 Mousseau, V. (2019). La sélection et l'évaluation des techniciens en scène de  
403 crime: Compétences attendues des techniciens en identité judiciaire par les  
404 dirigeants policiers du Québec. *Criminologie*, 52(2), 193–217. [https://doi.](https://doi.org/10.7202/1065861ar)  
405 [org/10.7202/1065861ar](https://doi.org/10.7202/1065861ar).
- 406 Mousseau, V., Baechler, S., & Crispino, F. (2019). Management of crime scene  
407 units by Quebec police senior managers: Insight on forensic knowledge  
408 and understanding of key stakeholders. *Science & Justice*, 59(5), 524–532.  
409 <https://doi.org/10.1016/j.scijus.2019.04.004>.
- 410 NAS. (2009). *Strengthening forensic science in the United States: A path forward*.  
411 Washington, DC: National Research Council of the National Academies,  
412 National Academies Press.
- 413 National Academies of Sciences, Engineering, and Medicine. (2017). *Proactive*  
414 *policing: Effects on crime and communities*. Washington, DC: The National  
415 Academies Press. <https://doi.org/10.17226/24928>.

- 416 Ouellet, M., & Morselli, C. (2013). Precursors and prices: Structuring the  
417 Quebec synthetic drug market. *Journal of Drug Issues*, 44(1), 37–55. <https://doi.org/10.1177/0022042613491104>.
- 418
- 419 Palmbach, T., Blom, J., Hoynes, E., Primorac, D., & Gaboury, M. (2014).  
420 Utilizing DNA analysis to combat the world wide plague of present day  
421 slavery—Trafficking in persons. *Croatian Medical Journal*, 55(1), 3–8.  
422 <https://doi.org/10.3325/cmj.2014.55.3>.
- 423 Pietro, D. S., Kammrath, B. W., & De Forest, P. R. (2018). Is forensic science  
424 in danger of extinction? *Science & Justice*, 59(2), 199–202. <https://doi.org/10.1016/j.scijus.2018.11.003>.
- 425
- 426 Pineau, T., Schopfer, A., Grossrieder, L., Broséus, J., Esseiva, P., & Rossy, Q.  
427 (2016). The study of doping market: How to produce intelligence from  
428 Internet forums. *Forensic Science International*, 268, 103–115. <https://doi.org/10.1016/j.forsciint.2016.09.017>.
- 429
- 430 President's Council of Advisors on, & Science and Technology. (2016). *Forensic  
431 science in criminal courts: Ensuring scientific validity of feature-comparison  
432 methods* (p. 174). Executive Office of the President.
- 433 Raymond, T., & Julian, R. (2015). Forensic intelligence in policing: Organi-  
434 sational and cultural change. *Australian Journal of Forensic Sciences*, 47(4),  
435 371–385. <https://doi.org/10.1080/00450618.2015.1052759>.
- 436 Ribaux, O. (2014). *Police scientifique: Le renseignement par la trace*. Lausanne:  
437 Presses Polytechniques Universitaires Romandes (PPUR).
- 438 Ribaux, O., Baylon, A., Lock, E., Delémont, O., Roux, C., Zingg, C., &  
439 Margot, P. (2010). Intelligence-led crime scene processing. Part II: Intelli-  
440 gence and crime scene examination. *Forensic Science International*, 199(1–3),  
441 63–71. <https://doi.org/10.1016/j.forsciint.2010.03.011>.
- 442 Ribaux, O., Baylon, A., Roux, C., Delémont, O., Lock, E., Zingg, C., &  
443 Margot, P. (2010). Intelligence-led crime scene processing. Part I: Forensic  
444 intelligence. *Forensic Science International*, 195(1–3), 10–16. <https://doi.org/10.1016/j.forsciint.2009.10.027>.
- 445
- 446 Ribaux, O., Girod, A., Walsh, S. J., Margot, P., Mizrahi, S., & Clivaz, V.  
447 (2003). Forensic intelligence and crime analysis. *Law, Probability and Risk*,  
448 2(1), 47–60. <https://doi.org/10.1093/lpr/2.1.47>.
- 449 Ribaux, O., & Hicks, T. (2013). Technology and database expansion: What  
450 impact on policing? In S. Leman-Langlois (Ed.), *Technocrime, policing and  
451 surveillance* (pp. 91–108). London and New York: Routledge.
- 452 Ribaux, O., Roux, C., & Crispino, F. (2017). Expressing the value of forensic  
453 science in policing. *Australian Journal of Forensic Sciences*, 49(5), 489–501.  
454 <https://doi.org/10.1080/00450618.2016.1229816>.

- 455 Ribaux, O., Walsh, S. J., & Margot, P. (2006). The contribution of forensic  
456 science to crime analysis and investigation: Forensic intelligence. *Forensic*  
457 *Science International*, 156(2–3), 171–181. [https://doi.org/10.1016/j.forsci](https://doi.org/10.1016/j.forsciint.2004.12.028)  
458 [int.2004.12.028](https://doi.org/10.1016/j.forsciint.2004.12.028).
- 459 Roberg, R. R., Kuykendall, J. L., & Novak, K. (2002). *Police management* (3rd  
460 ed.). Los Angeles, CA: Roxbury Publishing.
- 461 Robertson, J. (2012). Forensic science, an enabler or dis-enabler for criminal  
462 investigation? *Australian Journal of Forensic Sciences*, 44(1), 83–91. [https://](https://doi.org/10.1080/00450618.2011.595736)  
463 [doi.org/10.1080/00450618.2011.595736](https://doi.org/10.1080/00450618.2011.595736).
- 464 Rossy, Q., Décary-Hétu, D., Delémont, O., & Mulone, M. E. (2017). *The*  
465 *Routledge international handbook of forensic intelligence and criminology*.  
466 Abingdon, Oxon, UK: Routledge.
- 467 Rossy, Q., Ioset, S., Dessimoz, D., & Ribaux, O. (2013). Integrating forensic  
468 information in a crime intelligence database. *Forensic Science International*,  
469 230(1–3), 137–146. <https://doi.org/10.1016/j.forsciint.2012.10.010>.
- 470 Roux, C., Crispino, F., & Ribaux, O. (2012). From forensics to forensic  
471 science. *Current Issues in Criminal Justice*, 24(1), 7–24.
- 472 Roux, C., Talbot-Wright, B., Robertson, J., Crispino, F., & Ribaux, O. (2015).  
473 The end of the (forensic science) world as we know it? The example of trace  
474 evidence. *Philosophical Transactions of the Royal Society B: Biological Sciences*,  
475 370(1674), 20140260. <https://doi.org/10.1098/rstb.2014.0260>.
- 476 Sheptycki, J. (2004). Organizational pathologies in police intelligence systems:  
477 Some contributions to the lexicon of intelligence-led policing. *European*  
478 *Journal of Criminology*, 1(3), 307–332. [https://doi.org/10.1177/147737080](https://doi.org/10.1177/1477370804044005)  
479 [4044005](https://doi.org/10.1177/1477370804044005).
- 480 Strom, K., & Hickman, M. J. (2010). Unanalyzed evidence in law-enforcement  
481 agencies: A national examination of forensic processing in police depart-  
482 ments. *Criminology & Public Policy*, 9(2), 381–404.
- 483 Williams, R. (2004). *The management of crime scene examination in relation to*  
484 *the investigation of burglary and vehicle crime*. Home Office.