

CERTIFIED FOR PARTIAL PUBLICATION*

IN THE COURT OF APPEAL OF THE STATE OF CALIFORNIA
THIRD APPELLATE DISTRICT
(San Joaquin)

THE PEOPLE,

Plaintiff and Respondent,

v.

ALVIN LARRY DAVIS,

Defendant and Appellant.

C089567

(Super. Ct. No. STK-CR-FE-
2016-0004780)

APPEAL from a judgment of the Superior Court of San Joaquin County, George J. Abdallah, Jr., Judge. Affirmed.

Byron Charles Lichstein, under appointment by the Court of Appeal, for Defendant and Appellant.

Rob Bonta, Attorney General, Lance E. Winters, Chief Assistant Attorney General, Michael P. Farrell, Assistant Attorney General, Carlos A. Martinez, Enid A. Camps and Kelly E. LeBel, Deputy Attorneys General, for Plaintiff and Respondent.

* Pursuant to California Rules of Court, rules 8.1105 and 8.1110, this opinion is certified for publication with the exception of Parts II and III.

This case arises out of the violent sexual assault and killing of an 84-year-old woman inside her home and during a burglary. After the first trial ended in a mistrial because the jury could not reach a unanimous verdict, a second jury found defendant Alvin Larry Davis guilty of first degree murder (Pen. Code, § 187, subd. (a))¹ and forcible sexual penetration with a foreign object, a cane (§ 289, subd. (a)(1)(A)). The jury also found true the enhancement allegations, including that he tied or bound the victim (§ 667.61, subd. (e)(5)), personally inflicted great bodily injury on the victim (*id.*, subd. (d)(6)), sexually penetrated the victim during the commission of a burglary (*id.*, subd. (d)(4)), and knew or reasonably should have known that the victim was 65 years of age or older (§ 667.9, subd. (a)). The jury also found true the special circumstance allegation that the murder occurred while defendant was engaged in the commission of rape by a foreign object (§ 190.2, subd. (a)(17)(k)). In a bifurcated proceeding, the trial court found defendant had two prior convictions that qualified as strikes under the three strikes law. (§§ 667, 1170.12.) The court sentenced him to life in prison without the possibility of parole. This timely appeal followed; the case was fully briefed on June 28, 2021, and assigned to this panel thereafter.

On appeal, defendant contends the judgment must be reversed due to prejudicial evidentiary errors and prosecutorial misconduct during closing argument. His primary contention is that the trial court improperly admitted expert testimony based upon the application of the STRmix™ methodology,² which is a method of deoxyribonucleic acid (DNA) analysis that we describe in detail *post*. Defendant argues that the STRmix evidence should have been excluded under the test for the admission of new scientific evidence established by our Supreme Court in *People v. Kelly* (1976) 17 Cal.3d 24

¹ Undesignated statutory references are to the Penal Code.

² STRmix™ is properly referenced as a trademark and should be understood to be referenced as such throughout this opinion.

(*Kelly*), abrogated by statute on another point as explained in *People v. Wilkinson* (2004) 33 Cal.4th 821, 845-848. He makes additional claims of error and, recognizing that some of the claims may have been forfeited, he alternatively argues that his trial counsel rendered ineffective assistance. Finally, he argues cumulative error.

In the published portion of our opinion, we conclude the trial court did not err in determining that the STRmix method of DNA analysis is generally accepted as reliable by the relevant scientific community, such that expert testimony relying on the method satisfied the first requirement of the *Kelly* test. In the unpublished portion of our opinion, we reject or decline to consider the remaining claims of error and affirm the judgment.

BACKGROUND

The victim, Hazel Dingman, was 84 years old when she was found dead in her home on July 5, 2012. She had been tied up, sexually assaulted, and brutally attacked. Her home was in disarray and items were missing.

The facts underlying defendant's convictions are largely undisputed. The critical issue at trial was identity. The defense theory was that defendant was not the person who murdered Dingman. The People relied on a variety of evidence connecting defendant to the murder, including STRmix evidence, which linked defendant to a bloody shoelace found next to Dingman's body. We next summarize the pertinent facts surrounding the murder and subsequent investigation; we add more information as necessary later in the Discussion.

The Property and Relevant Events Prior to The Murder

Dingman lived on an approximately five-acre property on Downing Avenue in Stockton (the property). The property had multiple structures on it, including a house, a four-car garage with an attached shed, and an auto body shop. The property was just west of Interstate 5 and abutted a slough, which bordered the entire western portion of the property. The house was located in the southwestern portion of the property, near the slough. At the time of the murder, homeless people lived in an encampment underneath a

bridge on Downing Avenue, which bordered the northern portion of the property. The homeless encampment was located near the slough, close to the northwestern portion of the property.

The property had a long driveway that generally ran north to south. At the time of the murder, there were three gates (that locked) along the driveway. The first gate was located at the north end of the property near Downing Avenue. The second gate was approximately 40 feet south of the first gate. The house was farther down the driveway past a third gate.

In July 2012, Dingman was living alone on the property. Her 91-year-old brother, Bernard Froeliger, had moved out several months earlier due to health problems. He used a cane while he was living at the property. Froeliger's stepson, Edward Taylor Wingate (also known as Taylor), worked on the property almost every day, repairing cars in the auto body shop. Wingate frequently invited friends to the property to fish and hang out. He and a few of his friends were using methamphetamine at the property around the time of the murder.

Between 2005 and 2011, defendant and others sold various goods from an area of the property near Downing Avenue. Between March and mid-May 2012, Wingate and his friend Ericson Sanguir worked on defendant's Cadillac Escalade at the property. At trial, Sanguir acknowledged that he had been inside Dingman's house before and had smoked cigarettes in the four-car garage.

Defendant stopped by the property around 10-12 times while his Escalade was being worked on, but he never went inside Dingman's house or fished with Wingate. There were various items inside the Escalade, including a hat, socks, and other clothing. After the work on the Escalade was completed, defendant called Wingate and complained that he was still having problems with it and threatened to "mess [Wingate] up." Wingate did not see or speak to defendant after this conversation, which occurred prior to Dingman's death.

Less than two months before the murder (i.e., around May 2012), an outer gate was installed to prevent people from using the property to sell goods. Defendant told Wingate that the gate “pissed off a lot of people,” and that “something might be done about that.” Defendant was approximately 72 years old at the time of the murder and his hair and beard were partially gray. He was known to ride a bicycle, and once rode to the property while Wingate was working on his car.

The Murder

In the late afternoon of July 5, 2012, Dingman was found dead inside her home. Dingman was five feet one inch tall and weighed 128 pounds. She was last seen by her son around 12:15 p.m.; he had put a small amount of cash in her gold purse before he left the property.

At approximately 2:15 p.m., a woman driving on Downing Avenue saw a “tiny” elderly woman standing near an open gate on the property. But Dingman was not in her yard when the mail was delivered between 2:30 and 2:45 p.m., which was unusual.

When Dingman’s daughter arrived at the property around 4:00 p.m., all three gates were closed but only the second gate was locked. She parked near the third gate and walked to the house, which was locked. She called out to Dingman from the front porch but received no response. She heard noise coming from the back of the house that sounded like someone was walking on leaves and twigs. She went to her car and retrieved her keys. On her way back to the house, she heard the same noise coming from the back of the house. When the noise stopped, she used her key to enter through the front door.

The house was in disarray and items were missing. Dingman’s body was on the floor in the living room near the front door. Her head was covered by a pillowcase and her arms were bound behind her back with pantyhose. She was nude from the waist down and had welts on the back of her legs. A torn and knotted bra was near her leg. There was a shoelace by her head that had blood stains on it. The shoelace consisted of

two pieces that were tied together in the middle. It was near a white (unlaced) shoe that belonged to Dingman. A cane and broken pieces of electrical cord were on the floor beside her body. There was a blue and white Food 4 Less grocery bag in the entryway of the house, which contained Dingman's gold purse, a DVD player, and a variety of other items, including multiple pieces of jewelry. It also contained an empty orange soda can. When the daughter heard a noise toward the back of the house, she ran out front and called 911. It was 4:19 p.m.

The Investigation

Police officers arrived at the scene at 4:24 p.m. They searched the property but did not find an intruder. Inside the house, the bathroom window was open and the screen was on the floor. There was dirt on the floor below the window and a second screen was on the ground outside the house. This was unusual because Dingman never opened her windows. A closed window near the open bathroom window had what appeared to be a handprint on the glass.

Paramedics arrived shortly after the officers. Dingman was lying face down, not breathing, and had lividity in several parts of her body. There was dried blood near her head and she had rigor mortis in the joints of one of her legs. She was pronounced dead at 4:37 p.m.

Around the same time as they heard police sirens, two homeless men living underneath the bridge on Downing Avenue saw a shirtless African-American male with gray/white hair and a gray/white and black beard, later identified as defendant, coming toward them from the direction of Dingman's house along the water. Defendant was pushing and/or carrying a bicycle and nothing else. He was in a hurry and appeared to be scared, nervous, and shocked; he looked "front and back" as he walked under the bridge and up the hill past the encampment. Once defendant reached the top of the bridge, he rode his bike northeast on Downing Avenue and turned left onto Manthey Road, which ran parallel to Interstate 5.

At trial, the two homeless men identified defendant as the person they saw on the day of the murder. However, neither man identified defendant prior to trial when they were shown a photographic array containing defendant's picture; one of them identified a different man. Both men estimated that defendant was at least 50 years old, and one said defendant came within about 30 feet of him.

At approximately 4:20 p.m., a woman found a green cloth bag in a dirt lot on the north side of Downing Avenue across the street from the property. It contained various items, including coins, a money bag from the Bank of Stockton, and a white wallet. The money bag was similar to other money bags found on Dingman's desk, and the fabric of the white wallet matched the fabric of a white purse found in Dingman's bedroom. A gray sock was near the green bag. The woman brought these items across the street and gave them to one of the responding officers.

At approximately 6:00 p.m., a police canine named Hailey and her handler, Community Service Officer (CSO) Pauline Keener, arrived at the location where the green bag was found for the purpose of human scent trailing. Keener placed a sterile gauze pad inside the green bag for several minutes to allow it to pick up the scent. She then placed the gauze pad inside an empty Ziploc bag. After Hailey sniffed inside the Ziploc bag,³ she led Keener across the street to the property, passing underneath the bridge on Downing Avenue where the two homeless men lived in the encampment. While Hailey was under the bridge, she briefly circled one of the "dwelling[s]," which was about 25 feet from the water. She then followed a path on the property along the water to a beach area near a few chairs, did a quick half circle, and then headed toward the house. Hailey led Keener on a pathway past the back of the house to an area between a carport and some "very overgrown" trees and large bushes. Hailey started moving back

³ Keener explained that Hailey follows the strongest scent from the scent pad. A video was played showing Hailey's path.

and forth, whining and expressing frustration, like she was “trying to get to something that she couldn’t get to.” At that point, Keener saw a dark object in the bushes and notified one of the officers. A search of the area revealed a mask from the movie *Scream*.

During a search of the property, officers found a fedora hat on the ground near the shed attached to the four-car garage and cigarette butts and a black sock inside that shed. The sock and cigarette butts were not in the shed when Wingate had opened it two days earlier. Wingate told a detective that he saw the fedora hat in the front seat of defendant’s Escalade, and that defendant had worn the hat while his Escalade was being worked on.

The Autopsy

An autopsy revealed that Dingman had died from asphyxia caused by combined trauma to the face, neck, and back. Her brain had been deprived of oxygen due to forcible pressure applied to her back. She had significant bruising on her face, head, neck, back, and legs. There was also bruising on her shoulders, forearms, wrists, and upper abdomen. Several of her teeth had been knocked out. She had a laceration on her upper lip and hemorrhages in her eyes. There were bruises and “lash marks” on her lower back and buttocks, which were consistent with being struck by a cord. A circular abrasion approximately three quarters of an inch in diameter and blood deep inside Dingman’s vagina indicated that she had been penetrated with the cane prior to her death. She had multiple injuries that were consistent with defensive wounds.

DNA Evidence

DNA testing is a powerful tool for solving crime. It has an unparalleled ability to identify the guilty and exonerate the innocent. (*District Attorney’s Office for Third Judicial Dist. v. Osborne* (2009) 557 U.S. 52, 55, 62.) The basic science behind DNA testing has long been accepted in court; however, DNA testing is continually being improved, becoming more refined and sophisticated. (*People v. Cordova* (2015)

62 Cal.4th 104, 128 (*Cordova*.) Given the scope of defendant’s arguments on appeal, we need not discuss DNA testing and analysis in great detail. However, a brief overview of the underlying science is necessary to provide context for the issues raised on appeal.

DNA is the genetic material found in the nucleus of human cells. (*People v. Venegas* (1998) 18 Cal.4th 47, 58.) It is often referred to as the blueprint of life because it determines who one is and how one is going to develop. Over 99 percent of all human DNA is the same; DNA testing looks at the one percent that differs between individuals who are not identical twins. (*People v. Jackson* (2008) 163 Cal.App.4th 313, 322.) Forensic DNA analysis is the process by which characteristics of a suspect’s genetic structure are identified and compared with evidence samples taken from a crime scene to determine if there is a match. (*Venegas*, at pp. 57-58; see also *People v. Nelson* (2008) 43 Cal.4th 1242, 1257-1258 (*Nelson*.)

Our Supreme Court has summarized the comparison process of DNA analysis as follows: “ ‘With the exception of red blood cells, every cell in the human body has a nucleus containing the person’s genetic code in the form of DNA. . . . DNA consists of two parallel spiral sides, a double helix, composed of repeated sequences of phosphate and sugar. The sides are connected by a series of rungs, with each rung consisting of a pair of chemical components called bases. . . . There are four types of bases—adenine (A), cytosine (C), guanine (G), and thymine (T). A will pair only with T, and C will pair only with G. . . . There are over three billion base pairs in a person’s DNA. . . . [¶] Except for identical twins, no two persons have identical DNA. . . . This makes DNA valuable for forensic purposes. However, there is no practical way of sequencing all three billion base pairs. . . . Accordingly, forensic scientists test particular regions called loci that are known to be polymorphic, i.e., variable from person to person. . . . Scientists have identified loci where a particular pattern of base pairs is repeated successively for numbers of times that vary from person to person. . . . These repetitions are referred to as alleles. . . . These alleles can be measured and compared to determine whether a suspect

sample matches an evidentiary biological sample at each of the loci tested. . . .’ ”
(*Nelson, supra*, 43 Cal.4th at p. 1258.)

“ ‘The individual genetic makeup described by the alleles is known as the genotype. In forensic analysis, the genotype for a group of analyzed loci is called the DNA profile. When a sample of DNA is typed, the lab examiner looks at predetermined polymorphic loci, identifies the alleles that make up the DNA sequence at those polymorphic loci, and then determines how likely it is for this sequence to appear in a given population.’ ” (*People v. Smith* (2003) 107 Cal.App.4th 646, 654 (*Smith*).)

“ ‘[Polymerase chain reaction (PCR) testing] is used to amplify targeted loci of the sample of DNA by replicating the process by which DNA duplicates itself naturally. Thus, the lab is able to produce a substantial number of specific, targeted segments of DNA which can then be typed and compared. Short Tandem Repeats, or STRs, are a group of loci which are used to type and compare the DNA. Finally, statistics are used to evaluate how likely it is that a similar match would occur if the DNA sample were drawn randomly from the population.’ ” (*Ibid.*; see *People v. Lazarus* (2015) 238 Cal.App.4th 734, 778-779 (*Lazarus*) [describing PCR-STR method of DNA analysis].) “ ‘Experts calculate the odds or percentages—usually stated as one in some number—that a random person from the relevant population would have a similar match.’ ” (*Nelson, supra*, 43 Cal.4th at pp. 1258-1259.) When the defendant’s DNA matches the DNA of the evidentiary sample and the odds of a random match in the relevant population are astronomical, an expert may opine that the samples came from the same person. (*Cordova, supra*, 62 Cal.4th at pp. 130-131 [noting that it is now possible to determine with near certainty that an evidence sample and the defendant’s sample came from the same person].)

Pin Kyo, a senior criminalist from the California Department of Justice (DOJ), performed DNA testing on various items in defendant’s case, including the fedora, soda can, Scream mask, black sock, cane, pillowcase, bra, pantyhose, shoelace, Food 4 Less

Grocery bag, cigarette butts, green bag, and gray sock. Kyo swabbed each of these items and created DNA profiles utilizing the PCR-STR method of DNA analysis. Defendant does not challenge the PCR-STR method of DNA analysis that Kyo used to create the DNA profiles, which has gained general acceptance in the scientific community for the analysis of forensic evidence samples, including samples containing DNA from multiple contributors. (See *People v. Stevey* (2012) 209 Cal.App.4th 1400, 1411-1412; *Smith, supra*, 107 Cal.App.4th at pp. 665, 671-672; Chin et al., Forensic DNA Evidence: Science and the Law (The Rutter Group June 2021 update) § 11:7.) Nor does defendant challenge Kyo's use of capillary electrophoresis instrumentation in conjunction with the PCR-STR testing, which has also gained general acceptance in the scientific community. (See *Smith*, 107 Cal.App.4th at pp. 671-672; *People v. Henderson* (2003) 107 Cal.App.4th 769, 781-785.)

Kyo then compared these DNA profiles to the DNA profiles she created from the reference DNA samples provided by 11 individuals, including defendant, Dingman, her son and daughter, Froeliger, Wingate, Sanguir, and the two homeless men living under the bridge on Downing Avenue. Given the exceedingly small random match probability (i.e., the astronomical odds against any other person on earth having the same DNA profile), Kyo determined that Dingman's DNA was on the cane, bra, pillowcase, gray sock, pantyhose, and Food 4 Less grocery bag. Except for the pantyhose and grocery bag, Dingman's blood was on each of these items. Froeliger's DNA was also on the cane. The cane contained DNA from one other person and the Food 4 Less bag and gray sock contained DNA from two or more other persons, but those DNA profiles could not be interpreted. Defendant could not be excluded as a contributor to the male DNA on the bra. There was some, but not strong, evidence that his DNA was on the bra. The probability of a random match of an unrelated individual in the population was 1 in 13,000. All of the other individuals who provided a reference DNA sample were excluded as contributors to the DNA on the bra and pantyhose.

Kyo also determined that defendant's DNA was on the orange soda can, fedora hat, Scream mask, and black sock. All of the other individuals who provided a reference DNA sample were excluded as contributors to the DNA on these items. Defendant was excluded as a contributor to the DNA on the pantyhose, the green bag, and the cigarette butts. The DNA on the cigarette butts matched Sanguir's DNA profile.

Finally, Kyo determined that there were three contributors to the DNA on the bloody shoelace found next to Dingman's body, at least one of whom was a male. However, because the DNA mixture was too complex for her to interpret, Kyo sent the shoelace to another DOJ laboratory for application of the STRmix methodology, which is a method of DNA analysis that involves the use of probabilistic genotyping computer software to aid in the interpretation and evaluation of forensic evidentiary samples that contain a mixture of DNA from multiple contributors. Probabilistic genotyping is defined as: "[T]he use of biological modeling, statistical theory, computer algorithms, and probability distributions to calculate likelihood ratios . . . and/or infer genotypes for the DNA typing results of forensic samples" Scientific Working Group on DNA Analysis Methods (SWGDM), *Guidelines for the Validation of Probabilistic Genotyping Systems* (2015) at p. 2

<https://www.swgdam.org/_files/ugd/4344b0_22776006b67c4a32a5ffc04fe3b56515.pdf> [as of Feb. __, 2022], archived at: <<https://perma.cc/7EJS-ERKH>>.)⁴ A probabilistic genotyping system is comprised of software, or software and hardware, with analytical and statistical functions that entail complex formulae and algorithms that assist in the qualitative interpretation of a DNA mixture. (Chin et al., *Forensic DNA Evidence*:

⁴ SWGDAM is a group of approximately 50 scientists representing federal, state, and local forensic laboratories in the United States and Canada. It is sponsored by the Federal Bureau of Investigation (FBI) and develops guidelines for DNA analysis, including guidelines for the use of probabilistic genotyping software to interpret mixed-source DNA samples.

Science and the Law, *supra*, § 11:7.) The system uses the power of computing to exclude or include contributors to a DNA mixture. If a contributor is included, the software is used to calculate likelihood ratios that compare propositions including the contributor in question to mutually exclusive propositions that do not include the contributor in question. The resulting likelihood ratios can provide a measure of support for one proposition over the other. (See *ibid.* [probabilistic genotyping software programs (1) generate statistical models of observed allele combinations, and (2) express the results in likelihood ratios that compare competing propositions or theories in a case]; *id.*, § 5.5 [a likelihood ratio is a statistic measuring the probability that a certain individual or individuals contributed to a mixed-source DNA sample against the probability that other, unrelated individuals were the contributors].) The likelihood ratios are “generally ‘expressed as follows: a match between the suspect and the evidence is (x number) of times more probable than a coincidental match.’ ” (*People v. Superior Court (Dominguez)* (2018) 28 Cal.App.5th 223, 228.) “Probabilistic genotyping has been described as ‘ “[p]articularly useful for low-level DNA samples . . . and complex mixtures” ’ since it ‘ “can reduce subjectivity in the analysis of DNA typing results.” ’ ” (*Ibid.*, quoting Chin et al., *Forensic DNA Evidence: Science and the Law, supra*, § 11:7.)

Eric Halsing, a senior criminalist with the California DOJ, analyzed the DNA mixture on the shoelace using the STRmix method. Prior to explaining the results of his analysis, he described the STRmix method of DNA analysis. First, the criminalist evaluates the STR DNA-typing results and determines how many contributors are present in a DNA mixture. This number is then entered into the software program, which “deconvolutes” or interprets the mixture by using mathematical principles to come up with sets of genotypes or DNA profiles for the individuals that could possibly have contributed to the mixture. After the deconvolution process is completed (i.e., the mixture has been interpreted), the next step involves the calculation of likelihood ratios. The software program randomly picks values for a number of different variables, using

widely accepted mathematical principles to either accept or reject proposed DNA profiles based on those random values. This step is repeated up to billions of times. The DNA profiles are then ranked as to how well they fit the actual mixture. The software program assigns a statistical match probability to the sets of DNA profiles. The significance of the match is expressed in a likelihood ratio, which compares two conditional probabilities. Essentially, the likelihood ratio answers the question: Under which set of conditions is this DNA mixture better explained? At trial, Halsing emphasized that the STRmix method does *not* answer the question: How likely is it that a certain person is a contributor to the DNA mixture? Rather, the likelihood ratio is a numerical expression that explains that a DNA mixture is “x” number of times more probable or better explained as a combination of DNA from a certain group of people than as a combination of DNA from another group of people.

Utilizing the data (i.e., the STR DNA-typing results) he received from Kyo, Halsing concluded that there were three contributors to the DNA mixture on the shoelace, that defendant, Dingman, and Froeliger could not be excluded as contributors to the mixture, and that all of the other individuals who provided a reference DNA sample were excluded as contributors to the mixture. Halsing further concluded that application of the STRmix method provided strong support for the proposition that Dingman, Froeliger, and defendant were contributors to the DNA mixture. He determined that the DNA mixture on the shoelace was 1.8 quintillion to 360 quintillion times better explained as a combination of DNA from defendant, Dingman, and Froeliger than as a combination of DNA from Dingman, Froeliger and one random, unrelated individual in the population. A quintillion is rendered as a one followed by 18 zeros.

Cell Phone Evidence

Defendant’s cell phone connected to the cell tower closest to the property at 11:35 a.m. on the day of the murder. At 8:31 p.m., his phone connected to a tower near his apartment, which was more than two-and-a-half miles away from the property. There

was a break in call activity (no cell site connections) on the phone between 11:37 a.m. and 6:06 p.m. and no incoming or outgoing texts during this time period.

DISCUSSION

I

STRmix Evidence

Defendant contends the trial court prejudicially erred in admitting expert testimony that relied upon the STRmix method to interpret and evaluate the DNA mixture on the bloody shoelace found next to Dingman's body. He argues that the STRmix evidence should have been excluded under the test for the admission of new scientific evidence established in *Kelly, supra*, 17 Cal.3d 24, and that the prosecution failed to carry its burden to demonstrate that this new scientific technique had gained general acceptance in the relevant scientific community. Defendant adds that the admission of the STRmix evidence violated his due process rights under the state and federal constitutions, and contends that the evidence should have been excluded under Evidence Code section 352. We reject these contentions.

A. Applicable Legal Principles

In *Kelly*, our Supreme Court created a three part test that governs the admissibility of expert testimony based on a new or novel scientific method or technique. (*People v. Wash* (1993) 6 Cal.4th 215, 242, citing *Kelly, supra*, 17 Cal.3d at p. 30; see *People v. Soto* (1999) 21 Cal.4th 512, 515, fn. 3 [because *Frye v. United States* (D.C. Cir. 1923) 293 F. 1013 has been supplanted in federal jurisprudence, the foundational requirement formerly referred to as the *Kelly/Frye* test is now simply referred to as the *Kelly* test].)

Under the *Kelly* test, expert testimony that relies on a new scientific technique is inadmissible unless the proponent of the evidence satisfies three criteria, also referred to as three prongs: “ ‘(1) the reliability of the new technique has gained general acceptance in the relevant scientific community, (2) the expert testifying to that effect is qualified to give an opinion on the subject, and (3) the correct scientific procedures were used.’ ”

(*People v. Jones* (2013) 57 Cal.4th 899, 936.) The proponent of the evidence must show by a preponderance of the evidence that *Kelly's* standards are satisfied. (Chin et al., *Forensic DNA Evidence: Science and the Law, supra*, § 11:2.) Only the first criterion (or first prong) of this test is at play here.

The “narrow ‘common sense’ purpose” behind the *Kelly* test is “to protect the jury from techniques” that “convey a ‘misleading aura of certainty.’ ” (*People v. Stoll* (1989) 49 Cal.3d 1136, 1155-1156.) Under *Kelly*, the jury must be protected from such techniques until “the pertinent scientific community no longer views them as experimental or of dubious validity,” particularly where “the unproven technique or procedure appears in both name and description to provide some definitive truth which the expert need only accurately recognize and relay to the jury. The most obvious examples are machines or procedures which analyze physical data. Lay minds might easily, but erroneously, assume that such procedures are objective and infallible.” (*Id.* at p. 1156; see *People v. Cowan* (2010) 50 Cal.4th 401, 470 [the *Kelly* test “ ‘is intended to prevent lay jurors from being unduly influenced by procedures which seem scientific and infallible, but . . . are not’ ”].)

The *Kelly* test applies only to expert testimony “ ‘based, in whole or in part, on a technique, process, or theory which is *new* to science and, even more so, to the law.’ ” (*People v. Cowan, supra*, 50 Cal.4th at p. 470.) “To be new, a technique must be meaningfully distinct from existing techniques.” (*People v. Jackson* (2016) 1 Cal.5th 269, 316 (*Jackson*); see *People v. Nolan* (2002) 95 Cal.App.4th 1210, 1215 [*Kelly* test “applies to new methodologies,” not to “new devices [that] implement established scientific methods”].) A scientific technique that does not meet this standard is not subject to the *Kelly* test. (See, e.g., *Cordova, supra*, 62 Cal.4th at pp. 128-130 [*Kelly* test inapplicable because DNA testing kit used the same methodology as earlier kits].) Thus, a trial court must make an initial determination of whether a *Kelly* hearing is required. (*People v. Peterson* (2020) 10 Cal.5th 409, 444 (*Peterson*).) In determining whether a

new method of analyzing DNA is a new scientific technique subject to a *Kelly* hearing, “the threshold issue is ‘whether the improvement or refinement in DNA methodology qualifies as another breakthrough innovation within the meaning of *Kelly*, or whether the change represents a mere evolution of a generally accepted scientific technique.’ ” (*Lazarus, supra*, 238 Cal.App.4th at p. 783.)

“Establishing reliability is the overriding factor when a party seeks to admit evidence based on a new scientific technique.” (*People v. Fortin* (2017) 12 Cal.App.5th 524, 531.) “Under the *Kelly* test, the admissibility of evidence obtained by use of a scientific technique does not depend upon proof to the satisfaction of a court that the technique is scientifically reliable or valid. [Citation.] Because courts are ill suited to make such determinations, admissibility depends upon whether the technique is generally accepted as reliable in the relevant scientific community.” (*People v. Bolden* (2002) 29 Cal.4th 515, 546; *People v. Azcona* (2020) 58 Cal.App.5th 504, 511.) General acceptance means “a consensus drawn from a typical cross-section of the relevant, qualified scientific community.” (*People v. Leahy* (1994) 8 Cal.4th 587, 612 (*Leahy*)). Unanimous acceptance is not required; “ [r]ather, the test is met if use of the technique is supported by a clear majority of the members of that community.’ ” (*Ibid.*) “*Kelly* calls for the proponent of scientific evidence to provide evidence more akin to a survey of scientists and laboratories than a ‘nuts and bolts’ showing of how and why the technique works.” (Chin et al., *Forensic DNA Evidence: Science and the Law, supra*, § 11:1, citing *People v. Shirley* (1982) 31 Cal.3d 18, 55 (*Shirley*) [under *Kelly*, we are not required to decide whether a methodology is reliable as a matter of “ ‘scientific fact,’ ” but simply whether it is generally accepted as reliable by the relevant scientific community].)

In evaluating general acceptance, a trial court “must consider the quality, as well as quantity, of the evidence supporting or opposing a new scientific technique. Mere numerical majority support or opposition by persons minimally qualified to state an authoritative opinion is of little value” (*Leahy, supra*, 8 Cal.4th at p. 612.) The

court “ ‘determines from the professional literature and expert testimony whether or not the new scientific technique is accepted as reliable in the relevant scientific community and whether “ ‘scientists significant either in number or expertise publicly oppose [a technique] as unreliable.’ ” ’ ” (*People v. Soto*, *supra*, 21 Cal.4th at p. 519.) The court may also consider published California decisions and decisions from other jurisdictions. (*Lazarus*, *supra*, 238 Cal.App.4th at p. 783.) “ ‘[O]nce a trial court has admitted evidence based upon a new scientific technique, and that decision is affirmed on appeal by a published appellate decision, the precedent so established may control subsequent trials, at least until new evidence is presented reflecting a change in the attitude of the scientific community.’ [Citation.] In other words, ‘case-by-case adjudication as to the “general acceptance” prong of the *Kelly* test is not required once the scientific technique in question has been endorsed in a published appellate opinion.’ ” (*Ibid.*)

Whether a technique qualifies as a new scientific technique subject to the *Kelly* test is a question we review de novo. (*Jackson*, *supra*, 1 Cal.5th at p. 316.) “Whether a new scientific technique has gained general acceptance is a mixed question of law and fact. [Citation.] ‘[W]e review the trial court’s determination with deference to any and all supportable findings of “historical” fact or credibility, and then decide as a matter of law, based on those assumptions, whether there has been general acceptance.’ ” (*People v. Doolin* (2009) 45 Cal.4th 390, 447.) In conducting our review, we rely primarily on the trial court record, but may also consider published legal decisions and scientific literature not considered by that court when it made its determination. (*People v. Barney* (1992) 8 Cal.App.4th 798, 810 (*Barney*); *Lazarus*, *supra*, 238 Cal.App.4th at p. 783.)

B. *Additional Background*

Defendant filed a pretrial motion seeking to exclude expert testimony that relied on the STRmix method to interpret and evaluate the DNA mixture on the bloody shoelace found next to Dingman’s body. As relevant here, he argued that exclusion of such

evidence was warranted absent a *Kelly* hearing in which the prosecution proved the new method of DNA analysis was generally accepted as reliable by the relevant scientific community. The People opposed the motion, arguing that the STRmix method was not a new scientific technique subject to the *Kelly* test but rather a more precise, reliable, and efficient method to interpret and evaluate mixed-source DNA samples using well-accepted and long-established mathematical principles. The People further argued that, even assuming the STRmix method was a new scientific technique within the meaning of *Kelly*, a *Kelly* hearing was not required because the People had proffered information--legal opinions, scientific literature,⁵ and the SWGDAM guidelines for the validation of probabilistic genotyping systems--showing that the STRmix method of DNA analysis is generally accepted as reliable by the relevant scientific community.

After hearing argument, the trial court ordered a hearing, under the first prong of *Kelly*, to determine whether the STRmix method is generally accepted as reliable by the relevant scientific community. In doing so, the court did not explicitly decide the threshold question of whether STRmix is a new or novel scientific technique for purposes of *Kelly*.

The People called two witnesses at the two-day December 2017 *Kelly* hearing, John Buckleton, Ph.D., and Halsing. Dr. Buckleton, a forensic scientist employed by the New Zealand government and one of the creators of STRmix, testified as an expert on DNA analysis and the STRmix method of DNA analysis. His expertise in DNA analysis, including the STRmix method of DNA analysis, was not in question in the trial court and

⁵ In connection with the *Kelly* hearing, the People submitted two peer-reviewed articles published in scientific journals: (1) Budowle, et. al., *Mixture Interpretation: Defining the Relevant Features for Guidelines for the Assessment of Mixed DNA Profiles*, Journal of Forensic Sciences (2009); and (2) Bieber, et al., *Evaluation of forensic DNA mixture evidence: protocol for evaluation, interpretation, and statistical calculations using the combined probability of inclusion*, BMC Genetics (2016).

is not at issue on appeal. As relevant here, he explained that STRmix is a probabilistic genotyping software program that uses established and generally accepted scientific and mathematical principles to assist in the interpretation and evaluation of forensic DNA samples, including determining the probability of a DNA match when a DNA sample contains a mixture of DNA from multiple contributors. It was created in 2011, first used in casework in 2012, and was currently being used by 44 forensic laboratories worldwide, including 30 forensic laboratories in the United States. Probabilistic genotyping has been utilized by the scientific community since 1999 and has been endorsed by the International Society of Forensic Geneticists.

Dr. Buckleton described the two-step process involved in the STRmix method of DNA analysis: deconvolution and statistical analysis. He explained that after the standard or traditional STR DNA testing process is completed, the STR DNA-typing results are entered into the software program, which “deconvolutes,” or breaks down, a mixed-source DNA sample into its component mixtures and generates the genotypes or DNA profiles for the individuals who could possibly have contributed to the mixture. Statistical analysis then determines the likelihood ratios that express the probability that a person of interest contributed to the sample. Dr. Buckleton explained that the STRmix method involves the use of well-established and accepted mathematical principles, including the MCMC (Markov Chain Monte Carlo) algorithm in the deconvolution process and Bayes’ theorem in the statistical process. This method had been developmentally validated in accordance with the SWGDAM guidelines each time a new version of the software program was created. The SWGDAM guidelines describe developmental validation of a probabilistic genotyping software system as “the acquisition of test data to verify the functionality of the system, the accuracy of statistical calculations and other results, the appropriateness of analytical and statistical parameters, and the determination of limitations.” The guidelines note that developmental validation may be conducted by the manufacturer/developer of the system or the testing laboratory.

Dr. Buckleton stated that he was personally involved in the training of the STRmix method at each of the 44 forensic laboratories that were currently using the method for DNA analysis. He was also involved in the implementation and internal validation of the method at some of those laboratories, including about one-third (i.e., around 10) of the laboratories located in the United States. Dr. Buckleton noted that forensic laboratories in the United States are only permitted to use the STRmix method in casework after the validation guidelines published by SWGDAM have been satisfied. The SWGDAM guidelines require, among other things, the manual repetition of a large number of the calculations performed by the software and testing of the software by the use of known donors and nondonors (i.e., true and false donors). Dr. Buckleton estimated that approximately 65 percent of the accredited forensic laboratories in the United States had purchased STRmix and about 70 forensic laboratories were currently in the process of validating the STRmix method for use in casework. He noted that the United States Army began using STRmix in 2014, the FBI had been using it since 2015, and California DOJ began using it in 2016. He explained that the FBI internally validated STRmix for use in casework after empirically testing the method, and that the FBI's validation was published in a scientific journal. He had authored or co-authored 24 peer-reviewed articles published in scientific journals that "endorse[d]" the STRmix method and the mathematical principles it utilizes, some of which specifically involved validation of the method, including an article on the developmental validation of STRmix. He explained that, prior to publication, two anonymous "referees" (i.e., scientists) reviewed the articles to ensure the information was consistent with the standards of the respective journals. Dr. Buckleton opined that the STRmix method of DNA analysis is reliable, explaining that the mathematical principles used by the software have a "robust basis in science" and the method had been subjected to millions of trials (i.e., laboratory tests).

Halsing also testified at the *Kelly* hearing as an expert in the STRmix method of DNA analysis. He explained that he had obtained a Bachelor of Arts in Biology, and

that, with the exception of three months, he had worked for the California DOJ as a criminalist in a forensic laboratory since 2001. In May 2015, he began training on the STRmix method, which included reviewing “a large portion” of the peer-reviewed articles related to the development of the method and the underlying principles of the method (e.g., mathematical principles). The training, which ended in December 2015, involved generating reports from mock case data using the software to interpret and evaluate the data. Halsing stated that the STRmix method was approved by the California DOJ for use in casework after it was internally validated in accordance with the SWGDAM guidelines, which included a “great number of experiments” to test the accuracy of the software. However, only one of the eight California DOJ laboratories was currently using STRmix.

In connection with the *Kelly* hearing, the prosecution submitted a list of the forensic laboratories that were currently using the STRmix method for DNA analysis, which included the San Diego Police and County Sheriff’s Departments, the Sacramento County District Attorney’s Office, and others. Defendant did not present any evidence or witnesses at the *Kelly* hearing. At the conclusion of the hearing, he made a variety of arguments as to why the STRmix evidence should be excluded, including (for the first time) that exclusion was warranted under Evidence Code section 352 because the probative value of the evidence was substantially outweighed by the potential that it would be “absolute pixie dust for the jury,” that is, the jury would misunderstand the evidence as being an identification of defendant as the perpetrator, thereby shifting the burden of proof to the defense to prove he was not guilty of the charged offenses.

The trial court found that the STRmix method of DNA analysis applies proven and long-accepted mathematical formulas, and that the testimony at the *Kelly* hearing tended to show that the method is simply a more sophisticated rather than a new technique of DNA analysis; however, the court again appears to have skipped the threshold determination as to whether the method is a new scientific technique such that it is even

subject to the *Kelly* test. Instead, the trial court concluded that the People had met their burden to show the STRmix method was generally accepted as reliable by the relevant scientific community, and therefore expert testimony based upon application of the method was admissible under the first prong of *Kelly*. In so concluding, the court noted that there was no evidence showing that any laboratory or organization involved in forensic science had determined that the STRmix method was unreliable in any way and should not be accepted in the forensic DNA community. The court rejected defendant's contention that Dr. Buckleton's testimony should not be credited because it may have been motivated by potential financial gain, finding that there was no evidence to support such a conclusion. The court found that Halsing and Dr. Buckleton were not in the same position as the expert witness in *Kelly*, that is, neither of them was biased in that they were so self-interested in the acceptance of the STRmix method that there was a serious question as to their ability to fairly and impartially assess the position of the scientific community on the method, including the nature and extent of any opposing scientific views. (See *Kelly, supra*, 17 Cal.3d at p. 38.) Finally, the court rejected defendant's claim that the STRmix evidence should be excluded as prejudicial. (Evid. Code, § 352.)

The parties later stipulated that certain rulings from the first trial applied to the second trial, including the determination that expert testimony based upon the application of the STRmix method was admissible under the first prong of *Kelly*.

C. *Analysis*

1. *General Acceptance of Reliability*

We need not address the threshold question of whether the STRmix method of DNA analysis is a new scientific technique subject to the *Kelly* test, because even if we assume for the sake of argument that it is, we hold the People met their burden of establishing that the method is generally accepted as reliable by the relevant scientific community. As set forth in more detail *ante*, the record reflects that STRmix has been used for DNA analysis since 2012 and is widely used by forensic laboratories across the

world. At the time of the December 2017 *Kelly* hearing, STRmix was in use by 44 forensic laboratories worldwide, including 30 in the United States. The United States Army began using STRmix in 2014 and it has been used by the FBI since 2015 and the California DOJ since 2016. The scientific and mathematical principles behind STRmix are well-established and widely-accepted in the scientific community, and STRmix has been the subject of numerous peer-reviewed articles published in scientific journals. In addition to those articles already mentioned, we granted the Attorney General's request to take judicial notice of the following peer-reviewed scientific literature: (1) Buckleton, et al., *The Probabilistic Genotyping Software STRmix™: Utility and Evidence for its Validity*, *Journal of Forensic Sciences* (2018); (2) Coble & Bright, *Probabilistic genotyping software: An overview*, *Forensic Science International: Genetics* (2019); and (3) Bright et al., *Internal validation of STRmix™ - A multi laboratory response to PCAST*, *Forensic Science International: Genetics* (2018). (See *Shirley, supra*, 31 Cal.3d at p. 56 [courts may consider published writings by scientists in determining whether a scientific technique has gained general acceptance]; *Barney, supra*, 8 Cal.App.4th at p.810 [appellate court may consider scientific literature outside the record].)

Testimony at the hearing established that the STRmix method has been subjected to extensive empirical testing and found to be accurate and reliable by the FBI and numerous forensic laboratories. And while no published California appellate decision has specifically addressed the admissibility of STRmix evidence under the first prong of *Kelly*, numerous courts across the country have concluded that the STRmix method has gained general acceptance within the relevant scientific community. (See, e.g., *United States v. Gissantaner* (6th Cir. 2021) 990 F.3d 457, 466 (*Gissantaner*) [collecting cases], rehearing en banc denied May 11, 2021.)

We reach the same conclusion here. The record contains ample evidence supporting a finding of general acceptance and no evidence supporting a contrary determination. Defendant has not directed us to any published appellate authority

holding that the STRmix method is *not* generally accepted as a reliable method of DNA analysis by the relevant scientific community. Nor has defendant pointed to any evidence or scientific literature showing that the STRmix method is publicly opposed as unreliable by scientists significant either in number or expertise. We granted defendant's request to take judicial notice of a recent internal draft report issued by the National Institute of Standards and Technology (NIST), a non-regulatory scientific research agency within the United States Department of Commerce. (*Shirley, supra*, 31 Cal.3d at p. 56; *Barney, supra*, 8 Cal.App.4th at p. 810.) The NIST draft report is titled: *DNA Mixture Interpretation: A NIST Scientific Foundation Review (2021)* (NIST Report). As relevant here, it discussed reliability issues in DNA mixture interpretation practices and noted that the degree of reliability (i.e., trustworthiness) of a probabilistic genotyping system such as STRmix can be assessed using empirical data obtained through validation studies, interlaboratory studies, and proficiency tests. (*Id.* at pp. 5, 55, 62.) The NIST draft report concluded that there is currently not enough *publicly available* data to enable an *external and independent assessment* of the degree of reliability of DNA mixture interpretation practices, including the use of probabilistic genotyping software systems. (See *id.* at pp. 6, 75, 82.) In so concluding, the NIST draft report inspected 60 peer-reviewed articles on probabilistic genotyping systems that included some form of validation data and 11 publicly available validation summaries; 27 of the 60 articles involved STRmix while 10 of the 11 validation summaries involved STRmix. (*Id.* at pp. 66-75, 85-86.) However, the NIST draft report noted that forensic laboratories typically do not share the underlying data from internal validation studies and encouraged the laboratories to do so and to regularly participate in interlaboratory studies to allow for an external and independent assessment of the degree of reliability of probabilistic genotyping software systems going forward. (*Id.* at pp. 6, 50, 75, 87.)

After we granted defendant's request to take judicial notice of the NIST draft report, the Attorney General filed a motion for reconsideration of that ruling, requesting

that we strike the NIST draft report on the ground that it is incomplete and irrelevant to the *Kelly* issue presented in this appeal. The Attorney General subsequently filed a motion asking us to take judicial notice of certain public comments to the NIST draft report, which were comments submitted by SWGDAM criticizing the draft report's suggestion that the foundational validity and reliability of probabilistic genotyping software systems can only be assessed based on publicly available information, as well as an article written by the lead author of the NIST draft report, and a peer-reviewed scientific publication concerning the internal validation of STRmix for the interpretation of single source and mixed DNA profiles. The Attorney General requested that, in the event we deny his motion to strike the NIST draft report, we grant his motion for judicial notice. Defendant filed an opposition to the motion for reconsideration and to strike the NIST draft report, and a non-opposition to the motion for judicial notice.

We denied the Attorney General's motion for reconsideration and to strike the NIST draft report but granted his alternative motion for judicial notice.

Having reviewed the NIST draft report and the additional materials submitted by the Attorney General on the topic, we conclude the NIST draft report does not show that the STRmix method has failed to gain general acceptance in the relevant scientific community. Rather, it is largely a thoughtful discussion of the scientific foundation underlying the discipline of DNA mixture interpretation, which seeks to inform future work in the field by documenting and independently assessing the publicly available empirical evidence that supports the reliable use of DNA mixture interpretation methods. (NIST Report, *supra*, pp. 14-15, 48.) The NIST draft report does not offer any opinion as to whether STRmix is a reliable method of DNA mixture interpretation. Receipt and

careful review of this submission does not alter our conclusion that the STRmix method has indeed gained general acceptance within the relevant scientific community.⁶

2. *Impartiality of Experts*

Defendant contends that the prosecution failed to establish general acceptance because it did not present testimony at the *Kelly* hearing from impartial and disinterested expert witnesses. We disagree. A trial court “may receive the testimony of *disinterested and qualified* experts on the issue of the [scientific] technique’s general acceptance in the relevant scientific community.” (*In re Jordan R.* (2012) 205 Cal.App.4th 111, 123.) “A witness qualifying as an expert is *disinterested* if he is not ‘so personally invested in establishing the technique’s acceptance that he might not be objective about disagreements within the relevant scientific community.’ [Citations.] Factors such as being a leading proponent of the scientific technique, having a long association with its development and/or promotion, or having a vested career interest in its acceptance in the scientific community are among those that show a lack of impartiality by the expert.” (*Ibid.*) In *Kelly*, the high court voiced reservations about an expert testifying on the issue of general acceptance who was not a scientist and had “virtually built his career on the reliability of the [technique in question].” (*Kelly, supra*, 17 Cal.3d at pp. 38-39.) The *Kelly* court observed such an expert might not be capable of fairly and impartially assessing the extent of opposing scientific views. (*Id.* at p. 38.) In determining whether an expert is qualified, impartial, and disinterested, “[t]he trial court is given considerable latitude . . . and its ruling will not be disturbed on appeal unless a manifest abuse of

⁶ On December 10, 2021, the Attorney General filed a third motion for judicial notice, to which defendant filed a response and non-opposition on December 22, 2021. We now deny the Attorney General’s third motion for judicial notice as its consideration is not necessary to our resolution of the issues in this appeal. (See *Save Lafayette Trees v. East Bay Regional Park Dist.* (2021) 66 Cal.App.5th 21, 29, fn. 2; *Quantification Settlement Agreement Cases* (2011) 201 Cal.App.4th 758, 795, fn. 22.)

discretion is shown.” (*Id.* at p. 39; *People v. Ashmus* (1991) 54 Cal.3d 932, 971, overruled on another ground in *People v. Yeoman* (2003) 31 Cal.4th 93, 117.)

Here, we cannot conclude that the trial court erred in relying on the expert testimony presented at the *Kelly* hearing in determining that the STRmix method had gained general acceptance. We fail to see how Halsing was so unacceptably biased that the trial court abused its discretion in considering his testimony on the issue of general acceptance. As for Dr. Buckleton, while the record reflects that he has a vested professional interest in the acceptance of the STRmix method,⁷ nothing in the record suggests that he did not fairly and impartially assess the position of the relevant scientific community with regard to the general acceptance of the STRmix method, including the nature and extent of any opposing scientific views. Indeed, the defense did not elicit any testimony on cross-examination or present any evidence (e.g., expert testimony) or scientific literature in connection with the *Kelly* hearing showing that scientists either significant in number or expertise publicly oppose the STRmix method as unreliable for use in DNA analysis. Nor does the record otherwise reflect in any way that Dr. Buckleton was not truthful or accurate in his testimony about the general acceptance of STRmix. The People presented scientific literature, legal decisions, and evidence that supported Dr. Buckleton’s testimony. Under these circumstances, we see no abuse of discretion in the trial court’s decision to consider Dr. Buckleton’s testimony on the issue of general acceptance. Although there was clearly a level of self-interest underlying Dr. Buckleton’s testimony, “ ‘ ‘ [a] certain degree of “interest” must be tolerated if scientists familiar with theory and practice of a new technique are to testify at all.’ ” ’ ” (*Barney, supra*, 8 Cal.App.4th at p. 812 [concluding that self-interest underlying testimony of FBI

⁷ At the *Kelly* hearing, Dr. Buckleton conceded that he had a professional interest in the acceptance of the STRmix method as reliable. However, he noted that he did not have a financial interest in STRmix.

experts went to the weight of the testimony rather than its admissibility where other evidence and scientific literature was presented regarding the acceptance of the DNA analysis technique].)

Defendant asserts, without further elaboration, that the absence of impartial and disinterested witnesses at the *Kelly* hearing is “especially troubling” because there is case law from another jurisdiction demonstrating “significant dissent” from highly qualified scientists in multiple disciplines as to whether the STRmix method is reliable enough to be admitted in court. As a preliminary matter, we note that the federal district court case relied on by defendant was recently reversed. (See *Gissantaner*, *supra*, 990 F.3d at pp. 463-467 [concluding that the trial court abused its discretion in excluding STRmix evidence].) Moreover, as noted by the *Gissantaner* court, the question is *general* acceptance, not uniform acceptance, within the relevant scientific community. The existence of criticism does not mean that a scientific technique has not gained general acceptance. (See *id.* at pp. 466, 469 [concluding that STRmix had gained general acceptance in the scientific community, explaining that the trial court erred in excluding the evidence due to the concern that STRmix “ ‘remains controversial’ ” among computer scientists and in cases involving small amounts of DNA]; *Leahy*, *supra*, 8 Cal.4th at p. 612 [unanimous acceptance is not required].)

3. *Evidence of General Acceptance by Other Groups*

Nor do we agree with defendant’s related claim that the record is inadequate to show general acceptance because the testimony adduced at the *Kelly* hearing did not include any evidence as to whether the STRmix method is generally accepted by computer software engineers. Defendant has forfeited this claim by failing to raise it in the trial court. (*In re S.C.* (2006) 138 Cal.App.4th 396, 406.) He makes a broad and conclusory argument alleging ineffective assistance of counsel for failure to preserve “any argument,” and stating that “for the reasons previously explained in” his briefing, “each” of those issues “resulted in prejudice” but that argument is woefully inadequate to

preserve any claim of ineffective assistance. Thus, his claims of inadequate assistance are forfeited as unsupported by reasoned legal analysis and citation to authority.

(*People v. Stanley* (1995) 10 Cal.4th 764, 793.)

In any event, the claim has no merit. Defendant has not demonstrated that the prosecution needed to show that the STRmix method is generally accepted as reliable by computer software engineers. The authority defendant cites in support of his position does not convince us that reversal is required. (See *State v. Pickett* (App.Div. 2021) 466 N.J. Super. 270 [246 A.3d 279, 284, 311] [noting that while TrueAllele (a competitor of STRmix) may be generally accepted in the field of DNA forensics as methodologically sound, such validation *may* be too narrow to show that it has gained general acceptance in the computer science community to which it also belongs].) For purposes of *Kelly*, general acceptance means “a consensus drawn from a typical cross-section of the relevant, qualified scientific community.” (*Leahy*, supra, 8 Cal.4th at p. 612.) As we have already explained, that standard was met here. For the same reasons, we also reject defendant’s cursory and forfeited contention that the STRmix method is too untested to satisfy the *Kelly* test because one major DNA oversight organization did not consider the method to be sufficiently validated due to the need for additional research. The mere fact that one organization did not consider STRmix to be sufficiently validated does not establish the absence of general acceptance.

4. *Source Code*

Noting the parties agree that a defendant in a criminal matter may obtain access to the STRmix source code under a non-disclosure agreement, we reject defendant’s conclusory contention that the “black box” proprietary nature of STRmix supports a finding that the STRmix method is not generally accepted because the *broader* scientific community cannot fully assess the software’s reliability since it does not have access to STRmix’s source code. Again, defendant has forfeited this claim by failing to raise it in the trial court, and he has not adequately briefed his cursory ineffective assistance claim.

In any event, a scientific technique or method need not be subject to testing and/or assessment by the scientific community *at large* to satisfy the requirement of general acceptance. The *Kelly* test is met if the technique or method is supported by a clear majority of the members of the *relevant scientific community*. (*Leahy, supra*, 8 Cal.4th at p. 612.) As we have already explained at length, the record supports such a finding here, as does caselaw. (See *Gissantaner, supra*, 990 F.3d at pp. 464-466 [noting that there were more than 50 published peer-reviewed articles addressing STRmix at the time of the evidentiary hearing, and that one expert opined that it was the most tested and peer-reviewed probabilistic genotyping software available].)

5. *Human Judgment*

Next, we find no merit in defendant’s contention that the trial court erred in finding that the STRmix method had gained general acceptance because the People failed to show that the aspects of the method that require human judgment are generally accepted. Again, defendant has forfeited this claim by failing to raise it in the trial court, and he has not adequately briefed his cursory ineffective assistance claim. In any event, the record reflects that the STRmix method can be, and has been, tested to assess its reliability. The fact that the method involves human judgment (e.g., the determination of the number of contributors to a mixed-source DNA sample based on an interpretation of the STR DNA-typing results) does not render it incapable of garnering general acceptance under *Kelly*. Disputes about the accuracy, reliability, or validity of a testing method “provide grist for adversarial examination, not grounds for exclusion.” (*Gissantaner, supra*, 990 F.3d at p. 464; see also *Cordova, supra*, 62 Cal.4th at p. 130 [problems with test reliability may be explored on cross-examination or by presenting impeaching evidence]; *People v. Stoll, supra*, 49 Cal.3d at p. 1159 [“issues of test reliability and validity may be thoroughly explored on cross-examination” or by calling “another expert of comparable background” to challenge the methods employed]; *People v. Stevey, supra*, 209 Cal.App.4th at p. 1418 [challenges directed at the

components of the testing process or interpretation of the results go to the weight of the evidence, not to its admissibility].)

6. *Due Process and Evidence Code Section 352*

Finally, we reject defendant's due process arguments and his contention that the trial court erred by failing to exclude the STRmix evidence under Evidence Code section 352 as unduly prejudicial. To the extent defendant's due process claim is predicated on arguments we have already rejected on the merits, no further discussion of that portion of his constitutional claim is required. (*People v. Boyer* (2006) 38 Cal.4th 412, 441, fn. 17.) Defendant's remaining arguments are predicated on the theory that the STRmix evidence was likely to mislead the jury to believe the evidence was tantamount to an identification of defendant as the perpetrator, thereby resulting in an improper shifting of the burden of proof to the defense and unfair prejudice.

Under Evidence Code section 352, “[t]he court in its discretion may exclude evidence if its probative value is substantially outweighed by the probability that its admission will (a) necessitate undue consumption of time or (b) create substantial danger of undue prejudice, of confusing the issues, or of misleading the jury.” “ ‘Evidence is not prejudicial . . . merely because it undermines the opponent’s position or shores up that of the proponent. The ability to do so is what makes evidence relevant. The code speaks in terms of *undue* prejudice. Unless the dangers of undue prejudice, confusion, or time consumption ‘substantially outweigh’ the probative value of relevant evidence, [an Evidence Code] section 352 objection should fail. [Citation.] ‘The ‘prejudice’ referred to in [the statute] applies to evidence which uniquely tends to evoke an emotional bias against the defendant as an individual and which has very little effect on the issues. In applying [Evid. Code] section 352, ‘prejudicial’ is not synonymous with ‘damaging.’ ” [Citation.] [Citation.] [¶] The prejudice that [the statute] ‘is designed to avoid is not the prejudice or damage to a defense that naturally flows from relevant, highly probative evidence.’ [Citations.] “Rather, the statute uses the word in its etymological sense of

‘prejudging’ a person or cause on the basis of extraneous factors. [Citation.]” [Citation.]’ [Citation.] In other words, evidence should be excluded as unduly prejudicial when it is of such nature as to inflame the emotions of the jury, motivating them to use the information, not to logically evaluate the point upon which it is relevant, but to reward or punish one side because of the jurors’ emotional reaction. In such a circumstance, the evidence is unduly prejudicial because of the substantial likelihood the jury will use it for an illegitimate purpose.” ’ ’ ” (*People v. Scott* (2011) 52 Cal.4th 452, 490-491.)

Here, the STRmix evidence was highly probative on the issue of identity; it was powerful evidence linking defendant to the murder. Thus, the evidence was harmful to the defense in that it tended to prove the People’s case, but was not harmful in the legal sense. (See Evid. Code, § 352.) We find no merit in defendant’s contention that the trial court should have excluded the STRmix evidence because there was a substantial risk the jury would misinterpret it as “significant evidence of guilt.” Evidence is not unduly prejudicial under the Evidence Code merely because it strongly implicates a defendant. (*People v. Robinson* (2005) 37 Cal.4th 592, 632.) In short, because the STRmix evidence was highly relevant to the prosecution’s theory that defendant murdered Dingman and had no tendency to prompt an emotional reaction against defendant and cause the jury to decide the case on an improper basis, the trial court acted well within its discretion in finding that the probative value of the evidence outweighed any potential legal prejudice from its admission.

Nor do we find, as defendant claims, that admission of the STRmix evidence violated due process principles by invading the province of the jury or by improperly shifting the burden of proof to the defense. While the jurors may have been inclined to give considerable weight to the STRmix evidence given the particularly persuasive force of DNA evidence, admission of the evidence did not result in a due process violation. Although powerful and compelling evidence of guilt, Halsing’s testimony about the

application of the STRmix method to the DNA found on the bloody shoelace next to Dingman's body was not tantamount to an opinion that defendant was guilty of the charged offenses and did not shift the burden of proof to the defense. As we have explained, Halsing testified that he used the STRmix method to calculate likelihood ratios that compared propositions that included defendant as one of the persons that contributed DNA to the DNA mixture on the shoelace to other propositions that did not include defendant as a contributor. Halsing made clear that the likelihood ratios he calculated provided support for one proposition over the other but did not establish or prove that defendant's DNA was on the shoelace, let alone that defendant was guilty of the charged offenses. Halsing specifically told the jury that the STRmix method does not answer the question: How likely is it that a certain person (e.g., defendant) is a contributor to the DNA mixture on the shoelace? Rather, it answers the question: Under which set of conditions is this DNA mixture better explained? The jury was permitted to give whatever weight to and draw whatever conclusions from Halsing's testimony it deemed appropriate. Indeed, the jury was specifically instructed with CALCRIM No. 332 that it was "not required to accept" expert testimony, and that it could "disregard any opinion that [it found] unbelievable, unreasonable, or unsupported by the evidence."

7. Amicus Curiae Brief

While this appeal was pending, we granted the Electronic Frontier Foundation's (EFF) request to file an amicus curiae brief in support of defendant. EFF, a non-profit civil liberties organization, asserts that, in a criminal case, confrontation clause and due process principles require the disclosure of the source code utilized by probabilistic genotyping systems such as STRmix. EFF argues that analyzing the source code is critical to determining the reliability, and therefore admissibility, of expert testimony based upon application of the system.

We need not reach this issue because it was not raised by defendant in the trial court or in his appellate briefing. Indeed, defendant never sought disclosure of STRmix's

source code, which, as we have noted, may be obtained by a criminal defendant under a non-disclosure agreement. “Courts generally do not consider new issues raised in amicus briefs. Instead, ‘[i]t is a general rule that an amicus curiae accepts a case as he or she finds it,’ and ‘[a]micus curiae may not “launch out upon a juridical expedition of its own unrelated to the actual appellate record.”’ [Citation.] ‘California courts refuse to consider arguments raised by amicus curiae when those arguments are not presented in the trial court, and are not urged by the parties on appeal. “ ‘Amicus curiae must accept the issues made and propositions urged by the appealing parties, and any additional questions presented in a brief filed by an amicus curie will not be considered.’ ” ’ ” (People v. Hannon (2016) 5 Cal.App.5th 94, 105.) Accordingly, we decline to consider this issue.

II

Dog-Trailing Evidence

Defendant next contends the trial court prejudicially erred in admitting dog-trailing evidence. He argues that the People failed to establish the requisite foundation for the admission of the evidence, including that the dog was adequately trained in tracking humans and found to be reliable in doing so. We see no error.

A. Additional Background

At the preliminary hearing, the handler (Keener) testified that she was a CSO employed by the Stockton Police Department, and that her duties included the use of a canine (Hailey) to trail human scent. Keener explained that she received Hailey when Hailey was a puppy and had consistently worked with her for years on trailing human scent. In 2008, Keener and Hailey participated in a 40-hour trailing course when Hailey was just over a year old. During this training, Keener demonstrated that she could “read” Hailey, and Hailey showed she could successfully follow a scent trail. From 2008-2012, Keener and Hailey participated in daily scent trailing exercises as well as weekly training on scent trailing with others. Some of the daily training sessions consisted of testing

Hailey on whether she could follow practice scent trails laid by volunteers. Keener and Hailey also participated in numerous hours of search and rescue trainings in which they would follow human scent trails laid by volunteers. Keener estimated that she and Hailey had participated in a total of 45 search and rescue trainings, with approximately 15 of those trainings occurring before July 2012. Keener and Hailey also participated in 40-45 hours of training on scent trailing in Amador County before July 2012. During her training sessions, Hailey proved to be “reliable” in trailing human scent as she always found the subject and the end of the trail. Prior to July 2012, Keener and Hailey worked with law enforcement on at least one investigation involving scent trailing.

Defendant filed a pretrial motion to exclude dog-trailing evidence. As relevant here, he argued that the evidence adduced at the preliminary hearing was insufficient to meet the foundational requirements for the admission of such evidence, including that Hailey was adequately trained in trailing humans and found to be reliable in doing so. At the hearing on the motion, the People argued that Keener’s testimony provided the requisite foundation. The trial court agreed with the People and denied defendant’s motion.

B. Applicable Legal Principles

Dog-trailing, sometimes incorrectly referred to as “tracking,” is the use of a dog to find a particular individual by following a trail of their scent. (*Jackson, supra*, 1 Cal.5th at p. 316.) Evidence of dog trailing is admissible if the proponent establishes four foundational requirements: (1) the dog’s handler was qualified by training and experience to use the dog; (2) the dog was adequately trained in trailing humans; (3) the dog has been found to be reliable in trailing humans; and (4) the dog was placed on the track where circumstances indicated the guilty party had been. (*Peterson, supra*, 10 Cal.5th at p. 445; *People v. Westerfield* (2019) 6 Cal.5th 632, 706; *Jackson, supra*, 1 Cal.5th at pp. 321-322.)

A trial court has broad discretion in determining the admissibility of evidence. (*Jackson, supra*, 1 Cal.5th at p. 320.) “ ‘We review the trial court’s conclusions regarding foundational facts for substantial evidence. [Citation.] We review the trial court’s ultimate ruling for an abuse of discretion [citations], reversing only if “ ‘the trial court exercised its discretion in an arbitrary, capricious, or patently absurd manner that resulted in a manifest miscarriage of justice.’ ” ’ ” (*Id.* at pp. 320-321.)

C. *Analysis*

We find Keener’s testimony to be sufficient to support the trial court’s finding that an adequate foundation had been established to show that Hailey was adequately trained in trailing humans and was able to trail reliably in July 2012.

For the first time on appeal, defendant contends the People failed to establish the foundational requirement that Hailey was placed on the track where circumstances indicated the guilty party had been. Again, defendant has forfeited this claim by failing to raise it in the trial court, and he has not adequately briefed his cursory ineffective assistance claim. In any event, as we have discussed, the evidence adduced at trial showed that defendant rode his bicycle toward the area where the green bag was found as the police were approaching the property. Keener went to that location approximately two hours later and asked Hailey to find and follow a trail based on the scent from inside the bag.

We also reject defendant’s contention that the trial court erred in admitting *dog scent identification* evidence. Citing *People v. Willis* (2004) 115 Cal.App.4th 379, defendant argues that the People failed to establish the requisite foundational requirements for the admission of such evidence. Again, defendant has forfeited this claim by failing to raise it in the trial court, and he has not adequately briefed his cursory ineffective assistance claim. In any event, *Willis* is inapposite. In that case, the dog was not asked to smell for a scent trail, but instead was exposed to a scent and then “watched to see if the dog ‘show[ed] interest’ in various locales frequented by the defendant.”

(*Willis*, at p. 386.) The *Willis* court held this evidence admissible only upon the establishment of a foundation concerning such matters as “how long scent remains on an object or at a location,” “whether a particular breed of dog is characterized by acute powers of scent and discrimination,” and “the adequacy of the certification procedures for scent identifications.” (*Ibid.*)

The dog-trailing evidence in this case did not resemble the dog scent identification evidence at issue in *Willis*. Hailey was not asked to match a scent to a general location the target may have frequented. Rather, she was asked to find and follow a trail, if any could be found, based on the scent from the green bag discovered across the street from the property. Under similar circumstances, our Supreme Court has rejected the need to supplement the foundational requirements for the admission of dog-trailing evidence with the additional foundational requirements for the admission of dog scent evidence set forth in *Willis*. (See *Peterson*, *supra*, 10 Cal.5th at pp. 443, 446-447; *Jackson*, *supra*, 1 Cal.5th at pp. 309, 319-320.)

III

Closing Argument

Defendant contends the trial court erred in permitting the prosecutor to argue that Halsing’s testimony could be used to draw the inference that defendant’s DNA was on the bloody shoelace found next to Dingman’s body. He adds that, even assuming the trial court did not err in this regard, the prosecutor committed misconduct by violating a court order prohibiting her from arguing that Halsing concluded his DNA was on the shoelace. We see no error or misconduct.

A. Additional Background

In defendant’s first trial, Halsing relied upon the STRmix method to interpret and evaluate the DNA mixture on the bloody shoelace found next to Dingman’s body. Prior to the commencement of the second trial, defendant moved for an order prohibiting the prosecutor from arguing to the jury that Halsing concluded defendant’s DNA was on the

shoelace. After hearing argument from counsel, the trial court granted defendant's request, but ruled that it was permissible for the prosecutor to urge the jury to infer that defendant's DNA was on the shoelace based on Halsing's testimony.

As we have detailed *ante*, Halsing testified that the application of the STRmix method provided strong support for the proposition that defendant was a contributor to the DNA mixture on the shoelace. He explained that the use of the phrase "strong support" is a "verbal equivalent" that criminalists use to "give an English version of what . . . [the] likelihood ratio mean[s]." In Halsing's laboratory, a likelihood ratio above 10 million means there is strong support that an individual was a contributor to a DNA mixture. During his testimony, Halsing made clear he did not determine that defendant's DNA was actually on the shoelace. He told the jury that application of the STRmix method does not answer the question of how likely it is that defendant (or anyone else) was a contributor to the DNA mixture on the shoelace, but instead answers the question: Under which set of conditions is this DNA mixture better explained?

During closing argument, the prosecutor made the following remarks, which did not specifically reference the shoelace, about defendant's DNA being found on items near Dingman's body: "And the soda can left in that bag. Left in that bag that would have been taken had this not been interrupted by [the daughter]. And the defendant's DNA along with [Dingman's] and [Froeliger's] DNA, others were zeroed out, a zero likelihood ratio, but not here, not here. [Dingman], [Froeliger], and [defendant]. How does that come to be unless the most logical and reasonable explanation is that the defendant touched it, left his DNA on it. Where? Next to [Dingman's] dead body. That's because . . . defendant is the one who did this crime."

In rebuttal closing argument, the prosecutor concluded her remarks to the jury by stating: "You know DNA has evolved as well as it should. It inculcates people. It exonerates people. And if there is technology out there that should be used that doesn't only zero out, a zero likelihood on the people that were tested in this case, but also gives

you a likelihood ratio and a strong verbal equivalent as far as . . . finding the defendant's DNA on that shoestring, then you have no reason to reject that. That is reasonable. That is evidence. Look at the items that he utilized to tie and bind her. A shoestring laying right next to her dead body with his DNA evidence on it Look at all the items that they did test and then look at where it is that they do find the DNA. [¶] . . . [¶] I mean you look at the evidence that was found inside the house. You look at the evidence that was found outside the house. And to be certain, when you read CALCRIM 224, before you may rely on circumstantial evidence to conclude that a fact necessary to find the defendant guilty has been proved, you must be convinced that the People have proved each fact essential to that conclusion beyond a reasonable doubt. The People have proved that the defendant's DNA was on each of those items that has previously been discussed. [¶] The only reasonable explanation, the only reasonable interpretation of all the evidence taken into its totality is that . . . the defendant . . . is the person who did this crime. [¶] Circumstances don't lie. DNA doesn't lie. [¶] I ask you to find him guilty, ladies and gentlemen, based on the evidence in this case.”

B. *Applicable Legal Principles*

It is prosecutorial misconduct to misstate or mischaracterize the evidence or urge the jury to draw an impermissible inference from the evidence. (See *People v. Fayed* (2020) 9 Cal.5th 147, 204; *People v. Hill* (1998) 17 Cal.4th 800, 823; *People v. Grant* (2003) 113 Cal.App.4th 579, 590.) However, the prosecution “ ‘enjoys wide latitude in commenting on the evidence, including the reasonable inferences and deductions that can be drawn therefrom.’ ” (*Fayed*, at p. 204.)

“ ‘ “A prosecutor’ s conduct violates the Fourteenth Amendment to the federal Constitution when it infects the trial with such unfairness as to make the conviction a denial of due process. Conduct by a prosecutor that does not render a criminal trial fundamentally unfair is prosecutorial misconduct under state law only if it involves the use of deceptive or reprehensible methods to attempt to persuade either the trial court or

the jury.” [Citation.] When a claim of misconduct is based on the prosecutor’s comments before the jury, . . . “ ‘the question is whether there is a reasonable likelihood that the jury construed or applied any of the complained-of remarks in an objectionable fashion.’ ” [Citation.] To preserve a claim of prosecutorial misconduct for appeal, a defendant must make a timely and specific objection and ask the trial court to admonish the jury to disregard the improper argument. [Citation.]’ [Citation.] A failure to timely object and request an admonition will be excused if doing either would have been futile, or if an admonition would not have cured the harm.” (*People v. Linton* (2013) 56 Cal.4th 1146, 1205.)

C. Analysis

We initially conclude the trial court did not err in allowing the prosecutor to urge the jury to draw the inference that defendant’s DNA was on the bloody shoelace found next to Dingman’s body. This was a fair comment on the STRmix evidence, which was circumstantial evidence supporting the prosecution’s theory that defendant murdered Dingman. Halsing testified that application of the STRmix method provided strong support for the proposition that defendant’s DNA was on the shoelace. He determined that the DNA mixture on the shoelace was 1.8 quintillion to 360 quintillion times better explained as a combination of DNA from defendant, Dingman, and Froeliger than a combination of DNA from Dingman, Froeliger and one random, unrelated individual in the population.

Regarding defendant’s contention that the prosecutor committed misconduct in closing argument, we first observe that defendant failed to preserve his claim for appellate review. The record reflects that defendant did not make a timely and specific objection on the grounds of prosecutorial misconduct to any of the challenged remarks made by the prosecutor. Nor did he request the jury be admonished to disregard any impropriety. Defendant makes no attempt to bring himself within any of the exceptions to the forfeiture rule. Accordingly, defendant again has forfeited his claim of misconduct

