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Introduction

WELCOME TO THE CRIME LAB

When Allison tells people she is a forensic scientist, "they don't really understand. Everyone's watched *CSI*, and they think they know everything about it. I try to tell them it is not as glamorous, and it doesn't happen in fifteen minutes. Because a lot of people have the misconception that a crime occurs, and within two days they find the suspects and within a week and a half they are convicted and in jail. And it just doesn't happen that quickly or easily."

Contrary to the popular image, forensic science is not a glamorous job. Despite the crimes involved, the work resembles that of bench scientists or laboratory technicians. When dusting the whorls of a fingerprint on the handle of a knife, scrutinizing a slide under a microscope to locate sperm in a sample, or test-firing a gun to see if it was used in a crime, forensic scientists look like lab scientists. Of course, the science is more complicated and time-consuming, and less sexy, than what we see on television. Day in, day out, Allison makes sure her work table is sterile, her notes are meticulous, her samples uncontaminated, and her instruments calibrated and working properly.

The intricacies of the science are also embedded in the links between the work of forensic scientists and investigators, attorneys, judges, and juries. The science in a crime laboratory serves a specific function: to analyze the evidence on which the criminal justice system relies. The work forensic scientists do is constrained by this function. Unlike other scientists, they perform their work *only* for the criminal justice system. They struggle with the knowledge that the work they do is not ordinary science, but a science used by a complex system that assesses guilt or innocence. The people it affects are real, and the stakes are high.

In light of this knowledge, it makes sense that forensic scientists also refer to themselves as "criminalists." Every day, criminalists work in the shadow of the criminal justice system, which controls their budget, sets their agenda, and requires more evidence processed ever faster. Criminal justice permeates criminalists' ways of working and thinking; they write reports knowing a jury will hear their conclusions, worry about how to explain contamination on the stand, and analyze evidence for the purpose of addressing questions of criminal law. Criminalists do not relinquish their scientific standards, or allow outsiders—attorneys, politicians, journalists—to misuse science for their own ends. But criminal justice concerns penetrate their daily work.

Criminalists know that their work might end up in a court of law. What they worry about most is appearing in court themselves. Testifying is exceptionally rare, but the possibility looms. Despite all the thought and care criminalists put into preparing for court, they know that appearing on the witness stand can be risky and fraught. The courtroom is commanded by people who are not scientists, and they may willfully or ignorantly use the science in ways that criminalists do not intend. Defense attorneys can turn a small lapse in lab procedure into a challenge to the criminalist's job performance; prosecutors mistakenly believe they can twist a scrap of evidence into the missing link their case needed. And the jurors, of course, may misunderstand the intricate science completely.

Testifying is not just where the science meets the law, but is the main venue in which the science is represented in public. The courtroom is where outsiders judge, undermine, and occasionally attack the hard work of the crime laboratory—all part of the theater of criminal trials. In the lab, criminalists can spend hours or days polishing a report with the help of colleagues, making sure the science is presented accurately and impartially. In court, one misinterpretation could lead to important cases lost, innocent people convicted, and severe repercussions for their careers.

Given their understanding of all of these consequences, criminalists approach testifying with a mix of determination and concern. Anca, in

a crime lab's DNA unit, noted that criminalists should always be nervous when they go to court:

> I don't care how many years of experience you've had because there's so much riding on your testimony and it doesn't matter how good you are at what you do here. It's relaying it to the jury that's the important thing, and you could be a great scientist but you could be a really bad witness, so [it's both] being able to do the analysis and the work and explaining it and relaying the message. I think that's it: Did I do a good enough job to relay the message? Did I explain it well enough? Could I have done it better?

In the words of Tom, a firearms examiner, "I walk in there with a sense of responsibility. I'm nervous. I think if you're not nervous in some capacity, maybe you aren't taking it seriously enough."

This book examines the culture of the crime lab, specifically the challenges of working as a criminalist within the criminal justice system today. It is an ethnographic account based on eighteen months of fieldwork I conducted within a crime lab of a major metropolitan area in the western United States. Metropolitan County Crime Laboratory (a pseudonym) is a mid-sized laboratory with about sixty criminalists, operating under the auspices of the county's district attorney. The laboratory is located in a bright new spacious building rather than the cramped basement spaces of other laboratories I have visited. The caseload is typical for the state in terms of the types of analysis performed, but the lab handles more than the average number of cases per year relative to laboratories across the state.

As an organizational ethnographer, my goal is to try to understand and portray the daily life of the people working in the organization. Doing so meant that I was a regular presence at the lab benches, computer screens, and meeting tables in Metropolitan County Crime Laboratory (MCCL): watching, listening, and asking questions. Apart from

entering the evidence lockers, I was given full access to all areas of the laboratory and visited about three days a week for six to seven hours a day. I focused my attention on four forensic science units—forensic biology, chemistry, comparative evidence, and toxicology—and spent between three and six months in each unit.

I observed every criminalist in each of these four units for at least a day: not only watching them work, but also accompanying them to lunches, group and lab-wide meetings, presentations, professional conferences, and court. I augmented our informal work conversations with interviews of more than thirty criminalists at MCCL. During the workdays, I occasionally interacted with members of the criminal justice system, such as attorneys and police officers. However, this book is not a study of the entire justice system. This is a study of criminalists, their perspectives, and the work that they do.

To understand the tensions and challenges of a form of work, I find it illuminating to actually try to do it myself. Therefore, I wanted to learn some forensic science techniques. The crime laboratory presented an unusual constraint on my participation in because I was not permitted to touch any case evidence. To compensate, criminalists let me practice on non–case evidence: members of the DNA unit patiently taught me how to run my own DNA profile, and I test-fired weapons in the firearms unit. In a lab coat and gloves, I peered over shoulders and into microscopes as the criminalists worked.

In addition to participant observation at MCCL, I toured three other crime laboratories in the state and interviewed their directors. I spent a day in a county-level crime laboratory in an eastern state, where I interviewed the deputy director and observed the work of the units of forensic biology, controlled substances, and comparative evidence. I also attended both state and local professional meetings and workshops. Conversations with this wider set of criminalists, supervisors, and directors broadened my understanding of the field of forensic science. It also helped me to assess the representativeness of MCCL: while the lab seemed spiffier and better funded than average, the work done there was representative of criminalists' work everywhere I visited.

My study of MCCL coincided with a critical moment in recent forensic science history: the National Academy of Sciences issued its report "Strengthening Forensic Science in the United States" just after my arrival at the lab.[1] This government-sponsored scientific assessment was critical of the scientific foundations of many of the disciplines of forensic science, although it exempted DNA profiling from its criticisms. Its publication led to increased public scrutiny of forensic science, the impact of which reverberated throughout the lab. I had an inside view of the responses of laboratory members, as well as a fortuitous opportunity to observe the broader field examine itself in reaction to this critique of their methods, their thinking, and their very existence.

What I witnessed showed me that criminalists take their work incredibly seriously. They think of themselves as scientists first and foremost. I never saw anything that made me think that criminalists are the source of error within our criminal justice system. Instead, I saw criminalists expected to do more with less, conscious of being accountable to the law and the public and sometimes treated shabbily by law enforcement, attorneys, and judges. They are people, and, therefore, not perfect. But the standards to which they hold themselves are exacting.

Instead of directing blame at criminalists, this experience showed me that gaps can occur in translation. The process of moving the science from the lab into the courtroom is a worrisome fault line in the criminal justice system. The rigorous work of criminalists is used for purposes unique to this branch of science, and the outcomes of their work are judged on criteria outside that of scientific protocols. The disconnects between scientific findings and legal arguments create misperceptions, and scientific knowledge is difficult for nonexperts to parse. When scientific findings are used in the service of justice, misunderstandings can arise, and criminalists' translation is critical to averting and correcting them. Explaining this process of translation is the focus of the book.

This book is divided into three parts. In part 1, "The Work of Criminalists," I describe what criminalists do. I examine a typical day in each of

the various disciplines of forensic science (DNA analysis, firearms examination, narcotics analysis, and toxicology), as they receive new evidence, process ongoing cases, write up reports, and worry about testifying. Although the particulars of their analyses are different, criminalists across disciplines face a similar challenge: navigating between the worlds of science, criminal justice, and the public sphere. Every day, criminalists need to first ensure that their work meets the threshold of good science, but they also need to communicate this science accurately to attorneys and judges as well as to jurors. Moreover, in an age when technology is rapidly advancing and criminal justice is under scrutiny, criminalists must work to convey their value, discipline, and impartiality to the broader public. Americans today order DNA tests over the internet and see criminal cases neatly wrapped up through science in sixty-minute TV dramas. It is no wonder the public is both wary and overly enthusiastic about the capabilities of forensic science.

In part 2, "The Culture of Criminalists," I explore how criminalists make sense of their work. Navigating the three worlds (science, criminal justice, and the public sphere) requires more than scientific acumen and individual initiative. Criminalists are aware of the gaps that may occur in translation and have evolved a particular workplace culture to address them, which I identify as a "culture of anticipation." The needs and expectations of outside audiences are never separate from the daily work of criminalists, and, as a result, criminalists anticipate the concerns of others. Anticipation makes their work more difficult; performing their analyses thinking of what the attorneys might ask for next, or what questions jurors might have about their processes, is a demanding experience. Criminalists craft their reports carefully, with language they believe will accurately deliver information to the court. The specter of testifying informs every step of examination. Anticipating a future attack on their work (and, by extension, themselves), criminalists need to be able to say: "This is what I did and how I did it."

The culture of anticipation is written into criminalists' daily practices and reproduced in their training, their meetings, and their casual conversations. Criminalists watch each other's courtroom testimonies to see how it is done. They develop a shared understanding of their role,

assuring each other that the best way to anticipate is to be the "voice of the evidence"—an impartial, scientific, but lucid and clear translator of the lab into the court—and nothing more. Because of their position within the criminal justice system, they cannot separate today's work from how it may potentially be used tomorrow, and they have developed a culture that makes this position at the intersection of these social worlds tenable.

In part 3, "The Struggles of Criminalists," I investigate how criminalists confront the current challenges to their work, and I uncover the obstacles and conflicts that define their work lives, beginning with testifying. Attorneys may verbally attack criminalists, whose slip-ups on the stand can have terrible consequences, and, even in a relatively friendly courtroom, criminalists find it challenging to discuss details of science. Simply attesting to scientific results has become more complex, because technological breakthroughs have destabilized criminalists' footing. DNA testing has become America's darling: we are using it in our doctors' offices to predict disease and in our living rooms to find distant relatives, and we even use those same databases to track down serial killers. The rise of DNA profiling has raised questions about the science of many other disciplines, requiring criminalists across the field to examine and justify their standards and practices. The science of DNA seems obvious and irrefutable, and, not surprisingly, it receives the lion's share of attention and funding inside today's crime laboratories. Other disciplines are being pressured to emulate DNA's success and become more "objective." However, there is a degree of subjectivity in all their work, and differences in techniques make criminalists wary of comparisons. DNA profiling is only one technique of many needed to turn crime scenes into courtroom evidence.

What is the value of studying criminalists? One goal is to illuminate the inner workings of the American criminal justice system from an unexpected perspective. Seeing how messy crime scenes are transformed into clean scientific reports and courtroom evidence is key to understanding

how ideals of justice are put into practice in the United States. There is also value in revealing how diverse methods of science are conducted in the real world with real consequences. The work itself is fascinating, difficult, and worthy of study: criminalists' translation of their expert knowledge is just as important as the science itself. Ultimately, studying criminalists matters because their struggles reveal the struggles of expert workers in numerous occupations around the world.

Expert work is currently under siege. Commentators warn that workplace applications of digital technologies—algorithms, big data, artificial intelligence—are going to gut the work of professionals,[2] everyone from lawyers to doctors to criminalists. These technologies track and amass data, processing and calculating information at lightning speeds, which reduces the need for the people who traditionally worked with data. Consequently, pundits and scholars suggest, the work of experts will necessarily move away from thinking and processing information, which will radically change their occupations.[3] At the core of their argument is an image of expert work as merely the cognitive processing of a body of knowledge. If expert work is simply pattern-finding and clear-cut decision-making, it can be easily overtaken by the power of algorithmic technologies.[4] With machines doing the work of analyzing data, we can expect a future with fewer jobs for experts, and those jobs that remain will require different, and less complicated, skills.

Yet, in this study of criminalists, I show how this conception critically misconstrues the work of experts. In fact, expert work does not just entail the mastery of a large, complex body of knowledge. Instead, expert work relies on *interpreting* and *translating* knowledge. Experts sit at interfaces where they must communicate knowledge to others who need it but may be unable to easily understand it. Cultivating the skills of interpretation and translation are all the more critical in our digital age. The ability to holistically understand data and what it can and cannot tell us is a vital human trait in the world of big data.

Professionals and experts develop their craft through hands-on learning within a community of like-minded others. Problems in the real world rarely present themselves in neat packages that fit either the formal knowledge found in a textbook or the information processed

through machine learning. However, through extended apprenticeships, experts are able to contextualize and enrich their knowledge with daily practice under the guidance of seasoned colleagues.[5] Expertise goes beyond formal knowledge to skills that are both tacit and embodied; expert work is a form of visceral knowing. Across a spectrum of fields, expert workers hone their skills through this process of learning by doing.[6] And they figure out how to apply what they know to the specific problems at hand.[7] Their interpretation of the problems they face is central to their expertise.

Moreover, expertise is often useless in isolation; it is through translation that expert workers create value. In this process, experts translate their knowledge of the material world into more mobile forms, usually by inscribing it into documents, images, or other representations that can be used for communicating.[8] Experts are regularly called on to apply their knowledge beyond their own domains, sharing what they know with outside communities. Engineers need construction crews or production workers to execute their plans, and doctors must explain their diagnoses to patients. To make an impact, experts must convince others of the legitimacy of their knowledge, generate support for their ideas, and maintain their power in ways that that draw on shared language, materials, and conventions. Engineers bolster their expertise with drawings and prototypes, using these to convince others to support their designs.[9] Similarly, doctors interpret the language of medical records in collaboration with patients to help them understand their conditions.[10] In these settings, and others like them, the fundamental burden on experts is to translate their particular esoteric knowledge in a manner that persuades nonexpert audiences.

These acts of translation also depend on the broader context of social relations. Experts are embedded in a set of relationships with interested parties who have perspectives about what knowledge is relevant and whose expertise is valuable.[11] These structures matter in how expertise is taken up, used, and assessed. When politicians and journalists talk about climate science, this affects the influence that climatologists have in convincing the public to accept the evidence of climate change. Public opinion then affects the future institutional funding for climate research

as well as the ability to garner further evidence.[12] Such chains of influence also impact the everyday practices of scientific experts, who have to decide how and when they should talk to journalists or participate in government-sponsored activities.[13]

This conception of expert work is the foundation for my study of criminalists. Expertise is an interpretive skill developed through daily practical experience in a particular community, which needs to be translated to a set of people who do not share those experiences. Criminalists are expert science workers who are called on regularly to translate their findings for outside audiences. Unlike climate scientists, who can choose whether and how to participate in public science, criminalists do not have the autonomy to walk away from their audiences. They have to work in a state of anticipation and translation; their work is organized solely to produce findings for the criminal justice system.

Criminalists are a model case of what happens to expert workers like teachers, doctors, or engineers who have "good jobs," but are required to work within systems beyond their control. Perhaps securing expertise once promised some level of autonomy; this was particularly true for professionals, who often worked in partnerships managed through the collegial interactions of a set of peers. Today, being an expert worker often means that you report to nonexperts, or must justify your existence to those who do not know your field. Working with and depending on those outside of their occupational boundaries influences experts' work practices. Watching criminalists adapt to new technologies, invent new ways to communicate their science, and struggle to show how their subjective yet informed judgments are better than allegedly objective machines or automated algorithms is valuable; it offers lessons for other expert workers.

It is also important to understand the real way science is practiced, and the messy ways that knowledge is produced. Many want to believe that the work of criminalists is flawless, and that science itself is flawless. For example: *The bullet is a match. It is his DNA*. But looking at the real work criminalists do shows that even the most prized science—including DNA analysis—is interpretive, using tacit and subjective judgments to draw conclusions in context.

Unlike crime shows or courtroom pronouncements, the evidence rarely speaks for itself. Criminalists need to translate the realities of the science to outside audiences. Thus, instead of stating hard-and-fast truths, what criminalists say instead is more like the following: *These specific markings, at these particular locations, on this bullet found at the crime scene, match the markings on a bullet fired from the gun belonging to the suspect. The probability of selecting the observed DNA profile from a population of random unrelated individuals is expected to be 1 in 325,000 based on the alleles present in this sample.*

With this book, my hope is that by describing in detail the world of forensic science, you can see what is important (and representative) about the work of criminalists. In showing how vital interpretation is to the expertise and the judgments criminalists make about evidence, I make an argument for the value of communities of expertise, negotiated interpretations, and translation skills writ large. Examining how criminalists are situated within the worlds of criminal justice and the public, and the different expectations produced within these worlds, illustrates the challenges of working in a culture of anticipation. Criminalists are not simply free to do science; they cannot ignore the translation work that navigating worlds requires. In exploring the ways criminalists interact with these worlds—writing reports, talking to attorneys, testifying in court—I demonstrate what translating looks like for a set of experts, whose occupation is captive to another, and who have a commitment to serving the criminal justice community.

And, now, into the crime lab.

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