IN THE SUPREME COURT OF NEW ZEALAND

I TE KŌTI MANA NUI

SC 95/2018
[2019] NZSC 152

BETWEEN	MARK EDWARD LUNDY Appellant
AND	THE QUEEN Respondent

Hearing:	27 and 28 August 2019
Court:	William Young, O'Regan, Williams, Arnold and Miller JJ
Counsel:	J H M Eaton QC, J Kincade, J Oliver-Hood and H C Coutts for Appellant P J Morgan QC and M L Wong for Respondent
Judgment:	20 December 2019

JUDGMENT OF THE COURT

The appeal is dismissed.

REASONS
(Given by Miller J)

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Introduction

[1] On the morning of Wednesday 30 August 2000 the bodies of Christine Lundy, aged 38, and Amber Lundy, aged 7, were found in their family home at Palmerston North. Sometime the previous night someone had entered the house and attacked them with a weapon, likely a small axe or tomahawk. They died from head wounds.

[2] Mark Lundy was Christine's husband and Amber's father. He was a travelling salesman whose work had taken him by car to Petone, about 150 km away, the previous day. There he had booked a motel for the night. He was undoubtedly at the motel between 11.50 pm on 29 August and 12.50 am on 30 August. The Crown says that he then drove to Palmerston North, murdered his wife and daughter, and returned to Petone where he resumed work the following morning until called home after the bodies were discovered.

[3] Police stopped Mr Lundy near the family home and seized his car. Found in a bag on the back seat of the car was a polo shirt that he admitted wearing the previous evening. It carried two visible stains, one on the left breast pocket and the other on the left sleeve. The sleeve stain contained a "lump of substance".

[4] Scientists tested the stains using immunohistochemical (IHC) analysis,[1] which can identify specific proteins found in the brain. Crown and defence experts at Mr Lundy's 2015 trial – his second – agreed that IHC analysis proved the stains contained tissue from a central nervous system, meaning the brain or spinal cord. Because it was smeared in the fabric it had been fresh, or near-fresh, when it encountered the shirt. However, IHC analysis could not identify the species from which the tissue came, and so could not exclude the possibility that it originated in meat that Mr Lundy had handled.

[5] When the same stained parts of the shirt were first tested in 2000 forensic scientists extracted the DNA of Christine Lundy.[2] It was not trace DNA that might have been left by touching; rather, it came from a rich source. Central nervous system tissue is a rich source. So is blood, for which the stains tested positive. But the experts could not say when the DNA arrived on the shirt, or what was its source. It could have come from the central nervous system tissue, or the blood, or some other source such as mucus that Mrs Lundy might have sneezed onto the shirt.

[6] The Crown invited the jury to find that Mr Lundy had his wife's brain on his shirt. She had been hacked to death and brain tissue was spattered about the scene. The Crown relied on the expert evidence that the tissue on the shirt was central nervous system tissue and on its co-location with large quantities of Mrs Lundy's DNA.

[7] The Crown also tried to prove the tissue was human, so foreclosing the possibility that it came from meat. The evidence relied on the properties of messenger RNA (mRNA), which is found in human and animal cells. The tissue was tested by the Netherlands Forensic Institute (NFI) using mRNA markers chosen because they could identify human, as opposed to animal, central nervous system tissue. The results indicated that it was more probable that human central nervous system tissue was present than tissue of any of the eight food chain or pet species tested.

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1 Immunohistochemical analysis makes diagnostic use of immune system antibodies that target specific cells.

2 This eluted DNA was tested again in 2014. It was one million, million, million times more likely to have been hers than that of another randomly chosen person in the general New Zealand population. The appellant accepts it was her DNA. We will refer to it as such.

[8] In pre-trial decisions the High Court and Court of Appeal ruled the mRNA evidence admissible, finding that although the NFI's methodology was novel and capable of producing false positives, the evidence was sufficiently reliable to go to the jury.[3] After the trial, and with the benefit of the scientific evidence led there and on appeal, the Court of Appeal held that the methodology had not achieved a sufficient level of acceptance among scientists and the jury could not resolve their highly technical disagreements. It had been an error to admit the evidence.[4]

[9] The Court of Appeal nonetheless upheld Mr Lundy's convictions for murder, relying on the proviso to s 385(1) of the Crimes Act 1961.[5] Under s 385(1)(c) the Court of Appeal, or this Court as the case may be, must allow an appeal if it is of the opinion that there has been a miscarriage of justice. The proviso qualifies that obligation by stating that the appellate court may dismiss the appeal if it considers the miscarriage was not substantial.

[10] The Court of Appeal decided that there had been no substantial miscarriage of justice because the trial was not unfair and other evidence established Mr Lundy's guilt beyond reasonable doubt. Among the other evidence was the following: the IHC and DNA evidence justified the inference that the tissue was from Mrs Lundy's brain; red particles on the shirt, consistent with blood, had tested positive for Amber Lundy's DNA; the bodies bore paint chips consistent with paint that Mr Lundy used to paint his tools, suggesting that one of them had been the murder weapon; fuel usage was consistent with his car having made a return trip from Petone to Palmerston North on the night of 29 August; the scene had evidently been staged to make it seem the crime was a burglary gone wrong; a bracelet likely to have been in a jewellery box taken by the killer was found in Mr Lundy's car; Mr Lundy had misled the police in relevant respects; and there was a motive, for Mr Lundy was in financial difficulty and his wife's life was insured.

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3 *R v Lundy* [2014] NZHC 2527 [Pre-trial HC judgment] at [117] and [125]; and *Lundy v R* [2014] NZCA 576 at [94] per Harrison and French JJ (Ellen France P dissenting).

4 *Lundy v R* [2018] NZCA 410 (Cooper, Winkelmann and Asher JJ) [CA judgment] at [248].

5 At [393].

[11] This Court granted leave to appeal the convictions, limited to whether the Court of Appeal erred in applying the proviso.[6] The appeal poses two questions. The first is whether admission and use of the mRNA evidence was an error so fundamental that the trial was unfair. If the answer is yes, the appeal must be allowed no matter how strong the other evidence of Mr Lundy's guilt. If the answer is no, we must answer the second question, which is whether we are satisfied that the admissible evidence proved his guilt beyond reasonable doubt. If the answer to that question is yes, there was no substantial miscarriage and we will apply the proviso, upholding the convictions.

The trials of Mr Lundy

[12] A full history of proceedings since 2000 is found in the judgment under appeal.[7] For our purposes a short account will suffice.

[13] At the first trial, held in March 2002, the Crown contended that the victims had been murdered early in the evening of 29 August, soon after 7 pm. Its decision to present the case in that way rested, at least in part, on evidence of the pathologist, Dr James Pang, who had expressed the opinion, based on the appearance and smell of stomach contents, that the victims died about an hour after eating their last meal. Mrs Lundy had purchased meals from McDonalds at 5.43 pm. Mr Lundy was known to have used his cellphone in Wellington at 5.30 pm, and again at 8.28 pm.[8] The Crown contended that during that interval he drove to Palmerston North, committed the murders, disposed of the murder weapon, and returned to Petone.

[14] To do this Mr Lundy must have driven at very high speed on roads that can be very busy. The Crown case also confronted the difficulty that the Lundy family computer had apparently been shut down at 10.52 pm on the night of the murders. Relying on the evidence of a computer expert, the Crown alleged that Mr Lundy had manipulated the computer's clock to create the false impression it had been shut down at that time, so giving him an alibi. The Crown also called an eyewitness who lived

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6 *Lundy v R* [2019] NZSC 45 [Leave judgment].
7 CA judgment, above n 4, at [10]–[43].
8 This evidence rested on his call history and cellphone polling data which established the approximate location of his phone when he made these calls.

near the Lundys. She said that she saw a fat man wearing a blond curly wig running away from the scene at about 7.12 pm.

[15] Central to the Crown case was IHC evidence from Dr Rodney Miller, a pathologist and Director of Immunohistochemistry at a Texas laboratory called ProPath, to show that the stains on Mr Lundy's shirt were central nervous system tissue. The defence did not dispute that the tissue came from Christine Lundy's brain. Its case was that contamination in police custody or in a laboratory must account for the tissue because Mr Lundy could not possibly have committed the crime within the narrow window of time on which the Crown relied.

[16] Mr Lundy was convicted, and the convictions were upheld on appeal to the Court of Appeal in 2002.[9]

[17] In 2013 Mr Lundy brought a further appeal to the Privy Council.[10] He relied on new evidence from highly reputable consultants that contradicted Dr Pang's opinion about time of death. He also showed that IHC analysis had not previously been deployed to prove the origin and identity of cellular material. Its forensic application had not been validated by other experts and that might bear on its admissibility and weight. Doubt was also cast on the evidence that the computer's clock had been altered. A retrial was ordered.[11]

[18] Admissibility of the IHC evidence was then closely examined in a pre-trial ruling of the High Court.[12] Kós J explained that the Crown sought to lead not only the IHC and DNA evidence, both of which had been led at the first trial, but also the mRNA evidence (which he admitted by a "narrow margin")[13] and evidence using a further technique which was said to show that the central nervous system tissue was both human and female (which he excluded).[14] He recorded after hearing the evidence that the defence maintained only a formal objection to the IHC and DNA evidence.[15]

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9 *R v Lundy* (2002) 19 CRNZ 574 (CA) at [20].
10 *Lundy v R* [2013] UKPC 28, (2013) 26 CRNZ 699 [PC judgment].
11 At [164]–[165].
12 Pre-trial HC judgment, above n 3.
13 At [117] and [125].
14 At [126]–[130]. This evidence was based on fluorescent in situ hybridisation (FISH) analysis.
15 At [16] and [91].

The IHC technique was orthodox and there were no chain of custody or contamination concerns. All experts, including two engaged for the defence, had been able to get reliable results from tissue samples from the shirt. (The stained fabric had been fixed with formalin and embedded in paraffin blocks by Dr Miller's laboratory in 2001, and all experts at the 2015 trial used samples cut from those blocks.) They all agreed with Dr Miller, who was again a witness for the Crown, that the stained fabric contained central nervous system tissue.[16]

[19] At the second trial the Crown contended that Mr Lundy committed the murders in the early hours of the morning of 30 August. Dr Pang retracted the estimate he had given at the first trial that Christine and Amber had died about an hour after their last meal. He could not now say with any certainty when they died.

[20] The Crown case again relied on expert evidence showing that the tissue on Mr Lundy's shirt was central nervous system tissue and the DNA found at the same places was that of Mrs Lundy. It introduced the mRNA evidence to counter a defence hypothesis that the central nervous system tissue may have been animal in origin and its co-location with Mrs Lundy's DNA a coincidence. As it had done at the first trial, the Crown sought to show that the distance travelled by Mr Lundy's car and its known fuel consumption pointed to a "secret" return trip from Wellington to Palmerston North.

[21] It will be seen that Mr Lundy faced a different Crown case at his second trial. The opportunity that the Privy Council had afforded him to challenge the IHC evidence had not borne fruit; exhaustive analysis had rather confirmed its reliability. His successful challenge to Dr Pang's evidence had allowed the Crown to adopt a theory of the case in which he had ample time to drive to Palmerston North, commit the crime, dispose of the murder weapon and return to Wellington. The Crown no longer had to counter the evidence that someone had shut down the computer at 10.52 pm; it was common ground that Mrs Lundy had probably done so before going to bed. The Crown did not call the eyewitness.

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16 At [78] and [95]. See also Leave judgment, above n 6, at [3], n 2.

[22] The defence contested the forensic evidence, suggesting that the central nervous system tissue may have been animal in origin and mucus might be the source of Mrs Lundy's DNA. The defence also contended that if the tissue was Mrs Lundy's its presence on the shirt must be explained by contamination, for Mr Lundy could not possibly have committed the crimes. It invoked what were called the "three impossibilities":

(a) Mr Lundy's car did not have enough fuel to make the secret return trip to Palmerston North.

(b) A neighbour, Mr Tupai, said that he saw the sliding door to the Lundys' conservatory open at around 11 pm. The defence contended that it was likely open, unusually at that late hour, because the killer was already inside the house. Mr Lundy was undoubtedly in Petone at that time; a prostitute visited him at his motel between 11.50 pm and 12.50 am.

(c) Expert evidence about stomach contents showed that the victims must have died well before Mr Lundy could have returned to Palmerston North.

Law of the proviso

[23] Section 385 of the Crimes Act is no longer in force, but it continues to govern this appeal.[17] It provided relevantly that:

> (1) … the Court of Appeal or the Supreme Court must allow the appeal if it is of opinion—
>
> …
>
> (c) that on any ground there was a miscarriage of justice; or
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> …

[17] Section 385 was replaced from 1 July 2013 by s 232 of the Criminal Procedure Act 2011. Section 385 followed a form common to a number of Commonwealth jurisdictions. The proceedings against Mr Lundy commenced before this date, so the appeal provisions of the Crimes Act 1961 apply: Criminal Procedure Act, s 397.

> and in any other case shall dismiss the appeal:
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> provided that the Court of Appeal or the Supreme Court may, notwithstanding that it is of opinion that the point raised in the appeal might be decided in favour of the appellant, dismiss the appeal if it considers that no substantial miscarriage of justice has actually occurred.

[24] The leading authorities under s 385 established that not every error in a trial amounts to a miscarriage of justice for purposes of s 385(1)(c). To do so it must be plainly capable of affecting the outcome. As this Court held in *R v Matenga*:[18]

> … we consider that in the first place the appeal court should put to one side and disregard those irregularities which plainly could not, either singly or collectively, have affected the result of the trial and therefore cannot properly be called miscarriages. A miscarriage is more than an inconsequential or immaterial mistake or irregularity.

[25] Some errors are so serious that they cannot be saved by the proviso; put another way, in such a case the appeal will be allowed even if the appellate court is satisfied of the defendant's guilt. Such errors are characterised as "fundamental" or "radical" or said to go to "the root of the proceedings"[19] or to "undermine the integrity of the trial" so that it has lost the character of a fair trial according to law.[20] The High Court of Australia explained in *Wilde v R* that:[21]

> It is one thing to apply the proviso to prevent the administration of the criminal law from being "plunged into outworn technicality" … it is another to uphold a conviction after a proceeding which is fundamentally flawed, merely because the appeal court is of the opinion that on a proper trial the appellant would inevitably have been convicted. The proviso has no application where an irregularity has occurred which is such a departure from the essential requirements of the law that it goes to the root of the proceedings. If that has occurred, then it can be said, without considering the effect of the irregularity upon the jury's verdict, that the accused has not had a proper trial and that there has been a substantial miscarriage of justice. Errors of that kind may be so radical or fundamental that by their very nature they exclude the application of the proviso … .

[26] There exists no taxonomy of errors that are classified as fundamental;[22] rather, incurability depends on the appellate court's assessment of the significance of the error

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18 *R v Matenga* [2009] NZSC 18, [2009] 3 NZLR 145 at [30].
19 *Wilde v R* (1988) 164 CLR 365 at 373 per Brennan, Dawson and Toohey JJ.
20 *R v Howse* [2005] UKPC 30, [2006] 1 NZLR 433 at [33] per Lord Hutton, Lord Carswell and Sir Swinton Thomas.
21 *Wilde*, above n 19, at 373 per Brennan, Dawson and Toohey JJ.
22 *Gassy v R* [2008] HCA 18, (2008) 236 CLR 293 at [33] per Gummow and Hayne JJ.

in the context of the trial. In *Randall v R*, Lord Bingham, delivering the judgment of the Privy Council, explained that:[23]

> There will come a point when the departure from good practice is so gross, or so persistent, or so prejudicial, or so irremediable that an appellate court will have no choice but to condemn a trial as unfair and quash a conviction as unsafe, however strong the grounds for believing the defendant to be guilty.

[27] This Court held in *Matenga* that the New Zealand Bill of Rights Act 1990 guarantees of a fair trial and an appeal do not require that an appeal should be allowed and a retrial ordered whenever there has been a miscarriage at the first trial.[24] The Court cited *R v Condon*, in which it adopted the passage just cited from *Randall* when discussing the requirements of a fair trial and held that a "fundamentally flawed" trial is an unfair trial for the purposes of s 25(a) of the Bill of Rights Act.[25]

[28] The language of fundamental error sets a deliberately high threshold to ensure the proviso can do the work for which it was designed.[26] As this Court recognised in *Matenga*, it is a necessary, and usually sufficient, condition for use of the proviso that the appellate court be satisfied of the defendant's guilt:[27]

> … the decision to confirm a jury verdict, despite something having gone wrong, depends upon whether the appellate court considers a guilty verdict was inevitable on the basis of the whole of the admissible evidence (including any new evidence).

[29] The appellate court may take the jury's decision into account when assessing whether an error amounted to a miscarriage and whether it was incurable. The court may also do so when assessing guilt, to the extent that the court can be satisfied the jury's decision was not affected by the error and so long as the court recognises that it must reach its own decision.[28] It is frequently impossible to say whether the jury's

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23 *Randall v R* [2002] UKPC 19, [2002] 1 WLR 2237 at [28]. This passage was adopted in *Howse*, above n 20, at [36] by Lord Hutton, Lord Carswell and Sir Swinton Thomas and [49] by Lord Rodger and Sir Andrew Leggatt; *R v Condon* [2006] NZSC 62, [2007] 1 NZLR 300 at [38] and [78]; and *Guy v R* [2014] NZSC 165, [2015] 1 NZLR 315 at [38] by Elias CJ and Glazebrook J.

24 *Matenga*, above n 18, at [28]. See also *Randall*, above n 23, at [28].

25 *Condon*, above n 23, at [77]–[78].

26 *Howse*, above n 20, at [37] per Lord Hutton, Lord Carswell and Sir Swinton Thomas and [54] per Lord Rodger and Sir Andrew Leggatt; and *Guy*, above n 23, at [36] per Elias CJ and Glazebrook J.

27 *Matenga*, above n 18, at [28].

28 *Matenga*, above n 18, at [33]; and see *Cesan v R* [2008] HCA 52, (2008) 236 CLR 358 at [129] per Hayne, Crennan and Kiefel JJ.

decision was affected by the error,[29] but that is not invariably so. For example, a mix of verdicts may allow the appellate court to draw inferences about this.[30]

[30] Before it may apply the proviso the court must be satisfied of the defendant's guilt to the criminal standard, beyond reasonable doubt. As this Court said in *Matenga*:[31]

> The Court may exercise its discretion to dismiss the appeal only if, having reviewed all the admissible evidence, it considers that, notwithstanding there has been a miscarriage, the guilty verdict was inevitable, in the sense of being the only reasonably possible verdict, on that evidence. Importantly, the Court should not apply the proviso simply because it considers there was enough evidence to enable a reasonable jury to convict. In order to come to the view that the verdict of guilty was inevitable the Court must itself feel sure of the guilt of the accused.

[31] Mr Eaton QC, for Mr Lundy, invited us to revisit this last proposition. He argued that the appellate court must be satisfied to a standard higher than beyond reasonable doubt; the evidence must be so overwhelming that conviction must inevitably result. He sought to persuade us that the Privy Council, when allowing Mr Lundy's appeal in this case,[32] and this Court, in *Matenga*, used the term "inevitable" in this sense, and that this has always been the law in New Zealand. He sought support in Canadian authorities, *R v Mayuran* and *R v Trochym*.[33] It followed, he submitted, that the Court of Appeal erred in law in this case by deciding for itself whether the admissible evidence proved Mr Lundy's guilt beyond reasonable doubt.

[32] We do not agree. In *Matenga* this Court held, in the passage just cited, that a verdict is inevitable when it is the only reasonably possible verdict on the admissible evidence. As the Court went on to explain, that is another way of saying that the

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29 *Weiss v R* [2005] HCA 81, (2005) 224 CLR 300 at [36]. See also *Patel v R* [2012] HCA 29, (2012) 247 CLR 531 at [128] per Heydon J.

30 As happened in *Wilde*, above n 19, at 377 and 385.

31 *Matenga*, above n 18, at [31] (footnote omitted).

32 PC judgment, above n 10, at [161]–[162].

33 *R v Mayuran* 2012 SCC 31, [2012] 2 SCR 162; and *R v Trochym* 2007 SCC 6, [2007] 1 SCR 239.

appellate court must be sure of the defendant's guilt.[34] The Court affirmed that proposition in *Best v R*, stating that:[35]

> It has recently been suggested that the fact an appellate court is satisfied of guilt is not sufficient. The court, it is said, must also be satisfied that any jury acting properly must inevitably have convicted the defendant if the flaw in the proceedings had not occurred … That is not the position in New Zealand. If an appellate court is satisfied of guilt, then the conclusion that conviction was inevitable necessarily follows … .

[33] It is correct that Canadian authorities use "inevitable" in a different sense. That approach is traceable[36] to a 1911 judgment of the Supreme Court, *Allen v R*, in which a majority reasoned that Parliament had not authorised an appellate court to deprive the accused of the benefit of a trial by jury.[37] Only where it could not be supposed that inadmissible evidence had any effect on the jury might an appellate court uphold the conviction.[38] It appears that Canadian appellate courts still apply a higher standard than beyond reasonable doubt, requiring that the evidence must be "overwhelming". In *Trochym*, which was decided in 2007, the Supreme Court held by majority that:[39]

> [82] The instant case is one that falls squarely within the second category of serious errors that will justify a new trial unless the properly adduced evidence is so overwhelming that a conviction is inevitable, or would invariably result. This standard should not be equated with the ordinary standard in a criminal trial of proof beyond a reasonable doubt. The application of the proviso to serious errors reflects a higher standard appropriate to appellate review. The standard applied by an appellate court, namely that the evidence against an accused is so overwhelming that conviction is inevitable or would invariably result, is a substantially higher one than the requirement that the Crown prove its case "beyond a reasonable doubt" at trial. This higher standard reflects the fact that it is difficult for an appellate court, in particular when considering a jury trial, since no detailed findings of fact will have been made, to consider retroactively the effect that,

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34 *Matenga*, above n 18, at [31]. See also the judgment of the Privy Council in *Barlow v R* [2009] UKPC 30, [2010] 1 LRC 272 at [21], [59] and [74], in which the Board applied *Matenga*, finding that their Lordships were left with no reasonable doubt about guilt.

35 *Best v R* [2016] NZSC 122, [2017] 1 NZLR 186 at [96], n 83 per Elias CJ, Glazebrook, Arnold and O'Regan JJ. See also *Cameron v R* [2017] NZSC 89, [2018] 1 NZLR 161 at [99].

36 See, for example, *Gouin v R* [1926] SCR 539 at 544; *Brooks v R* [1927] SCR 633 at 636; *Colpitts v R* [1965] SCR 739 at 754–756; *R v S* [1991] 1 SCR 909 at 916; and *R v Khan* 2001 SCC 86, [2001] 3 SCR 823 at [104]–[105].

37 *Allen v R* (1911) 44 SCR 331 at 339–340 per Fitzpatrick CJ, with whom Duff J agreed, and 361–362 per Anglin J.

38 At 339 per Fitzpatrick CJ.

39 *Trochym*, above n 33.

> for example, excluding certain evidence could reasonably have had on the outcome.

It will be seen that the reason given for adopting a higher standard was that it is difficult for an appellate court to be sure of guilt on the facts.

[34] It is also correct that New Zealand courts once took a similar approach.[40] But in *Matenga* this Court elected to follow the judgment of the High Court of Australia in *Weiss v R*, in which is found an insightful analysis of the history and purpose of the proviso.[41] The High Court explained that the two-fold legislative purpose behind the proviso was that of doing away with the Exchequer rule, under which any wrongful admission of evidence was commonly understood to entitle the defendant to a new trial, and delimiting the defendant's right to the verdict of a jury.[42] To that end, the legislation established that an appeal need not be allowed unless the trial was affected by a substantial miscarriage of justice and assigned to the appellate court the task of deciding for itself whether such a miscarriage had actually occurred.[43] The High Court held that the right to a jury's verdict has always been qualified by the possibility of appellate intervention:[44]

> … the conduct of jury trials has always been subject to the direction, control and correction both of the trial judge and the appellate courts. Once it is acknowledged that an appellate court may set aside a jury's verdict "on the ground that it is unreasonable or cannot be supported having regard to the evidence", it follows inevitably that the so-called "right" to the verdict of a jury rather than an appellate court is qualified by the possibility of appellate intervention. The question becomes, when is that intervention justified? And that, in turn, requires examination of when a court should conclude that "no substantial miscarriage of justice has actually occurred".

[35] The Court also addressed the difficulty of deciding guilt on the trial record:[45]

> The appellate court must make its own independent assessment of the evidence and determine whether, making due allowance for the "natural limitations" that exist in the case of an appellate court proceeding wholly or substantially on the record, the accused was proved beyond reasonable doubt

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40 As the Court explained in *Matenga*, above n 18, at [13], an appellate court traditionally inquired whether the jury "would without doubt have convicted", citing *Stirland v Director of Public Prosecutions* [1944] AC 315 (HL); and *R v McI* [1998] 1 NZLR 696 (CA).

41 *Matenga*, above n 18, at [27].

42 *Weiss*, above n 29, at [18] and [30]. See also *Gassy*, above n 22, at [17] per Gummow and Hayne JJ.

43 At [18].

44 At [30].

45 At [41] (footnotes omitted).

> to be guilty of the offence on which the jury returned its verdict of guilty. There will be cases, perhaps many cases, where those natural limitations require the appellate court to conclude that it cannot reach the necessary degree of satisfaction. In such a case the proviso would not apply, and apart from some exceptional cases, where a verdict of acquittal might be entered, it would be necessary to order a new trial. But recognising that there will be cases where the proviso does not apply does not exonerate the appellate court from examining the record for itself.

On this approach to the proviso the natural disadvantages of an appellate court do not mean that the evidence of guilt must be overwhelming before the court may sustain a conviction. They mean rather that appeals will be allowed where the court cannot be sure of guilt.

[36] We decline to revisit this now-settled approach, which the Court of Appeal correctly followed in this case.[46]

Wrongful admission of evidence and the proviso

[37] Most cases in which an appeal has been allowed for fundamental or incurable error involved serious failures of trial process. The wrongful admission of evidence may amount to incurable error,[47] but in such cases appellate courts frequently go directly to the proviso. *Matenga* itself is an example. The jury had heard inadmissible expert evidence to the effect that an injury to the complainant's genitalia was probative of non-consensual intercourse. This Court decided the appeal on the ground that when the inadmissible evidence was put aside it could not be sure of guilt.[48]

[38] When called upon to consider whether wrongly admitted evidence has resulted in an incurable error the appellate court considers the evidence overall, but not for the objective of deciding whether the admissible evidence established the defendant's

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46 CA judgment, above n 4, at [324] and [364].

47 *Wilde*, above n 19, at 373; and *Howse*, above n 20, at [37] per Lord Hutton, Lord Carswell and Sir Swinton Thomas and [48] and [57] per Lord Rodger and Sir Andrew Leggatt.

48 *Matenga*, above n 18, at [35]–[36].

guilt. It is concerned rather to gauge the impact of the inadmissible evidence upon the trial.[49] As the Privy Council explained in *Barlow v R*:[50]

> … it is certainly not the case that a trial is rendered unfair simply because some potentially misleading evidence has been admitted. The fairness of the trial has to be judged in the light of the proceedings as a whole.

[39] We have noted that the standard for incurable or fundamental error is high. That is reflected in three leading cases involving inadmissible evidence. In *Wilde*, the defendant had been tried on charges arising from incidents in which he was accused of breaking into homes and stealing items. In two of these incidents he was accused of sexually assaulting or threatening to sexually assault a woman he found in the house. The trial issue was identity. The trial judge allowed the jury to treat the evidence of the two incidents as cross-admissible. On appeal it was held that the charges arising from the first incident ought to have been severed, for evidence about it was inadmissible on the charges arising from the second. A majority of the High Court of Australia found that it did not appear the inadmissible evidence could have carried significant additional weight having regard to other, cogent, evidence of guilt. The majority reasoned that the evidence in relation to the first incident was weak, so that the jury would not have needed to rely on it to establish identity for the second, and found support for that conclusion in the fact that the jury acquitted him on the only charge left to them for the first incident.[51]

[40] In *Barlow*, the Crown case depended on the jury accepting that a pistol owned by the defendant was the murder weapon. The jury had heard inadmissible expert evidence that bullets used in two murders were made by a specific manufacturer, Geco, and likely came from a particular box of ammunition that the defendant was known to have dumped at a landfill. The most that could properly have been said was that the scene bullets were consistent in composition with Geco bullets.[52] The Board concluded, citing *Wilde*, that this was not an incurable error.[53] Defence counsel at the trial had emphasised criticisms made of the Crown's evidence by defence experts, and

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49 *Wilde*, above n 19, at 374, adopted in *Howse*, above n 20, at [35]–[36] by Lord Hutton, Lord Carswell and Sir Swinton Thomas and [55]–[56] by Lord Rodger and Sir Andrew Leggatt.
50 *Barlow*, above n 34, at [58].
51 *Wilde*, above n 19, at 374.
52 *Barlow*, above n 34, at [54].
53 At [58].

the Judge had drawn attention to those criticisms in his summing-up.[54] The Crown had an otherwise strong circumstantial case.[55]

[41] In *R v Howse*, the defendant was convicted of murdering his two step-daughters. Evidence that the girls had claimed that he sexually abused them was admitted to establish motive, but the Crown attempted to go further and prove he had done so. The trial judge admitted a great deal of inadmissible hearsay evidence to that end and did not direct the jury about the limited use that could properly be made of it. The Privy Council divided on whether the error was fundamental.[56] The majority went directly to the proviso.[57] The minority reasoned that the error was fundamental because of the large quantity and highly prejudicial nature of the evidence and the trial Judge's failure to direct the jury appropriately.[58]

[42] The authorities establish that when considering the significance of inadmissible evidence in the context of the trial, an appellate court may inquire into whether the evidence went to an issue on which the verdict turned, how strong was the Crown case otherwise,[59] how cogent or prejudicial was the evidence and whether it was met by defence evidence,[60] what impact the inadmissible evidence had on the conduct of the defence case,[61] how counsel handled the evidence, and whether the trial judge's directions mitigated or cured the irregularity.[62] As explained above, it may be possible to take into account what the actual jury did with the evidence, if that is ascertainable.

[43] We turn to the application of these principles in this case.

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54 At [63].
55 At [66] and [72].
56 *Howse*, above n 20, at [39]–[40] per Lord Hutton, Lord Carswell and Sir Swinton Thomas and [68]–[70] per Lord Rodger and Sir Andrew Leggatt.
57 At [38]–[39].
58 At [69]–[70].
59 *Wilde*, above n 19, at 374.
60 The likely prejudicial effect of inadmissible evidence on the fact-finder has led appellate courts to treat the resulting miscarriage as substantial in a number of cases. See, for example, *Patel*, above n 29; *Swan v R* [2013] VSCA 226, (2013) 234 A Crim R 372; and *R v Southon* CA34/06, 19 September 2006.
61 *R v Cook* [2004] NSWCCA 52 at [70].
62 *Khan*, above n 36, at [79] per LeBel J.

Miscarriage established

[44] The Court of Appeal implicitly accepted that admission of the mRNA evidence amounted to a miscarriage of justice in the sense that it was an error capable of affecting the verdicts.[63] The rationale is that if accepted by the jury, the mRNA evidence would have supported the Crown case that the central nervous system tissue was of human origin and could only have come from Mrs Lundy. As explained above, leave to appeal was granted on the question whether the Court of Appeal erred in nevertheless applying the proviso. The appeal accordingly proceeded before us on the basis that admission was an error capable of affecting the result.

The challenge to the application of the proviso

[45] Mr Eaton argued that the Court of Appeal misapplied the proviso in three respects. It failed to appreciate that the error in this case was fundamental, meaning that the proviso could not save the convictions. It relied impermissibly on the jury's likely reaction to the evidence. And it erred by concluding on the merits that the admissible evidence proved Mr Lundy's guilt. We will address these arguments in turn.

Was admission of the mRNA evidence an incurable error?

[46] The Court of Appeal held that admission of the mRNA evidence was not a fundamental error, for several reasons: the Crown's case did not turn on the mRNA evidence; the evidence went to a central issue in the case but it was somewhat equivocal and was attacked by defence experts; it weakened but did not preclude the defence argument that the central nervous system tissue came from the food chain; and the Judge drew attention to its weaknesses.[64]

[47] Mr Eaton argued that the mRNA evidence was central to the Crown case on the crucial issue at trial. It bridged a gap by showing that the tissue on Mr Lundy's shirt was of human origin, and if accepted by the jury, as it may well have been, it made the food chain defence untenable.

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63 CA judgment, above n 4, at [323]–[324].
64 At [382]–[392].

The mRNA evidence

[48] It is necessary to examine the mRNA evidence in a little detail to gauge its significance and cogency.[65] Three expert witnesses – Dr Laetitia Sijen of the NFI for the Crown and Professor Stephen Bustin and Dr Marielle Vennemann for the defence – gave evidence on the topic at trial. Dr Sijen explained that there are about 210 different cell types in the human body. Every cell contains an identical copy of the person's DNA, which is unique to the individual and serves as a blueprint for the body's functions. Different portions of the DNA are transcribed to assign to each cell its appropriate function, such as (by way of example) that of transporting oxygen in blood cells. The transcribed portions are called messenger RNA or mRNA. Unlike DNA, mRNA takes common forms; for example, the mRNA for a blood cell is the same in person A as in person B. So DNA cannot be used to identify the organ or type of cell from which it came, but it is in principle possible to use mRNA for that purpose.

[49] The NFI has developed methods for typing cells from bodily fluids and organs using RNA. A typer tests a sample for specific genetic markers that are predominantly expressed in the cell or organ concerned and not elsewhere. When creating a blood typer, for example, markers are tested using known blood samples to establish that the samples test positive for blood and do not test positive for other cell types that the tester wants to exclude. The typer will also include a "housekeeping" gene, so called because it is expressed in every cell and so should test positive whenever the typer is applied to a sample, showing that RNA is present and the test has worked correctly. When a typer is used on a case sample, such as those from Mr Lundy's shirt, the test is normally replicated four times. The results are aggregated in what Dr Sijen described as a joint interpretation system. If more than 50 per cent of the results are positive the target tissue is considered present.

[50] The NFI developed a unique human central nervous system typer for this case. It did so for two reasons. The first was that its existing central nervous system typer would not work on the case samples it was given. The case samples, which were presented on two sets of slides provided by Dr Miller's laboratory, contained little

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[65] We need not address aspects of the expert evidence that were of concern to the Court of Appeal, such as the particular expertise of the witnesses and the novelty of mRNA organ typing in forensic science, because admissibility is not now in issue.

cellular material. Dr Sijen and a pathologist identified astrocytes and oligodendrocytes, cell types that are found in central nervous system tissue but were not the target of the NFI's existing typer. It was necessary to select markers that would identify those cell types. Second, the Crown wished to exclude the possibility that the central nervous system tissue came from animals forming part of the food chain or domestic animals. So the NFI chose human central nervous system markers that would not be expressed when tested with central nervous system tissue of eight species: they were cattle, sheep, chicken, pig, cat, dog, guinea pig and rabbit. The four markers were ACSBG1, GFAP, S100B (all astrocyte markers) and OPALIN (an oligodendrocyte marker). The housekeeping gene was 18SrRNA.[66] Together they comprise what was called the "brainplex".

[51] The brainplex was tested on mRNA from known brain tissue sourced from humans and the eight animal species. Dr Sijen deposed that it functioned well; the human samples tested positive and the animal samples produced no false positives, so achieving specificity to human central nervous system cells.[67] It was next tested on what were described at trial as positive control samples of known brain tissue which, like the case samples, had been fixed in formalin and embedded in paraffin. The samples mostly tested negative for OPALIN but were generally positive for the other markers.

[52] The brainplex was applied to the case samples. Because there was insufficient material the test was repeated three times, not four. The results did not identify human central nervous system markers in the chest sample. But results from the sleeve sample (which was denoted C3003/3) were positive, as follows:[68]

ACSBG1	GFAP	S100B	OPALIN	18SrNA
	X		X	X
X	X		X	X
X	X			X

[66] It is ribosomal rather than messenger RNA and is found in large quantities in cells. 18SrRNA is not human or brain-specific.

[67] The brainplex did generate false positives at an annealing temperature of 60 degrees, but these were eliminated when the temperature was increased to 64 degrees.

[68] This table is taken from jury materials prepared by the trial Judge.

An "X" denotes a positive result. It will be seen that GFAP appeared in each of the three tests and S100B appeared in none. ACSBG1 and OPALIN each appeared twice.

[53] The table shows that seven of 12 markers, or 58 per cent, were positive. (It will be recalled that 18SrRNA, in the fifth column, is the housekeeping gene.) As noted, the NFI adopted a 50 per cent threshold, so the overall result for the sleeve sample was positive. Based on these results, Dr Sijen deposed that it was "more probable that human [central nervous system] tissue is present than tissue of the other animals we tested".

[54] The defence subjected almost every step in the NFI's processes and reasoning to sustained criticism. The opinion of the defence experts, one of whom, Dr Vennemann, had observed parts of the testing, was that the brainplex was not fit for purpose and its results ought to be discarded.

[55] The starting point for the defence experts was that mRNA testing is not validated for forensic use, at least when using the NFI's methodology.[69] There are several reasons for this. RNA is less stable than DNA. It may degrade in ways which are not well understood and so are hard to predict or assess, and degradation may cause discordant results when the RNA is tested. RNA may also be present in cells in highly variable quantities, and testing necessitates that it first be converted into copy DNA in a process called reverse transcription which can be highly inefficient and can generate anomalies. The copy DNA is then replicated using a polymerase chain reaction (PCR) process which is stable but may amplify any anomalies. In the result, markers may not be reliably observed in test results. There is also a risk of false positives (a positive result for a tissue-specific marker when that tissue is not present). It is difficult to reproduce consistent test results, which is an essential condition for scientific validity. Indeed, there is no generally accepted methodology for the conversion and replication processes.

[56] The defence experts also took issue with specific features of the brainplex. The markers chosen were said to be idiosyncratic – there were said to be better

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[69] It appears that the NFI and the New Zealand Institute of Environmental Science and Research Ltd (ESR) are the only forensic science institutes employing RNA testing for cell or organ typing.

alternatives to two of them – and Dr Vennemann considered that some were potentially capable of testing positive for animal species they were intended to exclude. The S100B marker was not organ-specific either (meaning that the Crown would have to rely on the IHC evidence to show that the case samples were from the central nervous system). The experts also disputed the choice of housekeeping gene, contending that the NFI ought to have chosen one likely to be present in similar quantities to the target mRNA and that 18SrRNA can deliver a false positive result for mRNA if genomic (natural, rather than copy) DNA is present in the sample.

[57] The NFI's results when the brainplex was applied to the control and case samples were said to validate these concerns. The defence experts attached significance to discordancy in the results. Notably, one of the markers, OPALIN, did not appear at all in the fresh brain control sample prepared in the same way as the case samples. In Professor Bustin's opinion, this alone invalidated the OPALIN marker and meant that positive results for OPALIN in the case samples were "meaningless". Another marker, S100B, appeared in the control samples but not at all in the case samples. Professor Bustin accepted that a negative result for one marker did not invalidate any other marker, but he also expressed the opinion that the negative S100B result raised concern about the positive GFAP ones because the two are co-expressed in the same cells at roughly the same levels and so should yield a consistent result. Discordancy in the results was said to raise a possibility of contamination during testing.[70]

[58] Finally, the defence experts did not accept the NFI joint scoring methodology, which combined results for two different cell types, astrocytes and oligodendrocytes. Professor Bustin considered that it was inappropriate to "lump" results together without investigating reasons for discordance. Dr Vennemann characterised the 50 per cent threshold for a positive result as "completely random".

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[70] The NFI used an endpoint PCR method called capillary gel electrophoresis to replicate copy DNA in the polymerase chain reaction. Professor Bustin considered it inappropriate because it introduces a risk of contamination in the laboratory. He did not go so far as to say that he thought Dr Sijen's testing had in fact suffered from contamination, which she rejected, but he pointed to discordancy in the results as evidence that something had gone wrong.

[59] Dr Sijen rejected these criticisms. In her view negative and discordant test results cause no concern about methodology or results. A negative test means only that the tissue that is being tested for has not been detected in the sample. That may well be a false negative, meaning that the tissue is present but mRNA has fallen to undetectable levels or the relevant marker has disappeared. Markers disappear because RNA is unstable. That phenomenon does not invalidate any positive results observed. It is because results vary that the NFI replicates tests and uses a joint analysis. It is permissible to combine the results from four markers because all target brain tissue.

[60] Professor Bustin also accepted, importantly from the Crown's perspective, that GFAP and ACSBG1 were acceptable markers and the positive results would exclude the food chain species:[71]

> Q … just to make sure I've understood what you're saying. You're satisfied with the RNA work to the extent that what the NFI has done shows that this is not tissue from cow, beef, chicken or pork, on those two markers?
>
> A For those two markers [GFAP and ACSBG1] they would not have amplified if those, if it had been any of those yes.

[61] However, the Professor did not resile from his opinion that no reliable conclusions could be drawn from the NFI's methodology and results. He maintained that there was a possibility of "contamination or spurious amplification". Further, Dr Vennemann did not agree with him that the positive results for GFAP and ACSBG1 excluded the food chain species. In her opinion the NFI's methodology did not eliminate the risk of false positives.[72]

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[71] Elsewhere he accepted that the NFI had excluded the eight animal species tested. He made the point, however, that GFAP would not exclude other species, giving the examples of horse and golden hamster.

[72] The difference between Dr Vennemann and Professor Bustin lay in the Professor's acceptance that increasing the annealing temperature to 64 degrees eliminated false positives for the eight species. Dr Vennemann stated that the outcome depends not only on temperature but also on the total amount of both the target RNA and the chemical primers used during annealing to cause primer molecules to separate from the copy DNA. She noted that the amount of RNA available for testing was very small. In the result, she was not prepared to accept that the risk of "false binding" to animal copy DNA had been eliminated.

Use of the evidence by counsel

[62] In his opening address to the jury, and again in closing, Mr Morgan QC contended that Mr Lundy had his wife's brain on his shirt. He told the jury that the evidence about it was the most important evidence in the case.

[63] The Crown relied on the combination of central nervous system tissue and Mrs Lundy's DNA at the same two locations on the shirt. In his closing address, Mr Morgan suggested that Mr Lundy would have to be "the unluckiest man in the world" to have fresh animal central nervous system tissue land on his shirt followed, not once but twice, by "a lump of snot or mucus" from Mrs Lundy. The jury were also invited to dismiss as "silly" the defence theory, for which there was no evidence, that the tissue may have come from the food chain.

[64] Mr Morgan also cited the opinion of Dr Sijen that the tissue was more likely human than that of the animal species tested and suggested that she had expressed herself very conservatively. He also cited Professor Bustin's evidence about the GFAP marker in support of an argument that the NFI had excluded the food chain species.

[65] However, the jury were told that the mRNA evidence was not essential to the Crown case. Mr Morgan said of the evidence:

> So I just want to test you for a moment or two about this topic, I don't want it to really dominate my address to you, or even dominate the trial, despite the fact we had such a lot of evidence about it, because I say, on what I've already said to you, this is plainly Christine Lundy's brain. It's definitely central nervous system tissue. It's definitely her DNA only, human DNA. And there is no conceivable basis upon which you could decide that Mr Lundy was somehow in the presence or had access to fresh central nervous system tissue from any animal at all to get landed on his chest and landed on his sleeve. However, we have the evidence so let's address it.

[66] The defence maintained that the tissue may have come from the food chain. In his closing address Mr Hislop QC observed that Mr Lundy was the family cook and suggested that it might have been the product of food handling or cooking. Counsel summarised the defence experts' criticisms of the Crown's mRNA evidence, saying that the NFI's work was "not fit for purpose".

The Judge's directions about the evidence

[67] Simon France J summarised the Crown case as follows:

> [74] The starting point, and what the Crown would submit is the end point as well, are two facts:
>
> (a) first, on two separate parts of Mr Lundy's shirt, smeared into the fabric, was some fresh tissue which has been shown to be central nervous system tissue. CNS is tissue that can come only from the brain or the spinal cord, so it is wholly internal. It is not sneezed or coughed out for example. It has to be exposed by a cutting open. For example, when an animal is killed as part of food preparation, the brain and spinal cord tissue becomes accessible. And obviously, and sadly, we know it also happens when a person is killed in the manner Mrs Lundy and Amber were.
>
> So that is the first fact – on the shirt that Mr Lundy was wearing the night his wife was killed in a manner which exposed her brain, there was found smeared on the shirt, in two separate places, pieces of central nervous system tissue;
>
> (b) the second fact is that when these two pieces of tissue were cut out of the shirt, and tested for human DNA, each of them yielded significant amounts of one person's DNA, Mrs Lundy. No-one else's DNA was detected.
>
> [75] I set these two facts out in this manner because I think it captures the essence of Mr Morgan's argument on this part:
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> (a) Mrs Lundy was killed in a way that exposed large portions of her brain and flung them around the room;
>
> (b) CNS tissue was found smeared on the shirt her husband was wearing that same night;
>
> (c) on the same bits of shirt, in good quality amounts, Mrs Lundy's DNA was found.

[68] The Judge explained that the defence emphasised that science could not say whether Mrs Lundy's DNA came from the tissue or exclude the possibility that it was animal tissue. The Crown claimed that neither possibility sensibly arose on the facts, but it also tried to "shut off" the issue by trying to prove that Mrs Lundy's DNA came from the tissue.

[69] The Judge gave the jury a document summarising the mRNA evidence and what counsel said about it. He explained that to rely on the tissue the jury had to attribute its presence on the shirt to something Mr Lundy did, as opposed to

contamination from subsequent handling, and be satisfied that it was Mrs Lundy's brain tissue. He summarised Dr Sijen's evidence and the defence experts' criticisms of it. He noted that Professor Bustin appeared to accept that "standing alone, the [ACSBG1] and GFAP markers rule out cow, pig, sheep, and chicken as the tissue source" but disputed the legitimacy of basing conclusions as to the origin of the tissue on just two of the markers. He reminded the jury to consider "the lesser proposition that whether or not it is probably human, the NFI work at least eliminates the likely animal alternatives – cow, sheep, pig or chicken".

[70] The Judge concluded his discussion of the mRNA evidence by explaining that the Crown case did not rest on it. He contemplated that the jury might set it aside as unreliable. In that event it would still be necessary to assess the validity of the Crown's claim that the tissue was part of Mrs Lundy's brain from certain "basic facts", namely the combination of the way she was killed, the shirt Mr Lundy wore on the night, the presence of central nervous system tissue and the presence of her DNA in the same area.

Centrality and cogency of the evidence

[71] The proposition that the central nervous system tissue was Mrs Lundy's was central to the Crown case, but contrary to Mr Eaton's submission proof of that claim did not rest on the mRNA evidence. As just explained, it rested primarily on the IHC and DNA evidence and the absence of any alternative explanation for the tissue and her DNA ending up in the same locations. That was made clear to the jury.

[72] The Court of Appeal considered that Dr Sijen's opinion was somewhat equivocal and the defence attack upon her evidence must have reduced its impact. The Court concluded that the mRNA evidence did not exclude the food chain defence.[73]

[73] We agree that Dr Sijen's opinion that the tissue was more likely human than the other species was somewhat equivocal, and we accept that her evidence generally was subjected to sustained expert criticism that must have reduced the weight the jury

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73 CA judgment, above n 4, at [382]–[386].

attached to it. But we think it more likely than did the Court of Appeal that, when taken with Professor Bustin's evidence that the ACSBG1 and GFAP markers were acceptable, the mRNA evidence did tend to exclude the food chain defence. The Crown relied on his evidence about the two markers in closing, and as just noted, the Judge drew the jury's attention to it, reminding them that they must consider whether the mRNA evidence at least excluded the likely food chain species.

[74] However, we consider that the food chain defence was never viable, for several reasons. The first was that there was no narrative that might account for the inherently unlikely presence of a substantial lump of fresh central nervous system tissue on the shirt. It was never more than an hypothesis that scientific analysis of the tissue alone could not exclude. For example, there was no suggestion that the food Mr Lundy had eaten on the night of 29 August was a source of fresh central nervous system tissue.[74]

[75] Second, the presence of large quantities of Mrs Lundy's DNA on the same stained parts of the shirt invites the conclusion that she was the source of the tissue. Mr Eaton resisted this conclusion, arguing that the evidence does not show the tissue and the DNA came from exactly the same places on the shirt. He pointed out that DNA was obtained by eluting the entire fabric samples cut from the shirt, not just those parts of the cut-outs that were stained with central nervous system tissue, and emphasised that a person's clothes are routinely found to carry their partner's DNA. But the cut-outs were not significantly larger than the stains. The ESR scientist who made them deposed that the stains measured approximately 25 mm by 10 mm and 30 mm by 20 mm. He did not note the size of the cut-outs, saying only that he cut around the stains, but the processing cassettes in which they were set by Dr Miller measured 40 mm by 28 mm and photographs show that the cut-outs are smaller than that. And Susan Vintiner, an ESR analyst, deposed that the DNA was from a rich source, such as central nervous system tissue (or blood, for which the cut-outs tested positive and which might have come from the tissue itself),[75] while Dr Vennemann agreed that the DNA signal was strong and probably not the result of Mrs Lundy

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74 He purchased a deli meal comprising a piece of chicken and vegetables and also ate some pâté. There was evidence that central nervous system tissue dries out quickly when exposed to air and cannot be smeared into fabric. Professor Ironside considered that it might still smear if lightly heated, but there was no evidence to support that hypothesis.

75 Dr Daniel du Plessis confirmed that the tissue contained blood vessels.

touching the shirt. Mucus from sneezing was the only alternative source nominated by the defence.

[76] Third, had the tissue come from the food chain, smooth muscle tissue and/or collagen ought to have been found. The expert witnesses[76] agreed that the shirt samples contained central nervous system tissue and "nothing else". The defence sought to account for this in two ways. Professor James Ironside and Dr Colin Smith did not exclude the possibility that central nervous system could be the sole contaminant from, say, a neck chop.[77] And defence counsel suggested that forensic processes carried out by the ESR in 2000 might have removed such tissue, leaving only the central nervous system tissue. Those processes were the taking of a dab slide from the sleeve sample,[78] in which a wetted glass slide was rubbed on the stain, and the elution process in which the fabric was placed in liquid to extract DNA. The evidence was that elution would remove about 20 per cent of the cells present. We think it implausible that central nervous system tissue could have been the sole contaminant if meat was the source, and we observe that the experts thought it most unlikely that if other meat tissues were present the ESR processes would have removed all trace of them.

[77] Finally, large quantities of animal DNA should have been found in the elutions had the tissue come from a food chain species; and especially so if tissue, which is a rich source of DNA, had been washed off in the elution process. Animal DNA was present, but in quantities too small to explain the tissue. The ESR elutions were tested in 2014 by Elizabeth Wictum, an expert who specialises in forensic analysis of animal DNA. Her tests included a "meat ID" test, which is a very sensitive mitochondrial DNA test capable of detecting a smaller quantity of DNA than is found in a single cell. She identified DNA of pig and cattle in both samples and also sheep in the shirt pocket sample. The results were weakly positive, and the quantities present "barely

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[76] Dr Miller, Dr du Plessis, Dr Smith and Professor Ironside.

[77] Dr Smith initially accepted that the absence of other tissue made it unlikely that the source was the food chain, but in re-examination he accepted that it was possible if "relatively pure central nervous system tissue" is in foodstuffs sold in New Zealand.

[78] The dab slide appears to have been taken because the tissue on the sleeve formed a lump. The slide was the subject of much evidence at trial. Ultimately the experts agreed that the tissue on it had so degraded that it could not be identified. It did not detract from their consensus that the other paraffin block samples contained central nervous system tissue.

detectable". She found the evidence consistent with food spatter from cooking sausages, which we find an unlikely source of stains found to contain a large quantity of central nervous system tissue and nothing else. The quantity of animal DNA found was very much less than that of the human DNA also observable in the samples she tested.

Impact of the evidence on the defence case

[78] Mr Eaton argued that because the defence was forced to focus on meeting the mRNA evidence the opportunity was lost to mount a more comprehensive challenge to the IHC evidence. He submitted that IHC analysis was designed to identify cancerous cells in known tissue, not to identify tissue, and is still not validated for forensic use. He argued that it relies on subjective interpretation which introduces a risk of cognitive bias. However, the IHC evidence was thoroughly tested before trial, and as we have said, leading experts on both sides agreed at trial that the shirt samples contained central nervous system tissue. The Court of Appeal dismissed a renewed challenge to admissibility of the IHC evidence, and this Court denied leave to appeal on the point.[79]

[79] We accept that the need to counter the mRNA evidence must have been a significant distraction for the defence, but there is nothing before us to show that the defence case would have been any different had the evidence not been called.[80] There is no reason to think that the mRNA evidence affected Mr Lundy's decision to stay out of the witness box, and Mr Eaton did not suggest otherwise.[81] He did submit that because the defence had to focus on the mRNA evidence the opportunity was lost to pursue an "amplified" food chain defence, but he said that Mr Lundy is not in a position to articulate what that defence might be. The defence needed in any event to point to the possibility of contamination to explain the co-location of central nervous system tissue and DNA on the shirt, and that would also explain the mRNA evidence since any contamination must have happened before the case samples reached the NFI.

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79 CA judgment, above n 4, at [203]–[204]; and Leave judgment, above n 6, at [1] and [3].

80 The defence did make a late attempt to call expert evidence about fuel consumption at trial, but the delay was attributed primarily to late notice of a change in the Crown's case and the evidence was ruled inadmissible for other reasons, as the Court of Appeal explained: CA judgment, above n 4, at [278]–[287].

81 Compare *Cook*, above n 61, at [70].

Overall assessment

[80] We conclude that admission of the mRNA evidence was not a fundamental error but rather was capable of cure via the proviso. The Crown case rested on the claim that Mr Lundy had his wife's brain on his shirt, but that claim did not depend on the mRNA evidence. It depended rather on central nervous system tissue and Mrs Lundy's DNA being found together. The mRNA evidence also had limited probative value insofar as it supported the Crown case that the tissue was human. It had somewhat more value insofar as it excluded the likely food chain species, but the food chain defence had no prospect of success in any event. The evidence of Dr Sijen did not cause Mr Lundy to stay out of the witness box or alter the defence case.

The Court of Appeal's references to the jury's opinion

[81] Before turning to the proviso, we address Mr Eaton's argument that the Court of Appeal erred by referring to the jury's opinion. He submitted that the Court impermissibly deferred to the jury, and it did so when answering questions about which it cannot be known what the jury thought.

[82] The Court did refer to the jury's opinion in several places. For example, it said this when discussing the proposition that the central nervous system tissue may have been animal in origin:

> [343] Mr Eaton submits this was enough to found the defence that the CNS tissue on the shirt could be animal CNS tissue, but that plank of the case had been effectively denied [to] Mr Lundy because of the mRNA evidence. However, the amount of animal DNA detected by Ms Wictum was very small, and we think insignificant when compared with the substantial quantity of Mrs Lundy's DNA located on the shirt in conjunction with the CNS tissue. Quite apart from the mRNA evidence we consider it likely the jury would have discounted the possibility of the CNS tissue being animal in origin because of the vast distance between the small traces of animal DNA found and that of Mrs Lundy.

[83] The Court also referred to the jury's opinion when discounting the defence submission that stomach contents pointed to an earlier time of death. It suggested that a jury would find that Mr Lundy's car had enough fuel to make the return trip. And it remarked that other points taken by the defence, such as Mr Tupai's evidence that the

conservatory door was open at about 11 pm, "must have been rejected by the jury as not raising a reasonable doubt about Mr Lundy's guilt".[82]

[84] We have explained that an appellate court considers the impact of inadmissible evidence upon the trial when deciding whether a miscarriage happened and whether the proviso may be used to cure it. As part of that inquiry it will consider what effect the evidence may have had, or had, on the jury. When the court is assessing guilt it is permissible to consider what the jury did with the evidence, in those rare cases where the jury's opinion was not affected by the error and can be inferred from the trial record.

[85] In this case the Court of Appeal chose to combine its analysis of miscarriage and fundamental error with its own assessment of guilt. The passages to which Mr Eaton referred all appear in a single section of the judgment (headed "Miscarriage and fair trial") in which the Court evaluated the impact of the mRNA evidence on the trial and recorded its own findings of fact. We do not think that references to the jury distracted the Court from its task. The Court did not defer to the jury's findings of fact but rather formed and relied on its own view of the evidence. For example, the Court, after citing *Matenga*:

(a) concluded that the Crown had a very strong circumstantial case, founded on the IHC and DNA evidence;

(b) discounted the possibility of contamination of the shirt;

(c) excluded the possibility that Mrs Lundy's DNA arrived on the shirt though any normal domestic interaction;

(d) characterised the stomach contents evidence as inconclusive;

(e) decided that other defence contentions were insufficient to displace the implications of the central nervous system tissue and DNA on the shirt; and

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[82] CA judgment, above n 4, at [358].

(f) noted that it was able to form a view about guilt because the case did not turn on the credibility of witnesses.

[86] In any event, nothing ultimately turns on this ground of appeal since we must decide for ourselves whether the admissible evidence proved Mr Lundy's guilt. When approaching that decision we put the jury verdicts to one side.

Application of the proviso

[87] We turn to the question whether the admissible evidence proved Mr Lundy's guilt beyond reasonable doubt.

The tissue on the shirt came from Mrs Lundy's brain

[88] As just explained, the evidence establishes that the tissue was central nervous system tissue. It also excludes the possibility that the tissue came from the food chain; it was fresh and had it come from the food chain smooth muscle tissue and/or collagen would have been expected, along with large quantities of animal DNA.

[89] Subject to the possibility of contamination, which we reject below, the location of the central nervous system tissue and large quantities of Mrs Lundy's DNA in precisely the same places on the shirt is very strong evidence that the tissue came from Mrs Lundy's brain. There is a compelling inference that the DNA came from the blood found in the same places or from the central nervous system tissue itself, finding its way there during the murder of Mrs Lundy.

[90] We reject the defence suggestion that mucus, which is also a rich source, might explain the DNA. There is no narrative for that, and we think it very unlikely that Mrs Lundy sneezed mucus onto the shirt at precisely the same two places as the central nervous system tissue and the blood were found. We discount the possibility that transfer from one part of the shirt to the other explains the presence of central nervous system tissue and DNA from mucus in two places, if only because that would have had to happen when both the tissue and the mucus were fresh enough to smear into the fabric.

No evidence of possible contamination to explain the tissue on the shirt

[91] Mr Eaton did not develop the topic of contamination before us, choosing to focus on the tissue and DNA evidence, but he did not abandon the defence arguments made at trial and in the Court of Appeal about other parts of the case, including contamination. We have reviewed these arguments. The defence urged the jury to accept that the overall investigation and handling of exhibits lacked integrity, and it suggested specifically that the shirt samples may have been contaminated at two points. The first point was in a forensic bay at the Palmerston North Police Station, where the car was held after it was first seized. The defence made some headway with a claim that the police did not follow best practice at the crime scene – for example, there was evidence that some officers may not always have worn protective clothing – but the suggestion that the shirt may have been contaminated in police custody had no evidential foundation. Detective Curran removed the suit bag from the car and handed it to Detective Hansen, who removed items, recording any retained as exhibits. He handled the shirt, placing it in an exhibit bag where it remained until examined by the ESR. Both officers deposed that they wore protective clothing and gloves which they donned at the forensic bay. It appears that neither officer had been at the crime scene at all, and they searched the car several days after the murders. Further, the tissue was smeared onto the outside of the shirt, which was inside-out when located in the bag and remained in that state until examined by ESR some time later.

[92] The second possible point of contamination was at ProPath, before the fabric was embedded in paraffin blocks by Dr Miller on 4 February 2001. It was suggested that the fabric was contaminated by fresh brain tissue he had been experimenting with and that might explain why the quality of the paraffin block samples he produced was so much higher than that of the dab slide. (He had smeared chicken brain onto another shirt to ascertain whether the stained fabric could be embedded in paraffin then tested successfully.) The defence established that a diagnostic laboratory such as ProPath does not take all the precautions against contamination that are employed in a forensic laboratory. There was evidence that unknown DNA had found its way onto the chest pocket sample and that likely happened at ProPath.

[93] Dr Miller explained that the chicken sample was processed a week before the Lundy shirt, the benches on which he worked were cleaned daily and it is invariable practice to work on paper which is laid on the benches before beginning each new task. This evidence excludes the possibility that contamination accounts for the central nervous system tissue in the case samples he prepared.

Amber's DNA

[94] Amber's body was found in the doorway of the bedroom in which Christine was murdered. It seems likely that she had entered the room and was attacked as she fled. Very small particles of her blood were found when the ESR took tape lifts from the shirt.[83] The Crown suggested that it was no coincidence that her blood was found there. The defence case was that there was nothing unusual about such a finding. Amber had a healing scab on her right inner ankle, and the particles were flakes of dried blood rather than an actual stain. We think it improbable that contact between Amber's leg and Mr Lundy's shirt was the source, and we note there was evidence that fine blood spatter dries quickly and could have produced flakes when the shirt fabric moved or when the blood was removed by the tape lifts. This evidence supports the Crown case.

The paint fragments

[95] A substantial number of paint fragments were recovered from the scene and the bodies. Some were embedded in pieces of bone recovered from the master bedroom. Others were found when the bodies were washed at post-mortem. Fragments of paint were also found in plastic bags placed over the victims' heads to secure any loose material, and a bone sample taken from Mrs Lundy's skull carried paint fragments. An ESR trace evidence analyst, Dr Sally Coulson, gave evidence that paint fragments were embedded or fused onto the bone fragments.

[96] Mr Lundy was in the habit of identifying his tools by marking them with blue and orange paint. Several tools marked in that way were recovered from the garage and a storage lockup, along with tins of blue and orange paint.

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[83] The particles contained DNA which was 19 million times more likely to be Amber's than that of another randomly chosen person in New Zealand. The appellant accepts that it was her blood.

[97] The paint fragments taken from the scene and the bodies were blue and orange. Twelve of them were tested. Dr Coulson gave evidence that pale blue fragments could have come from a tin of paint found in the garage and on some of Mr Lundy's tools, by which she meant that the colour, chemical composition and elemental components were identical. The same was true of a pale blue fragment found with Amber's body. Similarly, the orange paint on the tools found in the garage could not be excluded as coming from the same source as the orange paint on one of the fragments found in the bedroom and four of those taken from Mrs Lundy's body. Some of the fragments contained more than one shade of paint.

[98] The Crown characterised the paint as a hallmark of Mr Lundy's. He admitted that he had repainted his tools each year (though he claimed he ceased doing so in 1985), which explained the different shades, and the presence of fragments containing more than one shade was powerful evidence that they came from a tool of his. The tools were locked in the garage and it would have been impossible for anyone else to gain access to them.

[99] The defence called Gillian Leak, a biologist with much expertise in forensic examination of crime scenes in the United Kingdom. She noted evidence that the spare bedroom had recently been redecorated, and she observed that there was no evidence to show that the population of paint fragments in the house generally was less than it was in the bedroom and on Mrs Lundy. She also suggested that a person who had used the painted tools or had been in the garage could end up with paint flakes in their hair. There was evidence that Mrs Lundy regularly spent time in the garage. The defence suggested that Mr Lundy would not have painted an axe because he had used paint to identify tools in the distant past when he was working on building sites and an axe or tomahawk is not a work tool; further, he painted the handles, not the heads or working edges. If such tool existed, it could easily have been left around the conservatory and so picked up by an intruder. Counsel emphasised that some of the paint fragments matched none of the tins found in the garage.

[100] We consider that the paint fragments support the Crown case that the murder weapon was a tool bearing blue and orange paint, a hallmark of Mr Lundy's. Cross-examination of Ms Leak tended to show that the alternative explanations were

unlikely. Notably, it is not likely that paint fragments at the scene were the result of redecorating; the house had been cleaned on 28 August and at that date redecorating equipment had been put away. Nor is it likely that Mrs Lundy would long retain in her hair and on her face paint fragments from tools used during redecorating. Ms Leak postulated that there could have been a fine dusting of paint flakes from the tools in the garage and these could be transferred by a draught, or by touching, but it is not clear what mechanism would have separated the paint from the tools hanging there. Some of the fragments were embedded in bone, suggesting that a blow transferred them from the murder weapon, and one of them came from the head of Amber, who was less likely to have been associating with tools.

A staged burglary

[101] The Crown contended that the murders were an "inside job" staged to disguise the crime as a burglary gone wrong. Its case began with evidence that Mrs Lundy's blood was found on an open window adjoining the conservatory door. This window had apparently been left open as a point of entry for a burglar. The catch was broken. Mrs Lundy's blood was smeared on the outside of the window, the transom and the inside lip of the window.

[102] The defence answer was that contamination might explain the blood. The adjoining conservatory door was used as the main point of entry by police and ESR staff, and one of them may have inadvertently left the blood when leaving the scene through the door. Personnel also removed their protective clothing near the window.

[103] It was common ground that the vicious nature of the attack suggested some personal antipathy. The evidence suggested Christine was asleep when attacked. The Crown also suggested that there would have been no reason for a burglar to attack Amber, a seven-year-old who presumably would not recognise or be able to identify them. The defence responded that there was no reason to assume the killer was acting rationally.

[104] The Crown also contended that the killing of Mrs Lundy was planned, basing that claim on the lack of forensic evidence elsewhere in the house. The killer must

have been covered in blood and brain tissue, but no trace was left outside the master bedroom and the doorway and hall where Amber's body was found, suggesting that the killer shed exterior clothing before leaving the house.[84] This was also the Crown's explanation for what the defence characterised as the striking absence of forensic evidence from Mr Lundy himself, or his car, or the motel in Petone.

[105] Finally, the only item taken was Mrs Lundy's jewellery box. Her car, purse, mobile phone, camera and laptop computer were left. A bracelet found on the front seat of Mr Lundy's car was attributed to Mrs Lundy and, the Crown contended, was likely to have come from the jewellery box. Mr Lundy, who identified it as hers, accounted for it by saying that Mrs Lundy must have dropped it in the car during a previous trip but there is evidence that it was too small and she never wore it.

[106] We consider that the blood on the window supports the Crown case that the killer wanted to mislead police into believing that access had been gained by forcing the window and reaching inside it to open the adjoining conservatory door. The evidence does not support the possibility of contamination. The taking of the jewellery box also suggests staging. We do not think that reliable inferences can be drawn either way from the absence of evidence of blood or tissue elsewhere at the scene, or on Mr Lundy or in his car or the motel in Petone.

[107] The evidence of staging provides some support for the Crown case because it points to the killer being someone known to the Lundys.

The car's odometer readings and fuel consumption

[108] We turn to the distance travelled by the car. It is the first of the three impossibilities posited by the defence, but it was also an affirmative part of the Crown's case. There are two parts to it. One concerns odometer readings and the other fuel consumption.

[109] We begin with the odometer readings. Mr Lundy's car was serviced on 21 August, when its odometer read 80,589 km. It read 81,859 km when the car was

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[84] Blood spatter extended several metres down the hall but it appeared to have come from the attack on Amber at the bedroom door.

seized. Both sides sought to account for the 1,270 km travelled during the intervening period; the Crown to show that on Mr Lundy's known movements there was a missing distance explicable by a 300 km return trip from Petone to Palmerston North, and the defence to show that the car was unlikely to have made that trip.

[110] Some of the distance travelled could be accounted for. Mr Lundy was known to have made a trip from Palmerston North to New Plymouth on 23 August, returning the following day, and one trip to Wellington on 29 August, returning the following day. His movements on eight days when he was in New Plymouth and in Palmerston North were unknown, but cellphone polling data and bank transactions showed that he did not leave those cities. His movements in Wellington on 29 and 30 August were known with some accuracy. A police analyst calculated, using the distances and most direct routes shown on Google Maps, that 847 km could be accounted for. The trial Judge suggested that the jury might increase that figure to about 867 km to better reflect the route Mr Lundy was likely to have taken, leaving 403 km unaccounted for.

[111] The Crown contended that local travel in New Plymouth on 23 and 24 August, and in Palmerston North on 21 to 23 August and 24 to 29 August, could not account for the remaining 403 km. To cover that distance the car would have had to average an additional 50 km on each of the eight days on which its movements were unknown or not fully accounted for.

[112] We accept Mr Eaton's submission that this is not compelling evidence of guilt, but it does tend to support the Crown's case that the car made the additional journey.

[113] We turn to fuel consumption. The car's fuel tank had a capacity of 68 litres. It was refuelled at Naenae at 3.07 pm on 29 August, and it is reasonable to infer that the tank was then full.[85] The Crown sought to show by reference to Mr Lundy's known movements that it then travelled about 202 km around Wellington and on the return journey he made when called home on the morning of 30 August. Its fuel warning light was showing when it was stopped by police at Palmerston North, and it was established that there was at that time 10.1 litres in the tank. The Crown contended

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[85] Mr Lundy told police that he was in the habit of driving until the fuel warning light came on then refilling the tank completely.

that this pointed to a return trip having been made. The defence contended that the car could not possibly have made the trip without running out of fuel.

[114] The car's fuel consumption was the subject of much attention at trial. The Crown's case was that:

(a) The manufacturer's fuel consumption figures for a Ford Fairmont Ghia were 13 litres per 100 km and 8 litres per 100 km in city and highway cycles respectively.[86] Using an Australian Department of Primary Industries report suggesting that drivers use on average about 16 per cent more fuel in city driving than the manufacturer's estimates, and about 35 per cent more in highway driving, the Crown arrived at rates of 15.08 and 10.81 litres per 100 km.

(b) Mr Lundy's car achieved an average consumption on its previous tank of fuel that was consistent with the Department of Primary Industries figures. The car had been refuelled on 23 August at Eltham, between New Plymouth and Palmerston North, and must have travelled a minimum of 461 km before being refuelled at Naenae. That would result in a consumption rate of 13.57 litres per 100 km on the Eltham tank. The Crown suggested that it likely travelled a further 125 km, resulting in a rate of 10.67 litres per 100 km.[87]

(c) On these rates of consumption the car could have made an additional return trip from Petone to Palmerston North although it would be, and was, low on fuel when stopped on the morning of 30 August.

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[86] Mr Lundy actually drove a Fairmont EL. Evidence at trial established that the manufacturer's rates for that model were 12.5 and 7.6 litres per 100 km, but the Crown continued to rely on the higher figures for the Ghia. In our analysis we have used the Fairmont EL figures.

[87] The minimum was calculated using Mr Lundy's known travel after refuelling at Eltham. Travel within New Plymouth on 23 and 24 August, and within Palmerston North between 24 and 29 August, was unknown. The estimate of an additional 125 km was apparently based on the odometer readings and rounded up. The Crown had estimated that the car travelled an unaccounted-for 423 km and 300 km of that was represented by the secret journey.

(d) Had the car driven only 220 km since being refuelled at Naenae its average consumption would have been a remarkable 26.32 litres per 100 km.[88]

(e) Mr Lundy is known to have driven at speed when he returned to Palmerston North on the morning of 30 August, but he would not want to risk drawing attention to himself when making the secret return trip in the dead of night.

[115] The Crown added that when Mr Lundy learned the police were investigating his fuel consumption he volunteered that fuel may have been siphoned from his car in Petone. He said that such thefts had happened several times, including at the same motel, because he often unlocked the fuel cap inadvertently when inserting the ignition key. The Crown claimed this was implausible, citing evidence that the act of inserting the ignition key did not unlock the fuel cap and such thefts are uncommon. Police had difficulty siphoning fuel from Mr Lundy's car because an anti-splashback valve made it difficult to get a hose into and out of the tank without damaging the valve.

[116] We note that the Crown also relied on evidence that Mr Lundy did not park his car in the motel car park on the evening of 29 August but rather left it on the street, suggesting that he wanted to ensure he did not come to the attention of other guests when he drove away in the early hours of the morning. Mr Lundy accounted for this in interview by saying he had driven to the Petone foreshore to read a book and left the car on the street when he returned because another car was blocking the motel entrance.

[117] The defence invited the jury to rely rather on evidence of actual journeys made by the police in 2000, driving a borrowed Ford Fairmont EL, as they originally sought to establish that Mr Lundy could have made a high-speed return trip from Petone to Palmerston North between the hours of 5.30 pm and 8.28 pm on 29 August. Detective Johanson made the trip three times, following slightly different routes.

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[88] The range given on the evidence was between 202 km and 230 km. The lower figure relied on Google Map estimates. In 2000, Detective Johanson had traced the route and covered 215 km but he did not go to all of Mr Lundy's destinations. Hence the estimate of 220 km.

He drove fast, at up to 140 km/h on the open road when he thought it safe to do so, and otherwise sought to replicate the effects of high-speed driving with heavy braking and acceleration. He achieved fuel consumption figures of 16.44 litres per 100 km for the return trip from Palmerston North and when retracing Mr Lundy's post-Naenae city travel. If one assumed that Mr Lundy drove in the same way on the secret 300 km return journey the car would have used 84.67 litres, more than its fuel tank could hold. The defence also suggested that the Fairmont EL was capable of much higher fuel consumption in ordinary use, pointing to evidence that Detective Johanson apparently achieved 27.7 litres per 100 km during a small amount of city driving in Palmerston North.[89]

[118] The defence also pointed to evidence that heavy acceleration consumes much fuel and observed that the manufacturer had no consumption figures for cars driven consistently above 100 km/h, as Mr Lundy's car was on the trip from Wellington to Palmerston North on the morning of 30 August. It relied on hearsay evidence of a Kevin Priest, a Ford technical service engineer who was interviewed by police in 2000. He believed this type of vehicle could use 58 litres of fuel if it drove between 50 and 100 km around town at an average speed of 50 km/h and between 150 and 170 km at an average speed of 140 km/h.[90]

[119] We observe that there is a linkage between the "missing" 403 km travelled and the car's fuel consumption. To explain the 403 km the defence had to posit that the car travelled a significant distance in Palmerston North following Mr Lundy's return from New Plymouth and before he went to Wellington and refuelled at Naenae, but the further it travelled in Palmerston North the lower was its rate of consumption on the Eltham tank. We consider that its consumption on that tank in Mr Lundy's hands is more reliable evidence of its consumption on the Naenae tank than are the rates achieved by Detective Johanson when driving aggressively or the untested opinion of

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89 He drove 18 km between return journeys to Wellington for which he refuelled the car at beginning and end.

90 During the trial the defence sought to call expert evidence about dynamometer testing of a Ford Falcon's fuel consumption. The application was not pursued after Simon France J indicated that in its then form the evidence was likely inadmissible. He gave leave to renew the application but it was not taken up. The Court of Appeal did not admit fresh evidence that a Ford Falcon used 36 litres per 100 km when driven hard on a racetrack, reasoning that the conditions were very different from those encountered when driving hard on the open road and citing the much lower figures achieved by Detective Johanson: CA judgment, above n 4, at [278]–[287].

Mr Priest. There is no reason to think that a secret return trip in the early hours of the morning would have been made at high speed.

[120] Mr Lundy did drive at speed when returning to Palmerston North the next morning. He told police that he encountered slow traffic en route but he drove much faster when he could. At one point a police patrol car recorded his speed at 140 km/h. A police analyst estimated by reference to the time and location when he took a phone call at the start of the journey and the time when he was stopped in Palmerston North that he averaged 100 km/h.

[121] We find it unlikely on the evidence before us that the car would have consumed 58 litres of fuel had it driven only 220 km. As noted above, that would be an average rate of 26.32 litres per 100 km. About 75 km[91] of that distance would have been travelled in normal city driving when a Fairmont EL should use somewhere between 12.5 and 14.5 litres per 100 km.[92] There is a large difference between 26.32 litres per 100 km and the rate of 16.44 litres per 100 km that Detective Johanson achieved when emulating a high-speed journey in a Fairmont EL. The point was put in another way at trial; had the car travelled 215 km at a rate of 16.44 litres per 100 km it would have had 32.65 litres of fuel left in the tank (rather than 10.1 litres). So on the evidence there is distance unaccounted for if the car did not make an additional return trip.

[122] The next question is whether the car could have made the return trip, in addition to its known travel, on 58 litres of fuel. The answer is that it could have done so if its fuel consumption lay between the factory and Department of Primary Industries rates. It likely travelled about 560 km[93] on the Eltham tank and used 62.54 litres at an average rate of 11.17 litres per 100 km. If it made the secret return trip it likely travelled 520 km on the Naenae tank and used 58 litres at an average rate of 11.15 litres per 100 km.

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91 Calculated by deducting the morning trip from Wellington on 30 August (approximately 145 km) from the car's estimated known travel on the Naenae tank (approximately 220 km).

92 The range uses the manufacturer's and adjusted Department of Primary Industries figures.

93 This assumes that the car travelled 100 km further on the Eltham tank than is accounted for by Mr Lundy's known travel, as discussed above at [110].

[123] The evidence establishes that fuel consumption rates are highly variable, depending on environmental factors (road and weather conditions), whether the vehicle has been correctly serviced, and driving style. In this case there is also a degree of uncertainty about the exact distances travelled on both the Eltham and the Naenae tanks, and as the defence pointed out at trial the notion of a "full" fuel tank also admits some variation. Allowing for these factors, we conclude that the odometer readings and fuel usage evidence do not exclude the possibility that the car travelled about 520 km on the Naenae tank, and so could have made the secret return trip.

Mr Tupai's evidence

[124] This was the second of the three impossibilities. As noted earlier, Mr Tupai, who lived next door to the Lundys, gave evidence that he saw the sliding door to the Lundy conservatory open at about 11 pm. The time could be fixed precisely because he was taking a telephone call from his father in Samoa. He said that he was outside in his garden and saw exterior security lights and some interior lights on and the conservatory sliding door half-way open. He had also seen it open the night before at about 11.30 pm, though he was uncertain about that. He deposed to hearing a noise like breaking glass at about midnight, when he was inside the sleepout in which he resided, but did not go out to investigate it.

[125] The defence suggested that the killer must have been in the house at that time and left the door open, apparently waiting for Mrs Lundy, who turned off the computer at 10.52 pm, to finish her evening rituals and go to bed. This rested on evidence that she was known to be security-conscious and was careful to lock up when Mr Lundy was away.

[126] We do not think this evidence points to the killer having been in the house at 11 pm. It is more likely that Mrs Lundy had not yet shut the door before going to bed. She must have been up at 11 pm because the computer had only just been turned off and interior and exterior lights were on. Although Mr Tupai was uncertain about it, he did give evidence that the same door was open late the previous evening. It also seems unlikely that someone who planned to attack Mrs Lundy after she had gone to bed would risk discovery by gaining access through the conservatory door, either

while it was open earlier in the evening or by forcing the adjoining window if it was closed, then waiting in the house until she had turned lights out and gone to bed. Mr Tupai's evidence does not exclude Mr Lundy.

Time of death

[127] This was the last of the three impossibilities. On the Crown theory of the case, the victims died after 2 am and likely after 2.30 am if, as the Crown suggested, Mr Lundy drove at prudent speed to Palmerston North. The defence contended that they died well before that time, based on their stomach contents.[94]

[128] Mrs Lundy purchased takeaway food from McDonalds at 5.43 pm. A Crown pathologist, Dr Martin Sage, and a leading defence expert in gastrointestinal function, Professor Michael Horowitz, agreed that it would normally take six to eight hours for a stomach to empty after eating such a meal, assuming an average rate of digestion. Dr Pang had given evidence at the first trial that the stomachs of both victims were "quite full" and the contents included potato chips and maybe fish. So the defence contended that they must have died before midnight, when Mr Lundy is known to have been in Petone.

[129] The experts agreed, however, that stomach contents are an unreliable indicator of time of death.[95] Professor Horowitz used an average rate of two kilocalories a minute, but the range is one to four kilocalories. There was evidence that digestion varies with the individual, what they ate, the time of day at which they ate, and whether they went to sleep after eating. Food that is high in fat has more calories and so takes longer to digest. In addition, it is not known whether the victims ate the McDonalds meal at once – there was evidence that Mrs Lundy was in the habit of reheating takeaway meals – or whether they did so but ate again later that night. Amber's usual bedtime was 8 pm, and the Crown accepted at trial that she likely did not eat after that

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94 It appears that a decision was made when the bodies were first found not to disturb them by taking internal temperatures or testing for lividity or rigor mortis, to ensure that evidence that might identify the offender was not compromised.

95 Professor Horowitz initially posited that this case was an exception because the duodenums were empty and gastric emptying had not begun. On this basis, the victims cannot have eaten any more than two hours earlier. However, this was based on the assumption that Dr Pang's observations were correct. Dr Sage responded that it is normal for the duodenum to appear empty at post-mortem.

time. Mrs Lundy likely did. Both stomachs appeared to contain thick fries and it was suggested that those from McDonalds were of the shoestring variety.[96] Finally, it is not clear just how full the victims' stomachs were when they died. The stomach is an elastic organ and Dr Pang's "quite full" assessment is both imprecise and subjective.

[130] We accept that the stomach contents evidence tends to point to a time of death that was earlier than, say, 2.30 am, which is about the time Mr Lundy might have arrived in Palmerston North if he left Petone at 1 am and drove normally, but it falls well short of excluding that possibility.

Motive

[131] The Lundys were in a financial crisis at the time of the murders. They had embarked on a vineyard venture and, among other things, urgently needed to settle the purchase of land. The transaction had already been delayed, and Mr Lundy had been told that it must settle on 30 August or he would face a claim for penalty interest of $100,000. The Lundys could not fund the venture from their own resources – their business was financially stretched – and attempts to secure investors had not borne fruit. On 28 August Mr Lundy had expressed concern that if forced to settle he would be bankrupt. The Crown contended that he saw Christine's life insurance policy as a way out. It also claimed that he lied by claiming in interview that he was not under financial stress.

[132] The defence suggested that the crisis was more apparent than real. Rather than sue the Lundys for non-performance the vendor likely would have cancelled and resold the land at a profit. Mr Hislop also argued it would have made no sense to kill Mrs Lundy on 30 August because the Lundys had recently increased the sum covered from $200,000 to $500,000 but they knew the increase had not yet taken effect.

[133] We accept that the Lundys' financial difficulties were real and supplied a potential motive.

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[96] Police officers who attended the post-mortems commented on the fries. Dr Sage explained that fries are a common part of gastric contents and remain readily identifiable. He suggested that McDonalds fries would have been conventional shoestring fries.

Evidence of another offender?

[134] The defence nominated other suspects at trial, seeking to explain the paint chips and staging, but they had been investigated and there was little if any evidence that might implicate them. The defence also pointed to evidence of unidentified fingerprints and footprints at the scene, hairs in Mrs Lundy's hands, and unidentified male DNA in fingernail scrapings. The Court of Appeal found none of this evidence cogent, and we agree.[97]

Other evidence

[135] There were other parts to the Crown case at trial. Notably, it also adduced evidence of Mr Lundy's conduct in video interviews, and it called a fellow prisoner who claimed that Mr Lundy said he killed Amber because she saw what he was doing to her mother. We attach no weight to this evidence.

Overall assessment

[136] We find that the central nervous system tissue on the shirt came from Mrs Lundy's brain and its presence there is not explained by contamination in police or ProPath custody. The evidence establishes these facts beyond reasonable doubt. It offers no alternative explanation consistent with innocence.

[137] We find that other parts of the evidence, notably but not limited to Amber's blood on the shirt, the paint chips and the apparently staged burglary, support the Crown case.

[138] Mr Lundy has cited the three impossibilities to displace the inference that the tissue arrived on the shirt as he murdered his wife. We find that they do not leave us with a reasonable doubt.

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[97] CA judgment, above n 4, at [357]–[358].

Decision

[139] Mr Eaton strongly urged us to grant Mr Lundy a third trial, emphasising that he has been twice tried and twice convicted on scientific evidence that was unreliable or otherwise inadmissible. But as we have explained above at [21], the evidential deficiencies in the first trial were remedied at the second. And the second trial must be examined on its own merits against the statutory appeal standard in s 385(1). Having done so, we are satisfied that admission of the mRNA evidence was not a fundamental error and the food chain defence that it was adduced to meet was never viable. The other evidence establishes beyond reasonable doubt that Mr Lundy murdered Christine and Amber Lundy. That being so, no substantial miscarriage of justice occurred at his trial. We will apply the proviso to uphold his convictions.

[140] The appeal is dismissed.

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