

SUPREME JUDICIAL COURT OF MASSACHUSETTS

Commonwealth v. McCowen

458 Mass. 461 (2010) · No. SJC-09935 · Decided December 10, 2010

OPINION

PER CURIAM.

458 Mass. 461 (2010) COMMONWEALTH v. CHRISTOPHER M. McCOWEN. SJC-09935 Supreme Judicial Court of Massachusetts, Barnstable. May 7, 2010. December 10, 2010. Present: MARSHALL, C.J., IRELAND, SPINA, COWIN, CORDY, BOTSFORD, & GANTS, JJ.[1] *463 Robert A. George (Gary G. Pelletier with him) for the defendant. Julia K. Holler, Assistant District Attorney, for the Commonwealth.

GANTS, J. A jury convicted the defendant of murder in the first degree on theories of extreme atrocity or cruelty and felony-murder, of aggravated rape, and of aggravated burglary. The defendant appeals from his convictions and from the trial judge's denial of his motions for a new trial.

On appeal, the defendant argues that (1) the judge erred in ruling that the defendant knowingly, intelligently, and voluntarily waived his Miranda rights after his arrest, and that his postarrest statements to the police were made voluntarily; (2) the indictments should have been dismissed because a grand juror knew the victim, and because the Commonwealth concealed exculpatory information from the grand jury; (3) the judge erred in denying the defendant's pretrial motions seeking a change in venue or, in the alternative, sequestration of the jurors for the entire trial; (4) the judge made various evidentiary rulings at trial that constituted reversible error; (5) the judge erred in discharging a deliberating juror without good cause; (6) the judge erred in denying the defendant's motion for a new trial because the prosecutor failed to disclose exculpatory information to the defendant; and (7) the judge erred in denying another motion for a new trial because the defendant was denied his right to an impartial jury by the racial bias of certain jurors.

The defendant also asks us to exercise our power under G. L. c. 278, § 33E, to reverse the convictions. We affirm the convictions and the judge's denial of the motions for a new trial. After a complete review of the record, we find no basis on which to reduce the degree of guilt or order a new trial under G. L. c. 278, § 33E. 1. Evidence at trial.

We summarize the facts the jury could have found from the evidence at trial, reserving certain details for our analysis of the issues raised on appeal. In the late afternoon of Sunday, January 6, 2002, Christa Worthington (victim) was found dead in her home in Truro by Tim Arnold, a former boy friend, who had stopped by the victim's *464 home to return a flashlight.

The victim was naked from the waist down, and her legs were spread apart. Her face was badly bruised, and her torso was splattered with blood. A vaginal swab indicated the presence of semen. The victim's two year old daughter was alive beside her, but she was unable to tell police investigators anything about her mother's death.

The exterior door leading from the driveway into the kitchen area and passageway where the victim was found was ajar, and damage to the door and deadbolt indicated that it had been forced open. The Commonwealth's medical examiner testified that the cause of death was a stab wound to the victim's chest; the knife had entered the front of the victim's chest and penetrated her left lung, and the tip of the blade had exited through her back.

The victim had also suffered contusions to her nose and chest, abrasions on her face, hands, arms, and legs, and internal hemorrhaging in her skull. The medical examiner testified that these injuries were consistent with blunt impact. Evidence presented at trial suggested that a struggle had occurred outside the house. Trace amounts of dried blood were found under the fingernails of the victim's left and right hands.

Small pieces of grass or other vegetative material were found entwined in the victim's hair, both on her head and in her pubic area. Outside on the ground between the house and the victim's automobile, crime scene investigators found a pair of woman's eyeglasses and barrette, a pair of socks, and the victim's keys. Near where the keys were discovered, just beside the victim's automobile, the dirt driveway had been disturbed.

Two long, irregularly parallel, furrow-like tracks led from the back of the automobile toward the entrance to the house. Police investigators were able to recreate similar markings by dragging a person across the driveway. Apart from the medical examiner's testimony as to time of death, which we will address later, the evidence would have allowed the jury reasonably to infer that the victim was killed after 8 P.M. on Friday, January 4, when she telephoned a babysitter, and before noon on Saturday, January 5, when she missed a hairdressing appointment.

Both the Saturday and Sunday newspapers were sitting uncollected at the bottom of her driveway when her body was discovered on Sunday afternoon. *465 In the course of their investigation of the murder, police detectives interviewed people who had known the victim or visited her property, including the defendant, who was employed by a private disposal company that removed the trash she left each week outside her residence.

On April 3, 2002, the defendant told State Troopers Christopher Mason and William Burke that he did not know the victim, had never spoken with her, and had no contact with her beyond an occasional wave as he picked up the garbage from a wooden bin in the yard.

The troopers told the defendant that they had recovered certain items from the crime scene and asked if the defendant would be willing to provide fingerprint or deoxyribonucleic acid (DNA)

samples in the future. The defendant told them he would have no problem providing these samples.

On March 18, 2004, after the State police crime laboratory identified a deoxyribonucleic acid (DNA) profile from various swabbings taken from the victim's vagina and breasts, Troopers Mason and Burke conducted a second interview with the defendant as part of a larger effort to collect DNA samples from men interviewed during the investigation.[2] The defendant repeated his assertions that he did not know the victim, had never spoken to her, and had never been inside her house.

He agreed to provide a DNA sample and police swabbed the inside of his cheek. The defendant's DNA sample was sent to the State police crime laboratory in July, 2004, with a batch of DNA samples from other persons. After receiving a written report on April 13, 2005, that the defendant "matched the major profile" in the DNA mixture taken from the victim's right breast and was "included as a potential contributor of the minor profile" in the DNA mixture taken from the sperm in her vagina, the State police obtained warrants for the defendant's arrest and the search of his residence.

Police officers arrested the defendant at his home in Hyannis shortly after 7 P.M. on April 14, 2005, and transported him to *466 the South Yarmouth State police barracks for questioning and booking. After the defendant waived his Miranda rights, Troopers Mason and Burke conducted a six-hour interview of the defendant, which the defendant declined to allow to be recorded.

The defendant again said that he had never been in the victim's home and had never spoken with her. He admitted to having sex with some women on his trash route, but said that the victim had not been one of those women. He said the last time he picked up trash at the victim's home was the Thursday before her body was discovered, and that he had not been there since this last pickup.

When Trooper Mason showed the defendant the DNA report and told him that the crime laboratory had concluded that it was his DNA on the body of the victim, the defendant looked at the report for approximately one minute and said, "It could have been me."

The defendant then told the officers that, on Friday night, January 4, 2002, he was with Jeremy Frazier and had gotten "piss ass drunk" in the parking lot of the Juice Bar, an Orleans club.[3] Frazier drove him to Dennis, where the defendant visited with the mother of his baby for about forty to sixty minutes, and then they returned to the Juice Bar. He said he drank to "blackout" that evening, did not recall what he did after returning to the Juice Bar, and did not "remember having sex with this lady."

When Trooper Mason told him that recalling one small event will often trigger a recollection of the surrounding events, the defendant admitted that he had had consensual sex with the victim that

night. He added that "[a]nything could have happened. I know I didn't kill her."

The defendant then recalled that Frazier had driven him to the victim's home, following the defendant's directions, and that Frazier had accompanied him inside the house when they arrived. He said he and the victim had engaged in vaginal sex on the floor in the hallway off the kitchen (where the victim's body was found), but then said they may have had sex in an office or the living room.

Initially, he said everything was "cool." He said that, as he and the victim parted, he gave the victim his telephone number, and then left, but he later said that the victim "flipped" *467 when she saw Frazier going through her belongings and began screaming at them as they were leaving.

The defendant gave various versions as to what happened next. He first said that when the victim angrily confronted Frazier, Frazier started punching the victim and followed her as she ran back to her house, while the defendant remained in Frazier's automobile. He then said that he told Frazier that the victim had a telephone to her ear and was contacting the police from the house,[4] that Frazier ran to the residence and kicked in the front door while the defendant remained in the automobile, and that Frazier was in the residence for approximately ten minutes before returning to the automobile.[5] After Troopers Mason and Burke told him that they felt he still had more to say, the defendant said, "It was a mistake."

He then told the troopers that, after Frazier struck the victim, he (the defendant) "automatically started firing on her" and punched the victim in the face and chest once, knocking her out. He said that when the victim fell, her head hit the gravel driveway "so hard that he could still hear it to this day."

After she was on the ground, the defendant said, "We put the boots to her." He and Frazier then dragged the victim inside the residence, and he watched as Frazier took a knife from the kitchen and stabbed her in the chest.

As if in conclusion, the defendant stated, "I had sex with her... I beat her ass, but it was [Frazier] that stabbed her." He told the officers, "I never meant for that lady to get killed. It's a nightmare after nightmare. And not a day goes by that I don't think about it." When asked what he would say if the troopers determined that Frazier was somewhere else that evening, the defendant responded, "Then it's all on me...."

Frazier testified that he was with the defendant at the Juice Bar that night and drove him to Dennis to visit the mother of his baby, but said that he later returned to the Juice Bar and went to a house party in Eastham in a vehicle driven by a friend, Shawn Mulvey. According to Frazier, the defendant followed them to the party in a separate vehicle that he drove.

Frazier *468 testified that after the house party broke up, he left with Mulvey and spent the night at Mulvey's house. Mulvey testified that "[t]here is no doubt in my mind" that Frazier spent the night at his house. Both Frazier and Mulvey testified that the defendant was at the house party, but did not leave with them.[6] The Commonwealth's DNA analyst, Christine Lemire, testified that the DNA profile obtained from the swabbing of the victim's right breast was a mixture of DNA from more than one source, with the defendant's DNA matching "the major profile" and the victim "included as a potential contributor of the minor profile in this mixture."

Lemire testified that the statistical probability of such a match occurring in the major profile was one in 5.2 trillion among the Caucasian population, one in 99.8 billion among the African-American population, and one in fifteen trillion among the Hispanic population.

The DNA profile obtained from the swabbing of the victim's vaginal cavity was also a mixture of DNA from more than one source, with the victim's DNA matching "the major profile" and the defendant "included as a potential contributor" of the minor profile. Lemire testified that the statistical probability of such a match occurring in the minor profile was one in 7.2 billion among the Caucasian population, one in 1.1 billion among the African-American population, and one in 10.2 billion among the Hispanic population.

The DNA profile obtained from a swabbing of the victim's left breast was also a mixture of DNA from more than one source, with the victim's daughter's DNA matching "the major profile"[7] and the victim and defendant included as potential contributors of the minor profile.

The probability of a randomly selected unrelated individual having contributed DNA to this mixture was approximately one in sixty-two among the Caucasian population, one in 769 among the African-American population, and one in 124 among the Hispanic population.[8] The testing done on the male DNA detected in the fingernail clippings *469 taken from the victim's right hand did not allow for as definitive a conclusion.

The analyst testified that the defendant was a potential contributor to this DNA sample and that the frequency of occurrence of this DNA profile was one in six among the Caucasian population, one in twelve among the African-American population, and one in eight among the Hispanic population. 2. Motion to suppress the defendant's postarrest statements.

Before trial, the defendant moved to suppress his postarrest statements to Troopers Mason and Burke. The judge denied the motion following an evidentiary hearing. On appeal, the defendant renews his argument that he did not knowingly, intelligently, and voluntarily waive his Miranda rights, and that his statements were not made voluntarily.

Although the voluntariness of the defendant's statements was decided by the jury under the humane practice rule, see *Commonwealth v. Cryer*, 426 Mass. 562, 571 (1998), the defendant directs his challenge on appeal primarily to the judge's pretrial ruling.

Therefore, in considering the defendant's present challenge, we rely on the findings of fact made by the judge following the suppression hearing, recognizing that the testimony presented at trial concerning the voluntariness of the defendant's statements was in all significant respects identical to that presented at the motion hearing.

We accept as true the subsidiary findings of fact made by the judge in the absence of clear error and give deference to his credibility findings, because he had the opportunity to observe and evaluate the witnesses as they testified. See *Commonwealth v. Peters*, 453 Mass. 818, 822-823 (2009).

We do, however, "make our own independent determination on the correctness of the judge's application of constitutional principles to the facts as found." *Commonwealth v. Tavares*, 385 Mass. 140, 145, cert. denied, 457 U.S. 1137 (1982), quoting *Brewer v. Williams*, 430 U.S. 387, 403 (1977).

The judge found that around 7 P.M. on April 14, 2005, the defendant was arrested, handcuffed, and led from his home to a police cruiser. There, Trooper Mason advised the defendant that he was under arrest for the murder of the victim and read him his Miranda rights from a standard waiver of rights form.

The defendant said that he understood his rights and wanted to discuss the case, but Trooper Mason told him to wait until their arrival at the State police barracks where recording equipment would be available. *470 At the State police barracks, the defendant was taken to a conference room, where he sat with Troopers Mason and Burke, and his handcuffs were removed.

At 7:32 P.M., he was again read his Miranda rights from a waiver of rights form, which the defendant signed first to acknowledge receipt of his rights and then to waive them. Trooper Mason asked the defendant if he would consent to having the interview recorded and the defendant said he did not want to be recorded unless his refusal would "make me look like an asshole."

Trooper Mason informed him that courts preferred that interviews be recorded, but the decision belonged to the defendant. The defendant declined to be recorded and signed a standard form declaring his unwillingness to consent to a recording. Trooper Mason also advised the defendant of his right to make a telephone call and told the defendant that a telephone was available whenever he wanted to use it.

The defendant said that he wanted to talk with the officers first "to straighten everything out" and that later he would telephone his girl friend. Trooper Mason offered the defendant medical attention, but the defendant did not ask to see a doctor or appear to be in physical or mental distress. Troopers Mason and Burke conducted the interview in "a loose format," without raising their voices, and the defendant was talkative.

As described earlier, the defendant initially restated his denial of any involvement with the victim and then, after being confronted with the DNA report, gave multiple versions of the events of the night of Friday, January 4, 2002. At 11:20 P.M., pizza and soda were brought to the interview room; the defendant accepted a soda but declined the food.

After the defendant gave his final version of events, in which he admitted that he had joined Frazier in hitting and kicking the victim, and that Frazier had stabbed her in the chest, Trooper Burke stepped out of the interview room and the interview stopped. During the break, the defendant said that he knew he could have a lawyer but wanted to cooperate instead.

He said he wanted to contact his attorney to arrange for the attorney to meet him at court in the morning, and placed a telephone call to his attorney at 12:09 A.M., leaving a voice mail message. Trooper Mason told the defendant that they would proceed with booking, but the defendant said that he was not finished discussing the case. Trooper Mason twice expressed *471 his willingness to wait for the defendant's attorney, but the defendant said he wanted "to clear things up," and they returned to the interview room.

The defendant provided no significant new information in the discussion that followed. At 12:40 A.M., Trooper Burke advised the defendant of his right to a prompt presentment through a standard form, and the defendant waived his right. At 1:15 A.M., the defendant asked to telephone his girl friend, and was allowed to make the call. At 1:35 A.M., after the defendant said that his story was not going to change, the interview terminated.

During the interview, the defendant was sober and not under the influence of marijuana, Percocet, or alcohol. Nor did he suffer "from any defect of intellect or mental disorder." He was responsive to the questions, and gave "rational, cogent answers," at times "in a narrative form." His signatures on the various rights forms were "firm, clear and consistent," and his diagrams of the crime scene were "accurate."

The troopers' interrogation was "not heavy-handed but more in the nature of guiding a co-operative, albeit cagey, witness." The judge's findings of fact are fully supported by the evidence in the motion hearing record and are not clearly erroneous.

We conclude, as did the motion judge, that the defendant was twice advised of his Miranda rights and twice waived them, first in the police cruiser and later at the commencement of the interview in the conference room.

We also conclude that the defendant's waivers were knowingly, intelligently, and voluntarily made. The defendant wished to speak to the troopers in an attempt, in his words, "to straighten everything out" following his arrest for the victim's murder. His refusal to be recorded, which immediately followed his second waiver of his Miranda rights, demonstrated that he could say "no" to the police when he wished.

The test for voluntariness of a defendant's statement is "whether, in light of the totality of the circumstances surrounding the making of the statement, the will of the defendant was overborne to the extent that the statement was not the result of a free and voluntary act." *Commonwealth v. Selby*, 420 Mass. 656, 663 (1995).

In addressing the voluntariness of the defendant's statement, the judge carefully weighed the evidence before *472 him, which, in addition to the facts we have discussed, included a videotaped record of the arrest itself, the defendant's booking photograph, and extensive testimony from multiple witnesses on the question of the defendant's demeanor and sobriety.

There is nothing in the record that leads us to question the judge's determination that the defendant's statement was voluntary beyond a reasonable doubt. Although the six-hour period over which the interview unfolded was lengthy, there is nothing in the judge's findings or our own independent review of the record to suggest that the defendant's will was overborne to the extent that his statement was not the result of his free and voluntary act.

See *id.* at 662-663. Despite the defendant's contention that he is "marginally retarded," the judge was entitled to rely on the testimony of the troopers who conducted the interview in finding that the defendant gave "rational, cogent answers" during the extended interview, and that the defendant attempted "to talk his way out of his predicament." See *Commonwealth v. Brown*, 449 Mass. 747, 766-768 (2007) (where defendant raised claim of mental illness, finding of voluntariness supported by testimony that he did not appear to have difficulty understanding and responding to questions); *Commonwealth v. Beland*, 436 Mass. 273, 281-282 (2002) (even though defendant suffered from mental deficiencies, statements made voluntarily where judge credited police testimony that defendant's statements were "articulate and coherent," and where defendant gave exculpatory explanation of events to police officers).[9] 3.

Motions to dismiss the indictments. Both before and during trial the defendant moved to dismiss the indictments based on *473 claims that the integrity of the grand jury had been violated. On appeal, the defendant argues that it was error for the judge to have denied these motions.

We disagree. The defendant contends first that the indictments should have been dismissed when it became apparent, days after the indictments issued, that one of the grand jurors knew the victim, the victim's child, and the child's father.

The defendant argues that this grand juror could not have been impartial, and that her presence compromised the integrity of the grand jury. Before the motion was filed, the grand juror was questioned by a judge (who was not the motion judge[10]) without the presence of counsel, and a transcript was made of the interview.

The grand juror acknowledged that she knew the victim, the victim's child, and the child's father, and stated that she had been "totally destroyed" by what she saw and learned while on the grand

jury.[11] She also said that, when the grand jury were selected, she felt it was "okay for me to sit" as a grand juror because, when asked if she could put her feelings aside, she felt that she could and believed she had done so.

"It is clear that a grand jury must act in a manner consistent with their oath," which includes the obligation to indict no one "based on `hatred or malice.'" *Commonwealth v. McLeod*, 394 Mass. 727, 733-734, cert. denied sub nom. *Aiello v. Massachusetts*, 474 U.S. 919 (1985), quoting G. L. c. 277, § 5 (grand juror's oath). Where a defendant makes a prima facie showing of grand jury bias or prejudice so egregious that it suggests that the grand jury returned an indictment based on "envy, hatred or malice" rather than the evidence in the grand jury record, further inquiry is warranted.

See *Commonwealth v. McLeod*, supra at 733-734 & n.10. Evidence that a grand juror knew the victim and members of her family falls well short of the showing of bias or prejudice necessary to require such an inquiry, especially where, as here, the grand juror had said that she put her personal feelings aside during the proceedings and there is no evidence to the contrary.

See *id.* at 734 ("fact that grand jurors may have some familiarity with an alleged crime, bring this information into the grand jury *474 room, and act on it, is not sufficient to require either further inquiry into alleged prejudice or the automatic dismissal of an indictment"); *Commonwealth v. McNary*, 246 Mass. 46, 54 (1923) ("It is an ancient principle of grand jury procedure that [grand jurors] may act on personal knowledge...").

Cf. *Commonwealth v. Monahan*, 349 Mass. 139, 155-156 (1965) (grand jurors' exposure to extensive, adverse publicity implicating defendant in case provides no basis to conclude grand jury were biased against defendant).

The motion judge correctly ruled that the grand juror's personal knowledge of those affected by the crime did not require her disqualification or otherwise impair the integrity of the grand jury. See *Commonwealth v. O'Dell*, 392 Mass. 445, 449-451 (1984) (dismissal of indictment required only where defendant has shown impairment of integrity of grand jury proceedings).

The defendant also argues that the prosecution knowingly presented false evidence to the grand jury that "so seriously tainted the presentation to that body that the indictment should not have been allowed to stand." *Id.* at 447. Frazier testified before the grand jury that, after a fight broke up the house party that followed the event at the Juice Bar on the night of January 4, 2002, Shawn Mulvey drove him to Mulvey's house, where he spent the night.

The defendant contends that Frazier's account was false and that the prosecutor presented Frazier's testimony to the grand jury knowing it to be false. The defendant also contends that the prosecutor concealed exculpatory evidence by failing to reveal to the grand jury that Mulvey (who did not testify before the grand jury) initially had denied to police that Frazier slept at his house that night.

To justify dismissal of an indictment, a defendant must show not only that false or deceptive evidence was given to the grand jury knowingly and for the purpose of obtaining an indictment, but also that on the entire grand jury record, the false or deceptive evidence was material to the question of probable cause and probably made a difference in the grand jury's decision.

Commonwealth v. Mayfield, 398 Mass. 615, 621-622 (1986). The defendant has failed to show that Frazier's grand jury testimony was false, much less that the prosecutor knew that it was false. After the indictments were returned, Shawn Mulvey admitted to police that he drove Frazier home with him after the house *475 party and that Frazier spent the night at Mulvey's home.

At trial, Mulvey testified that he had initially claimed to have no memory of the evening in the hope of avoiding any involvement in the case, but that he was in fact "one hundred percent sure" that Frazier had spent the night at his house. Nor was Mulvey's earlier false statement to police investigators exculpatory.[12] In his initial statement, Mulvey had not contradicted Frazier's testimony that he had spent the night of January 4, 2002, at Mulvey's house; he had only told police that he could not recall anything about that night.

Moreover, as the judge recognized, the DNA evidence tying the defendant to the victim, along with the defendant's various statements to the police, provided the grand jury with more than sufficient evidence to support a finding of probable cause.

The failure to disclose Mulvey's initial statement to the police therefore could not have affected the grand jury's decision to indict. See *id.* at 621. 4. Motion for change of venue or juror sequestration. In light of extensive media coverage of the murder, the three-year police investigation, and the pretrial proceedings, the defendant sought a change of venue pursuant to Mass. R. Crim.

P. 37 (b), 378 Mass. 914 (1979), or, in the alternative, sequestration of the jurors. The judge denied the motion for a change of venue before commencing jury selection, but said that he would reconsider his ruling if he determined during jury selection that it would not be possible to seat a fair and impartial jury. He also denied the motion for sequestration of the jurors, but said that he would reconsider that ruling if developments during trial suggested that the media were disregarding his order not to communicate with the jury or that the jury were disobeying his order to avoid exposure to media coverage of the trial.

The defendant contends that these rulings deprived him of his right to a fair and impartial jury. A judge has substantial discretion in deciding whether to grant a motion for a change of venue or whether to sequester jurors. See *Commonwealth v. Clark*, 432 Mass. 1, 10 (2000); *Commonwealth v. James*, 424 Mass. 770, 775 (1997), and cases cited.

The judge did not abuse that discretion here. *476 A trial judge may order a change of venue if "there exists in the community where the prosecution is pending so great a prejudice against the

defendant that he may not there obtain a fair and impartial trial." Mass. R. Crim. P. 37 (b) (1). "A trial judge should exercise his [or her] power to change the venue of a trial `with great caution and only after a solid foundation of fact has been first established.'" Commonwealth v. Clark, supra at 6, quoting Commonwealth v. Colon-Cruz, 408 Mass. 533, 551 (1990).

"The mere existence of pretrial publicity, even if it is extensive, does not constitute a foundation of fact sufficient to require a change of venue." Commonwealth v. Colon-Cruz, supra. "Rather, a defendant must show that in the totality of the circumstances, `such publicity deprived him of his right to a fair trial.'" Commonwealth v. James, supra at 776, quoting Delle Chiaie v. Commonwealth, 367 Mass. 527, 532 (1975).

In evaluating the risk of prejudice posed by pretrial publicity, we give careful attention to the evaluation of the trial judge, especially one who, as here, presides in the county where the crime occurred and is familiar with the nature and pervasiveness of the pretrial publicity.

Here, the defendant has shown nothing more than the existence of substantial pretrial publicity surrounding the murder of the victim and the arrest of the defendant. In selecting the jury, the judge conducted an individual voir dire where he asked each prospective juror whether he or she had read, seen, or heard anything about the case from any source and, if so, whether this information would affect the prospective juror's ability to render a fair and impartial verdict.

The judge, after appropriate inquiry, properly excused the one prospective juror who indicated that he could not be fair and impartial as a result of the media coverage. We have carefully examined the transcript of the jury selection and conclude, as did the judge, that the pretrial publicity did not prevent the selection of a fair and impartial jury.

The record reflects that the judge also properly exercised his discretion in initially refusing to sequester the jury, and in taking appropriate steps to ensure that the jury were shielded from media reporting of the trial.

Before empanelment of the jury, the judge issued orders protecting the jury from being photographed by the media and prohibiting reporters from contacting *477 or communicating with jurors before they reached their verdicts; he enforced these orders aggressively during the course of the trial.

The judge repeatedly questioned the jury throughout the course of the trial to determine whether any juror had learned anything about the case outside the court room, and carefully instructed jurors to avoid media reports about the case and to refrain from discussing the case with friends and family members.

The judge was entitled to assume that the jurors would follow his instructions. Commonwealth v. Clark, supra at 10. When, during jury deliberations, a juror's involvement in a criminal matter

unrelated to the defendant's case, see *infra* at 486-489, increased the risk that media coverage would affect those deliberations, the judge appropriately exercised his discretion once again and sequestered the jurors in order to address the changed circumstances.

We conclude that the judge acted reasonably within his discretion both when he decided not to sequester the jury at the commencement of trial and when he decided to sequester them during their deliberations. 5. Evidentiary rulings at trial.

The defendant claims the judge erred by admitting in evidence certain inculpatory information and excluding certain exculpatory information. He argues that these errors entitle him to a new trial. We consider each of these claims in turn. a. Prior bad acts evidence. Over the defendant's objection, the judge allowed Trooper Mason to testify during redirect examination that, apart from the contradiction between the laboratory report indicating that the defendant's DNA had been found on the victim's body and the defendant's denials that he had had any contact with the victim beyond picking up her garbage, two factors that weighed in his decision to seek an arrest warrant against the defendant were that the defendant had five protective orders brought against him by five different women and a number of criminal charges in the Barnstable Division of the District Court Department.

The defendant argues that admission of this latter evidence unfairly invited the jury to convict him because of his bad character or his propensity to abuse women. While the prosecution "may not introduce evidence that a defendant previously has misbehaved, indictably or not, for the purposes of showing his bad character or propensity to commit *478 the crime charged," such evidence may be admitted if relevant for some other purpose, and if the probative value of the evidence outweighs the risk of unfair prejudice.

Commonwealth v. Helfant, 398 Mass. 214, 224-225 (1986). The judge instructed the jury immediately after the admission of this bad act evidence (and again in his final charge) that this evidence was admitted for the limited purpose of explaining the trooper's decision to obtain an arrest warrant and to confront the defendant with the DNA report after he was arrested rather than before his arrest.[13] The judge also told the jury that they were not permitted to use the information to infer that "if somebody did something in the past, then they must have done the matter that we're now on trial for.

That's never allowed." Whether evidence of prior bad acts is relevant, and whether the probative value of such evidence is outweighed by its potential for unfair prejudice, are determinations committed to the sound discretion of the trial judge and will not be disturbed by a reviewing court absent "palpable error." *Commonwealth v. Fordham*, 417 Mass. 10, 23 (1994).

Commonwealth v. Robertson, 408 Mass. 747, 750 (1990). To evaluate whether the judge abused his discretion in allowing this testimony, we examine his decision in the context of the trial.

During the direct examination of Trooper Mason, the judge sustained the defendant's objection to the admission of evidence regarding the prior protective orders issued against the defendant and his denial that he had an anger management problem.

The judge asked defense counsel whether he intended to bring up these issues on cross-examination, and defense counsel assured him he would not. On cross-examination, however, defense counsel repeatedly questioned Trooper Mason concerning the adequacy of the evidence supporting the defendant's arrest.

The inference the defense attorney sought the jury to draw from this line of questioning was that Trooper Mason had decided to arrest the defendant based solely on the DNA report and the defendant's prior denials of any personal contact with the victim, and that *479 this was "a pretty thin case." Trooper Mason mentioned that there was additional information in the arrest warrant affidavit, but did not describe that information.

Defense counsel also elicited from Trooper Mason that Tim Arnold had not been arrested for the victim's murder, even though Arnold's semen and hair were found at the crime scene and Arnold had a "rocky relationship" with the victim.[14] He asked why the defendant was not "allowed the luxury of being brought in for an interview as opposed to being arrested."

Trooper Mason answered that there were "were other things that I considered." When the prosecutor attempted to rebut the suggestion that Trooper Mason had acted unfairly through a series of questions to Trooper Mason on redirect examination, the judge agreed with the prosecutor that, by pursuing a "fundamental theme" in cross-examination that "the lead investigator has been less than scrupulously fair," the defendant had "opened the door" to the admission of the bad act evidence for the limited purpose of explaining Trooper Mason's state of mind in arresting the defendant.

The judge did not abuse his discretion in admitting the evidence subject to his firm limiting instructions. By challenging the good faith of the lead investigator in the case, defense counsel invited a fuller explanation of the investigator's reasons for applying for an arrest warrant against the defendant.[15] We also note that the evidence admitted regarding these prior bad acts was limited.

The prosecutor did not elicit any testimony about the conduct that resulted in the protective orders or when they had issued. Nor did the prosecutor elicit any description of the District Court charges against the defendant or of their disposition. No *480 further mention was made of these prior bad acts during the trial or in closing arguments. They were referred to again, at the request of the defendant, only during the judge's charge to the jury for the sole purpose of reminding the jury of the limited purpose for which the evidence was admitted. b. Medical examiner testimony.

The autopsy of the victim was conducted by Dr. James Weiner, but Dr. Weiner was unavailable to testify at trial due to illness; in his place, the prosecution called Dr. Henry Nields, whose knowledge of the case derived solely from his review of the reports, notes, and charts prepared by Dr. Weiner.

The defendant argues that his right to confrontation, as guaranteed by the Sixth and Fourteenth Amendments to the United States Constitution, was violated by the admission of testimonial hearsay the opinions and factual findings in Dr. Weiner's reports and notes through the testimony of Dr. Nields.

In his direct examination, Dr. Nields testified in detail from Dr. Weiner's notes and reports as to Dr. Weiner's observations of the victim's body and his findings as to the nature of her wounds when he arrived at the scene of the crime at 7:55 P.M. on January 6, 2002, and when he conducted the autopsy on January 7. Three charts prepared by Dr. Weiner documenting the location and nature of the wounds on the victim's body were admitted in evidence.

Dr. Nields also testified to Dr. Weiner's opinion as to the time of death of the victim, which was "an estimated postmortem time of twenty-four to thirty-six hours." [16] The observations, findings, and opinions of Dr. Weiner reflected in his notes and reports were testimonial hearsay, because a reasonable person in his position would anticipate that they would be used against the accused in investigating and prosecuting a crime, and they were offered for the truth of the matters asserted.

See *Commonwealth v. Nardi*, 452 Mass. 379, 392-394 (2008). As the Commonwealth concedes, it was error for the judge to permit Dr. Nields to testify to what Dr. Weiner saw, found, and opined. See *Commonwealth v. Durand*, 457 Mass. 574, 585 (2010) (substitute medical examiner may not testify to factual findings made at autopsy by unavailable medical examiner); *Commonwealth v. Nardi*, supra at 392, 394 (same).

Because the defendant failed to object at trial to the admission of this testimonial hearsay, we consider whether its admission resulted in a substantial likelihood of a miscarriage of justice. See *Commonwealth v. Nardi*, supra at 394.

We conclude that it did not. The facts that Dr. Nields recited from Dr. Weiner's notes and report concerning the physical condition of the victim's body at the crime scene had already been admitted in evidence through the testimony of multiple other witnesses who had observed the crime scene and gave nearly identical firsthand descriptions of the victim's body after she was found.

The facts concerning the location and nature of the victim's injuries that Dr. Nields recited from Dr. Weiner's notes and reports had been previously admitted in evidence through the testimony of State Trooper Carol Harding, who attended the autopsy, testified to each injury Dr. Weiner examined during the autopsy, and authenticated ten photographs from the autopsy that

documented the victim's injuries and that were admitted in evidence.[17] As to these facts, the testimonial hearsay erroneously admitted in evidence added nothing of significance to the evidence properly admitted.

Dr. Weiner's opinion as to the estimated time of death of the victim, however, was not in evidence except through the erroneously admitted testimonial hearsay. See *Commonwealth v. Nardi*, supra at 394. Although Dr. Nields properly could have testified to his own opinion as to time of death, based on his forensic expertise as a medical examiner and his review of Dr. Weiner's notes and reports, see *Commonwealth v. Avila*, 454 Mass. 744, 761-762 (2009), he did not do so.

The erroneously admitted evidence of Dr. Weiner's estimate of the victim's time of death, however, favored the defendant, because it suggested that the victim most likely had been killed between 8 A.M. and 8 P.M. on *482 Saturday, January 5, rather than late Friday night or shortly after midnight on Saturday morning, as indicated by the defendant's statement.

As a result, on cross-examination, defense counsel attempted to elicit from Dr. Nields that, if Dr. Weiner's outside estimate of thirty-six hours were accepted, the earliest possible time of death would have been 8 A.M. on Saturday, January 5.[18] After the prosecution rested, the defendant called Gerard Smith, a neighbor of the victim, who testified that at approximately 1 P.M. on January 5, he saw a dark "work type van" depart the driveway of the victim's house "at a very fast speed" driven by a dark-skinned Caucasian man.[19] In his closing argument, defense counsel argued that the victim died on Saturday, and suggested that the person in the van seen by Smith, and not the defendant, had killed her.

He reminded the jury that the Commonwealth's "own medical examiner puts the time of death on Saturday." There can be no substantial likelihood of a miscarriage of justice where the defendant fails to object to the admission of testimonial hearsay and then relies on that erroneously admitted hearsay to challenge the prosecution's theory of the case as to the time of death, the reliability of the defendant's confession, and ultimately the defendant's guilt.

See *Commonwealth v. Nardi*, supra at 395-396 (no substantial likelihood of miscarriage of justice where defense strategy relied on factual findings erroneously admitted in testimony of substitute medical examiner). c. DNA expert testimony.

The defendant raises a similar confrontation clause challenge to the admission of testimony by the Commonwealth's DNA analyst, Christine Lemire, regarding the results of DNA testing generated by another analyst. Lemire testified that the analysis employed by her laboratory assigned numbers to specific locations, or allele sites, on DNA extracted from the known sample provided by the defendant and from the unknown samples drawn from swabbings and fingernail scrapings recovered from the victim's body.

Lemire herself developed *483 the DNA profile from the unknown samples recovered from the victim's vaginal cavity, her right and left breasts, and beneath her fingernails. Lemire then performed the comparative analysis that enabled her to offer the opinion that the defendant was a potential contributor of the DNA profile developed from the unknown samples taken from the victim's right and left breasts, her vaginal cavity, and the fingernail clippings, and to opine as to the frequency of that DNA profile being found in various population groups.

Lemire illustrated her analysis for the jury with an over-sized chart that made a side-by-side comparison of the allele numbers generated from the defendant's known sample with the allele numbers generated from the unknown samples; the chart was admitted in evidence. Lemire's testimony regarding the DNA testing she performed on the unknown samples was not hearsay.

Nor was her opinion testimony because, as an expert, she was entitled in reaching an opinion to rely on her own personal knowledge as well as facts or data that are themselves hearsay, provided this information is of a type reasonably relied on by experts to form opinions in the relevant field. See *Commonwealth v. Barbosa*, 457 Mass. 773, 783-784 (2010); *Commonwealth v. Nardi*, 452 Mass. 379, 390 (2008).

Therefore, Lemire's opinions as to whether the defendant was a potential contributor of the DNA profile in each unknown sample and the statistical likelihood that an individual in various population groups could have been a contributor of that DNA profile was not hearsay. See *Commonwealth v. Barbosa*, *supra*. But the allele numbers derived from the testing of the known samples by another analyst that were included in Lemire's chart were testimonial hearsay, because these were factual findings made by a nontestifying witness for the purpose of investigating the murder.

See *Commonwealth v. Barbosa*, *supra* at 784; *Commonwealth v. Banville*, 457 Mass. 530, 540-541 (2010). The allele numbers produced by the nontestifying analysts were therefore admitted in error. Because the defendant did not object at trial to the admission of the other analyst's factual findings or to the chart that included these findings, we consider whether the admission of this evidence resulted in a substantial likelihood of a miscarriage of justice.

See *Commonwealth v. Nardi*, *supra* at 394. We conclude that it did not. *484 In *Commonwealth v. Barbosa*, *supra* at 789, we noted that without an expert's interpretation and analysis, the admission of the raw DNA testing results alone, even where the allele numbers match, is meaningless to a jury.

Because the human genome sequence is almost exactly the same (99.9%) in all people, "the mere fact that the characteristics of certain alleles of a defendant's DNA matches the characteristics of alleles of DNA found at a crime scene says almost nothing about the likelihood that the defendant

was present at the crime scene unless the jury learn from an expert about the nature of the DNA profile used."

Id., citing Human Genome Program, U.S. Dep't of Energy, Genomics and Its Impact on Science and Society: A 2008 Primer 3 (2008). For a jury, the compelling information is an expert's properly admitted opinion testimony regarding the statistical likelihood that the defendant was the source of the unknown DNA sample recovered from a crime scene. See *Commonwealth v. Barbosa*, supra.

Here, the probative testimony given by Lemire was not the allele numbers generated by the other analyst's testing, which were inadmissible in evidence, but her opinions, which were admissible in evidence, that there was an infinitesimal likelihood that someone other than the defendant could have been the source of the male DNA found on the victim's right breast and in her vaginal cavity.

Because Lemire was permitted to use the other analyst's findings in reaching her own opinion, *Commonwealth v. Nardi*, supra at 390, and because these findings had no meaningful probative value without her expert testimony, the erroneous admission of these underlying facts in evidence did not result in a substantial likelihood of a miscarriage of justice. See *Commonwealth v. Barbosa*, supra at 792-793. d. Exclusion of defendant's statements made to defense expert psychologist.

At trial, the defense called Dr. Eric Brown, a clinical psychologist, who offered his expert opinion that, because of the defendant's low level of intelligence and limited cognitive abilities, the defendant lacked the "cognitive functioning" necessary to participate intelligently in the interview that resulted in his postarrest inculpatory statements to Troopers Mason and Burke.

On cross-examination, the prosecutor asked if, in making his evaluation, Dr. Brown had reviewed the diagrams that the defendant sketched for the troopers of the interior and exterior *485 of the victim's home during the course of the interview. When defense counsel asked Dr. Brown on redirect examination whether the defendant had told him how he knew about the interior of the victim's house, the Commonwealth objected.

Defense counsel argued that the prosecutor had opened the door to this testimony by asking Dr. Brown about the diagrams in an attempt to show that the defendant had the intelligence to recall what he saw at the victim's house. During voir dire, Dr. Brown testified that the defendant had told him that he drew the diagram based on his memory of being in the house on Thursday afternoon, January 3, 2002, when he had a "sexual encounter" with the victim.[20] The judge found that the prosecutor had not opened the door to the admission of this evidence, and sustained the Commonwealth's objection.

The defendant argues that the judge's ruling was error. The trial judge is afforded substantial discretion in deciding whether, and for what purposes, evidence is relevant, see *Anthony's Pier*

Four, Inc. v. HBC Assocs., 411 Mass. 451, 477 (1991), and a trial judge's rulings on these questions are reversible only for an abuse of discretion. See *Cottam v. CVS Pharmacy*, 436 Mass. 316, 327 (2002).

If offered to prove that the defendant had a "sexual encounter" with the victim that Thursday afternoon, the defendant's statement to Dr. Brown was inadmissible hearsay, because the defendant made the statement outside the court room, the defendant was not subject to cross-examination regarding the statement, the statement was intended to prove the truth of the matter asserted, and the defendant, not an adverse party, was offering the statement in evidence.

See generally Mass. G. Evid. § 801 (2010). The defendant argued at trial that the purpose of offering the defendant's prior statement was not to prove that he was inside the victim's house that Thursday afternoon, but to explain how he had been able to draw the diagram of the interior *486 of the house in spite of his low cognitive abilities.

However, the defendant's argument on appeal that the judge's preclusion of this evidence left "the jury with the impression that [the defendant] knew the home because he committed the crime" demonstrates that the evidence was offered for the truth of the matter asserted, that is, to explain the presence of the defendant's DNA on the victim's body and his familiarity with the interior of the victim's house as the result of his consensual sexual encounter with her on Thursday afternoon, not the result of an attack on her the evening she was killed.

The judge acted within his discretion in precluding the defendant's statement to Dr. Brown because it was offered for the truth of the matter asserted, and because the prosecutor had not opened the door to the admission of this statement when he referenced the defendant's sketching of these diagrams.[21] 6. Removal of deliberating juror.

The defendant argues that he is entitled to a new trial because the judge improperly removed a deliberating juror after the jury had informed the judge that they were deadlocked on each of the charges. We set forth the undisputed facts concerning this issue.

The jury commenced deliberations on Tuesday, November 7, 2006, and continued through Friday, November 10. During the weekend recess, one of the jurors became involved in a highly publicized police investigation unrelated to the defendant's case when the father of her child was arrested at her home in connection with a shooting in Falmouth.[22] The juror was not implicated in the shooting.

Several of the jurors learned of the juror's connection to the arrest from news reports over the weekend, and more learned of it through discussions in the jury room on the following Monday. In accordance with the practice approved in *Commonwealth v. Jackson*, 376 Mass. 790, 800-801 (1978), the judge conducted an individual voir dire of each juror (including two alternate *487

jurors) to determine whether exposure to reports of the weekend arrest had affected any juror's ability to render an impartial verdict.

He found that, despite some knowledge of the weekend incidents, the other eleven deliberating jurors and the two alternates remained fair and impartial, free of taint, and capable of deliberating further. The juror assured the judge that she had not formed any prejudice or bias toward the Commonwealth or those arrested or involved with the criminal law, and could remain as fair and impartial as when she was first seated, despite the events of the weekend.

Neither the Commonwealth nor the defense moved to dismiss the juror based on this inquiry. After ordering her not to discuss the events of the weekend with anyone during the remainder of her jury service, the judge permitted the juror to continue to deliberate. Later that day, the jury informed the judge that they were deadlocked on all counts.

The judge issued a Tuey-Rodriguez charge and instructed the jury to return to deliberations. See *Commonwealth v. Rodriguez*, 364 Mass. 87, 101-102 (1973) (Appendix A); *Commonwealth v. Tuey*, 8 Cush. 1, 2-3 (1851). At the close of the day, the judge ordered the jury sequestered for the remainder of their deliberations in light of the increased media focus on the jury following the weekend arrest.

Before jury deliberations commenced the following day, the Commonwealth moved to dismiss the juror on the basis of two telephone conversations between the juror and the jailed father of her child that had been recorded by the Barnstable house of correction the previous afternoon following the judge's issuance of the sequestration order.

In a hearing attended by the defendant, defense counsel, and the prosecutor, the judge found on the basis of the recordings that she maintained a "strong ongoing relationship" with the father of her child. The judge further found that the recordings showed that the juror was disregarding his repeated orders to the jury not to communicate with others about the case and to avoid media reports concerning it.

Finally, he found that the juror's representation that she remained fair and impartial "to be less than reliable" because "she clearly sides with [the father of her child]" and "expresses concern" about the conduct and integrity of the police involved in the shooting investigation.

The judge concluded "that the palpable conflict is not only one that can be inferred; it's one that can be established *488 by the direct evidence before the court." On the basis of these findings and over the defendant's objection, the judge discharged the juror.

The judge then informed the remaining members of the jury that he had removed the juror for reasons personal to her that had nothing to do with her view of the case. An alternate juror was then drawn by lot, and the judge instructed the reconstituted jury to begin their deliberations anew.

The jury returned their verdict three days later. Once a jury commence deliberations, a juror may be discharged if "unable to perform [her] duty" because of illness or "any other good cause shown to the court," G. L. c. 234, § 26B; or, after a hearing, "upon a finding of an emergency or other compelling reason." G. L. c. 234A, § 39.

The facts of *Commonwealth v. Garrey*, 436 Mass. 422 (2002), presented circumstances similar to those before the judge here. There, we concluded that "a palpable conflict existed" that justified the discharge of a deliberating juror where her son and husband were arrested, held in jail, and awaited prosecution by the same district attorney's office prosecuting the defendant.

See *id.* at 430-431 & n.5. Here, a comparable "palpable conflict existed," where the father of the deliberating juror's child, with whom the juror had a "strong ongoing relationship," was arrested on felony charges, held in jail, and awaited prosecution by the same district attorney's office prosecuting the defendant. While that "palpable conflict" was sufficient to support the judge's exercise of his discretion, there were additional reasons that supported the judge's decision to discharge the juror here.

The juror's statements in the tape-recorded telephone calls supported the judge's findings that the juror was upset with the police and their conduct of the investigation of the child's father, and that she had learned of media reports regarding the arrests for the shooting.[23] There is no evidence that the judge sought to affect the jury's verdict by his discharge of the juror.

As the judge found, there *489 was no information before him to suggest whether the juror favored the defendant's conviction or acquittal. Nor was there any information before him as to whether one or more jurors were the source of the jury's deadlock, or whether this juror was in the minority or majority. See *Commonwealth v. Olavarria*, 71 Mass. App. Ct. 612, 619-620 (2008) ("Even greater care [in deciding whether to discharge a deliberating juror] should be taken when the jury is at an impasse with a lone dissenting juror").

The judge here acted within his discretion in concluding that there was compelling reason to discharge the deliberating juror. See, e.g., *Commonwealth v. Garrey*, *supra* at 430-431 & n.5; *Commonwealth v. Olavarria*, *supra* at 620-622.[24] There was no error. 7. Motion for a new trial based on prosecutor's alleged failure to disclose exculpatory evidence.

The defendant argues that he is entitled to a new trial because the prosecutor failed to reveal to the defense that Jeremy Frazier had been charged with assault by means of a dangerous weapon in August, 2003; he contends that this information would have implicated Frazier in the stabbing of the victim. Defense counsel, however, had a copy of Frazier's board of probation record during his cross-examination of Frazier at trial and questioned him regarding the dismissal of various District Court charges, suggesting in his questioning that the charges had been dismissed in return for Frazier's testimony at the defendant's trial.

Defense counsel, therefore, knew of the charge and of its dismissal at the time of trial. Defense counsel did not attempt at trial to offer the underlying alleged incident which involved the brandishing of a two-inch pocket knife against British tourists in an argument *490 that ended without violence as a prior bad act and, if he had, the judge would have acted within his discretion had he barred the evidence as too remote in time and too weak in probative value to support the inference that Frazier had participated in the brutal rape and murder of the victim more than one and one-half years earlier.[25] See *Commonwealth v. Graziano*, 368 Mass. 325, 329-300 (1975).

The defendant also contends that he is entitled to a new trial because the prosecutor failed to reveal administrative problems in the reporting of DNA test results at the State police crime laboratory that were documented in two official reports. These reports, however, were issued in 2007, after the conclusion of the defendant's trial, and there is no evidence that the prosecutor or his investigators were aware at the time of trial of the deficiencies at the laboratory.

"It is clear that a `prosecutor cannot be said to suppress that which is not in his possession or subject to his control.'" *Commonwealth v. Daye*, 411 Mass. 719, 734 (1992), quoting *Commonwealth v. Donahue*, 396 Mass. 590, 596 (1986).

Moreover, the 2007 reports focused on the backlog of unprocessed DNA samples held by the laboratory and administrative inefficiencies in the laboratory's handling of information in the DNA database used by law enforcement; they did not reveal any deficiencies in the quality of scientific work conducted at the crime laboratory that would put in question the analyst's opinion that the defendant was a contributor of DNA found on the victim's body.

The judge did not err in denying this frivolous motion for a new trial. 8. Allegations of juror misconduct. Approximately one month after the conclusion of trial, the defendant moved for a postverdict inquiry of the jurors based on information contained in affidavits from the discharged juror and two other deliberating jurors that the jury's deliberations had been infected by racial prejudice.

The claims of racial prejudice were based on three separate incidents and alleged (1) that one juror (Juror X) had *491 said that she was frightened of the defendant because he was "big" and "black" and had been trying to "intimidate" her by staring at her in the court room; (2) that another juror (Juror Y) said that bruises like those found on the victim's body would result "when a big black guy beats up on a small woman"; and (3) that a third juror (Juror Z) said that he had always been around white people and did not like black people because "look at what they are capable of." [26], [27] The defendant asked for a hearing to determine if the allegations of racial bias were true and for a new trial if the inquiry determined that they were.[28] The judge conducted a postverdict evidentiary hearing in open court where he questioned ten of the twelve jurors who deliberated to verdict, the discharged juror, and the alternate juror concerning the allegations in the affidavits.

[29] The judge also permitted the defendant to call and question two additional witnesses: a great-aunt of Juror Z, who testified regarding statements she claimed Juror Z had made expressing animus toward African-Americans, and a social psychologist who offered expert testimony regarding the influence of race on juries.

Following the hearing, the judge made detailed findings of fact in which he concluded that there was "no factual basis" to support the allegation that Juror X had tied her fear of the *492 defendant to race[30] or that Juror Z had expressed racial animus toward African-Americans.[31] As to Juror Y, the judge found that, at one point during the deliberations, she stood at the easel in the jury room explaining her view of the evidence, which was challenged by other jurors in a heated discussion.

In defense of her position, Juror Y blurted out that the victim's injuries were the result of a beating administered by a big black man.[32] Juror Y's words provoked an immediate reaction from the black female juror, who asked Juror Y what being black had to do with it and called her a racist. Juror Y denied she was racist, responding that the defendant was a big black man and that her words were an accurate description.

The two swore at each other and the black female juror approached the easel while Juror Y returned to her seat. A juror put a leg up to separate them, but the judge found that this gesture was unnecessary as the two remained apart and their disagreement remained verbal, not physical.

The confrontation ended when Juror Y said she meant no harm, and the jury foreperson called for a break in the deliberations. After considering whether Juror Y's statement reflected "overt prejudice" or "veiled or subconscious bias or stereotyping," the judge found that it "was descriptive in nature and intent and did *493 not constitute racial bias on her part."

He concluded that the defendant had failed to prove by a preponderance of the evidence that Juror Y was not impartial. The judge recognized that, regardless of Juror Y's "innocent intention, the image of a big black man beating on a small woman dovetails into a common racial stereotype that black men are prone to violence," and considered whether "the remaining jurors perceived such a stereotype from the words spoken."

The judge concluded that the defendant had failed to prove by a preponderance of the evidence that the jurors were exposed to racial bias from the statement of Juror Y, or the resulting interchange between Juror Y and the black female juror.[33] He declared that this racial stereotype was "inherent in the facts of the case," and that interchange between Juror Y and the black female juror "served the salutary purpose of exposing the jurors to a healthy, albeit heated, discussion about identifying the defendant by the color of his skin, thereby blunting the effect of the stereotype." [34] Because "[t]he determination of a juror's impartiality `is essentially one of credibility, and therefore largely one of demeanor,'" Commonwealth v. Ferguson, 425 Mass. 349,

352-353 (1997), quoting *Patton v. Yount*, 467 U.S. 1025, 1038 (1984), we give a trial judge's determination of impartiality great deference.

See *Commonwealth v. Ferguson*, *supra* at 353, and cases cited. We will not disturb a judge's findings that a juror is unbiased absent a showing that the judge's conclusion was clearly *494 erroneous. See *Commonwealth v. Amirault*, 399 Mass. 617, 626 (1987).

We recognize the difficulty of the judge's task in ascertaining the facts here and the extraordinary care he took in setting forth in detail his findings. Having taken similar care in examining the record, we conclude there was no clear error in his findings of fact.

We therefore turn to the question whether the judge erred as a matter of law in denying the defendant a new trial based on the facts that the judge found. Article 12 of the Declaration of Rights of the Massachusetts Constitution and the Sixth Amendment to the United States Constitution, applied to the States through the due process clause of the Fourteenth Amendment, guarantee the right of a criminal defendant to a trial by an impartial jury.

Commonwealth v. Vann Long, 419 Mass. 798, 802 (1995). "The presence of even one juror who is not impartial violates a defendant's right to trial by an impartial jury." *Id.* See *Aldridge v. United States*, 283 U.S. 308, 314 (1931) ("if any [juror] was shown to entertain a prejudice which would preclude his rendering a fair verdict, a gross injustice would be perpetrated in allowing him to sit").

Where a defendant files an affidavit from a juror (or, as here, from more than one juror) alleging that a juror (or more than one juror) made a statement to another juror that reasonably demonstrates racial or ethnic bias, and the credibility of the affidavit is in issue, the trial judge should conduct a hearing to determine the truth or falsity of the affidavit's allegations, because "the possibility raised by the affidavit that the defendant did not receive a trial by an impartial jury, which was his fundamental right, cannot be ignored."

Commonwealth v. Laguer, 410 Mass. 89, 97 (1991). See *Commonwealth v. Amirault*, *supra* at 625-626 (where defendant after verdict raises "reasonable claim" that juror in child rape case failed during voir dire to reveal that juror had been victim of rape during childhood, defendant entitled to hearing conducted by trial judge to determine whether juror was actually biased).[35] In evaluating claims of juror bias, a judge, as the judge did *495 here, must first determine whether the defendant has satisfied his burden of proving by a preponderance of the evidence that the challenged statements that possibly reflect racial or ethnic bias were actually made by the juror.

See *Commonwealth v. Laguer*, *supra* 410 Mass. at 98-99; *Commonwealth v. Amirault*, *supra* at 626; *Commonwealth v. Laguer*, 36 Mass. App. Ct. 310, 314 (1994). If the judge finds that the statements were not made, the judge need make no further findings. See *id.* Where one or more of

the challenged statements are shown to have been made, the judge must then determine whether the defendant has proved by a preponderance of the evidence that the juror who made the statements was actually biased because of the race or ethnicity of a defendant, victim, defense attorney, or witness.

See *United States v. Henley*, 238 F.3d 1111, 1121 (9th Cir. 2001). See also *Commonwealth v. Tavares*, 385 Mass. 140, 156 (1982) (finding that alleged statement suggesting racial prejudice had been made but determining that statement considered in context did not show actual bias). A juror is actually biased where her racial or ethnic prejudice, had it been revealed or detected at voir dire, would have required as a matter of law that the juror be excused from the panel for cause.

Cf. *McDonough Power Equip., Inc. v. Greenwood*, 464 U.S. 548, 556 (1984) (where civil litigant seeks new trial because of alleged juror bias, "a party must first demonstrate that a juror failed to answer honestly a material question on voir dire, and then further show that a correct response would have provided a valid basis for a challenge for cause"); *Commonwealth v. Amirault*, supra *496 at 625.

Cf. also *Patton v. Yount*, supra at 1036 (where partiality of individual juror is at issue, question is: "did a juror swear that he could set aside any opinion he might hold and decide the case on the evidence, and should the juror's protestation of impartiality have been believed").^[36] In some instances, the statement made by the juror may establish so strong an inference of a juror's actual bias that proof of the statement alone may suffice.

See *Commonwealth v. Laguer*, 410 Mass. at 94, 98-99 (if alleged statement "[T]he goddamned spic is guilty just sitting there; look at him. Why bother having the trial" were made by juror, judge must find actual ethnic bias). See also *Commonwealth v. Amirault*, supra at 628 & n.5 ("in certain exceptional circumstances implied bias may be applicable"). Generally, though, the judge must determine the precise content and context of the statement to determine whether it reflects the juror's actual racial or ethnic bias, or whether it was said in jest or otherwise bore a meaning that would fail to establish racial bias.

See *Commonwealth v. Tavares*, supra at 153 n.21, 154 (jurors referred to witness as "Sapphire," a reference to shrewish wife on "Amos 'n Andy Show" on radio and television, but record supported judge's findings that "this term had been used in a jocular manner without any racial prejudice").

Because actual juror bias affects the essential fairness of the trial, a defendant who has established a juror's actual bias is entitled to a new trial without needing to show that the juror's bias affected the jury's verdict. See *Commonwealth v. Hampton*, 457 Mass. 152, 163 (2010); *Commonwealth v. Vann Long*, 419 Mass. 798, 802-805 (1995). See *Commonwealth v. Laguer*, supra at 98-99.

Where statements suggesting juror bias are shown to have been made but the defendant has failed to prove that the statements reflect actual bias by the juror who made the statements, the judge still

must determine whether the statements so infected the deliberative process with racially or ethnically charged *497 language or stereotypes that it prejudiced the defendant's right to have his guilt decided by an impartial jury on the evidence admitted at trial.[37] See *Commonwealth v. Tavares*, supra at 155-156.

See also *United States v. Villar*, 586 F.3d 76, 81, 87 (1st Cir. 2009) (judge has discretion to hear juror testimony "to determine whether ethnically biased statements were made during jury deliberations and, if so, whether there is a substantial probability that any such comments made a difference in the outcome of the trial").[38] Although juror statements that may reflect juror bias are not extraneous matters in jury deliberations, see *Commonwealth v. Laguer*, supra at 97, we conclude today that this evaluation requires the same two-step process that we apply where jury deliberations have allegedly been compromised by exposure to improper outside influences.

See *Commonwealth v. Kincaid*, 444 Mass. 381, 386 (2005); *Commonwealth v. Fidler*, 377 Mass. 192, 201 (1979). The defendant therefore bears the initial burden of proving, by a preponderance of the evidence, that the jury were exposed to statements that infected the deliberative process with racially or ethnically charged language or stereotypes. See *Commonwealth v. Kincaid*, supra.

If the defendant meets this burden, the burden then shifts to the Commonwealth to show beyond a reasonable doubt that the defendant was not prejudiced by the jury's exposure to these statements. See id., quoting *Commonwealth v. Fidler*, supra.

In making this determination, "[t]he judge may not receive any evidence concerning the actual effect of the matter on the juror's decision, for this would involve probing the juror's thought processes." *Commonwealth v. Fidler*, supra. Rather, the judge must focus on "the probable effect" of the statements "on a hypothetical average jury." Id. See 3 J. Weinstein & M. Berger, *Evidence* par.

606.05[2][b] (2010), and cases cited. The judge here correctly applied the law and made the necessary findings of fact, which were supported by the record and not clearly erroneous. While the judge found that Juror Y did not *498 hold actual racial bias, he recognized that Juror Y's reference to the race of the defendant potentially communicated such a bias to the jury and concluded that the black female juror's appropriate response to the statement served the beneficial purpose of exposing and "blunting the effect" of the racial stereotype, and of warning the jury of the risk of racial stereotypes infecting their deliberations.[39] See *Commonwealth v. Kincaid*, supra at 389, quoting *Commonwealth v. Fidler*, supra at 201 n.8 (judge may consider whether "improper remark prompted an immediate reprimand from another juror").

We conclude that the judge did not err in finding that the defendant was not denied his due process right to an impartial jury because of a juror's racial bias. 9. Review under G. L. c. 278, § 33E. Having reviewed the entire record pursuant to our duty under G. L. c. 278, § 33E, we discern no

error, considered alone or collectively, that provides a just basis to set aside or reduce the verdict of murder in the first degree.

Judgments affirmed. Orders denying motions for a new trial affirmed. IRELAND, J. (concurring). I concur in affirming the judgments of conviction against the defendant. I write separately to set forth my thoughts on the issue of juror bias raised in this case. I agree with the judge that Juror Y's statement that the victim's injuries would result "when a big black man" beat a small woman raised the specter of racism, warranting closer examination.

Indeed, Juror Y's statement provoked an immediate reaction from the black female juror (Juror A), who accused Juror Y of racism. The confrontation included the two women yelling back and forth and swearing at each other.

In assessing whether the defendant met his burden to prove that Juror Y was actually biased, *Smith v. Phillips*, 455 U.S. 209, 215 (1982), the judge very conscientiously and sensitively *499 explored the issue of racial bias and juror taint, including a careful determination of credibility and context. I agree that his findings are not clearly erroneous. *Commonwealth v. Amirault*, 399 Mass. 617, 626 (1987).

However, there is one conversation between Juror Y and Juror A that I would have explored further to broaden the context of Juror Y's statement. That is, Juror A claimed that, at some point during the day that Juror Y made her statement about the defendant's race, Juror Y also asked Juror A about her hairstyle and the level of education she had achieved. Juror A told the judge that the comments were made in a "snide" manner, "suggesting racial bias."

"Since the 1990's, a number of studies have deconstructed the complicated ways in which the human mind maintains and manifests racially biased implicit attitudes and stereotypes. Many of these studies have reached the same conclusion that implicit biases are real, pervasive, and difficult to change.... [Moreover] racial attitudes and stereotypes are both automatic and implicit.

That is, that people possess attitudes and stereotypes over which they have little or no 'conscious, intentional control.' Levinson, *Forgotten Racial Equality: Implicit Bias, Decisionmaking and Misremembering*, 57 *Duke L.J.* 345, 351-354 (2007) (Levinson). This is because, according to "[r]esearch on stereotype formation and maintenance[,],... stereotypes are instilled at an early age and come from cultural and societal beliefs....

[P]sychologists have found that stereotypes arise when a person is as young as three years old and are usually learned from parents, peers, and the media. As people grow older, their stereotypes become implicit and remain mostly unchanged even as they develop nonprejudiced explicit views. 'Stereotypes about ethnic groups appear as a part of the social heritage of society....

[And] [n]o person can grow up in a society without having learned the stereotypes assigned to the major ethnic groups.' Id. at 363, quoting Page, *Batson's Blind-Spot: Unconscious Stereotyping and the Peremptory Challenge*, 85 B.U. L. Rev. 155, 203 n.22 (2005). See Symposium *Forbidden Conversations: On Race, Privacy, and Community* (A Continuing Conversation with John Ely on Racism and Democracy), 114 Yale L. J. 1353, 1391 (2005) (individuals restrict their racist speech).

Courts are aware that unconscious racism could affect the *500 outcome of trials. See *Commonwealth v. Laguer*, 410 Mass. 89, 99 (1991), quoting *Smith v. Phillips*, supra at 221-222 (O'Connor, J., concurring) ("Determining whether a juror is biased or has prejudged a case is difficult, partly because the juror may have an interest in concealing his own bias and partly because the juror may be unaware of it").

See also *Georgia v. McCollum*, 505 U.S. 42, 68 (1992) (O'Connor, J., dissenting) ("It is by now clear that conscious and unconscious racism can affect the way white jurors perceive minority defendants and the facts presented at their trial, perhaps determining the verdict of guilt or innocence").[1] The judge here expressed his understanding of unconscious bias by relying, in part, on the defendant's "expert social psychologist on matters of racial bias," Samuel R. Sommers, and stating that he was assessing Juror Y's testimony through the filter of Justice O'Connor's concurring opinion in *Smith v. Phillips*, supra at 221-222, (O'Connor, J., concurring) concerning unconscious bias.[2] As the judge also recognized, courts use mechanisms that studies suggest can counteract implicit racially based attitudes and stereotypes.

Here, during the voir dire, the judge asked each juror about their attitudes about race.[3] The empanelled jury *501 were racially diverse.[4] The defense argued that the prosecution was based on racial stereotyping of the defendant.[5] The judge instructed the jury to "remove bias from their deliberations." Studies suggest that these types of mechanisms have the effect of at least temporarily reducing stereotyping by calling it to the attention of white jurors who are motivated to present the appearance of impartiality.

See Levinson, supra at 414-415. Moreover, studies show that even hostile confrontations such as the one that took place between Juror Y and Juror A following Juror Y's statement can, at least temporarily, decrease automatic stereotyping.[6] Levinson, supra at 413-414 & n.321. Given the societal norm that one does not overtly express racially biased attitudes, see Somers, 7 Psychol., Pub.

Pol'y & L., supra at 208, as well as the mechanisms to which the jurors *502 were exposed before their deliberations, Juror Y's "big black man" statement is all the more remarkable. I recognize that her statement could have been parroting the statements of defense counsel,[7] or that she was being descriptive, as the judge found. That being said, I would have liked the judge to explore,

with more jurors, the questions concerning Juror A's hairstyle and level of education, before he concluded that these statements were "[a]t worst... equivocal.

What one woman reports as small talk initiated by others... the other interpreted as snide." The judge elicited from Juror Y that she never directly asked Juror A about her hair, but that Juror A was asked about it during trial because, every Friday, Juror A had her hair styled differently. Juror Y denied ever asking about Juror A's education level.

The judge asked only one other juror. That juror denied hearing either statement. It would have been informative to know whether Juror A was the only juror asked about her level of education. If she were the only one, it would have raised a red flag for me, as it apparently did for Juror A.[8] See Lawrence, *The Id, the Ego, and Equal Protection: Reckoning *503 with Unconscious Racism*, 39 Stan.

L. Rev. 317, 323 (1987) (discussing cultural stereotype that blacks are lazy or unintelligent). Because of unconscious racism, it is the subtle clues that help give a judge insight into a juror's true feelings. Indeed, the judge here explored in detail such a subtlety: whether Juror Y said "this" big black man rather than "a" or "the" big black man. He found that she was referring directly to the defendant and concluded that she did not harbor prejudice against blacks as a class but was speaking descriptively of the defendant.

A similar analysis of the hair and education questions would have added another dimension to the judge's analysis. Both questions, but particularly the question about Juror A's level of education implicate racial stereotyping. See Lawrence, *supra*. I would want to know whether Juror Y asked other jurors about their education or asked just Juror A. I agree with the court that the judge's task here was tremendously difficult, ante at 494, and do not suggest that the judge would have reached a different conclusion concerning whether Juror Y was actually biased.

I do think that more inquiry concerning whether any other jurors were asked questions about their level of education and hairstyle would have given context and insight into whether the questions put to Juror A were simply small talk or indicative of implicit bias. NOTES [1] Chief Justice Marshall participated in the deliberation on this case prior to her retirement.

[2] At the time of the March, 2004, meeting with the defendant, thirty to thirty-five other men had provided DNA samples to investigators. At a later point in the investigation, police conducted a public "DNA roundup" in Truro in which police officers asked men voluntarily to provide DNA samples to assist in their investigation. Approximately 150 to 200 men provided samples.

[3] The police confirmed that the Juice Bar in Orleans held a "rap night" on Friday night, January 4, 2002, and a videotape taken that night showed that both the defendant and Jeremy Frazier attended the event. [4] The police found the victim's cellular telephone in her home; the number nine appeared on the screen, indicating that that digit had been pressed.

[5] The defendant later provided a variation on this account in which Frazier kicked in the door when he left the house, after earlier having chased the victim inside. [6] Another witness, Christopher Bearse, testified that he saw Frazier and Mulvey leave the house party together and enter the same automobile. He acknowledged that the defendant was "nowhere in sight" when Frazier and Mulvey departed.

[7] Christine Lemire testified that this was consistent with the victim's daughter attempting to nurse from the victim's breast. [8] The defendant is African-American. [9] Because the voluntariness of the defendant's statements was a live issue at trial, the judge properly submitted the issue to the jury by providing the humane practice instruction. See *Commonwealth v. Cryer*, 426 Mass. 562, 571 (1998).

The judge's instructions on voluntariness adhered to the requirement in *Commonwealth v. DiGiambattista*, 442 Mass. 423, 447-448 (2004), that the absence of an electronic recording of a custodial interrogation permits the jury to conclude that the Commonwealth has failed to prove voluntariness beyond a reasonable doubt.

The defendant urges us to go beyond that ruling to hold that the fruits of an unrecorded interrogation may not be admitted at trial and that the defendant's statement here must be suppressed. We decline to revisit the holding of the *DiGiambattista* case and note that the present appeal presents a singularly unlikely occasion on which to do so, where, even after being informed by Trooper Mason that courts prefer the electronic recording of interviews, the defendant declined in writing to consent to such a recording.

[10] The motion judge was also the trial judge. [11] The evidence presented to the grand jury included a videotape that showed the victim as she was discovered. [12] The record before us does not include any police reports documenting Mulvey's statements in the course of the investigation.

We therefore rely on uncontested testimony at trial concerning these statements. [13] The judge explained to the jury, "To the extent that it's a live issue in this trial as to whether the police have acted fairly or appropriately or as to whether statements are or not voluntary, then perhaps this trooper's thought process leading up to taking the statement is fair game."

[14] Arnold and the victim lived together in the victim's home for approximately one year while they were romantically involved. He had moved out of the house when the romantic relationship ended sometime in the early months of 2001. His semen was found on a blanket that had been taken from a couch by one of the emergency responders to cover the victim after she was found.

The DNA analyst, Christine Lemire, testified that DNA may remain on an item for twenty to thirty years. [15] We caution defense counsel, in preparing cross-examination, to consider the risk that their inquiry may open the door to the admission of evidence that would otherwise not have been admitted.

We also caution judges that evidence that poses a risk of unfair prejudice need not always be admitted simply because a defendant has opened the door to its admission; the judge still needs to weigh the probative value of the evidence and the risk of unfair prejudice, and determine whether the balance favors admission.

[16] On cross-examination, Dr. Nields indicated that the twenty-four to thirty-six hour period was measured from the time Dr. Weiner observed the body on the evening of January 6, not from the time of the autopsy on January 7.

[17] In addition, Dr. Nields, using the photographs admitted in evidence, properly testified to the location and nature of the victim's injuries based on his expertise as a forensic examiner. Dr. Nields also properly offered his own opinion as to the cause of the victim's death a stab wound to the chest and as to her death from that wound not being instantaneous.

See *Commonwealth v. Avila*, 454 Mass. 744, 761-762 (2009). [18] Defense counsel failed to elicit this concession from Dr. Nields, who testified that Dr. Weiner's estimate did not set "an outside time limit for time of death."

[19] Gerald Smith testified that he told the police that the driver was the sole occupant of the vehicle. [20] The defendant in his statement to the police in April, 2005, did not speak of a sexual encounter with the victim on Thursday, January 3, 2002; he claimed that his first and only sexual encounter with her was on Friday night, January 4. But the defendant at trial called a social psychologist, Dr. Richard Ofshe, who, while he did not offer an opinion as to whether the defendant's statement to police in April, 2005, was false, offered expert testimony regarding the existence of false confessions and the circumstances that increase the risk of a false confession.

[21] Although the defendant did not testify and defense counsel never found a permissible basis to introduce evidence that the defendant had a sexual encounter with the victim that Thursday afternoon, he suggested in closing argument that it was a "reasonable inference" the jury could draw from the facts in evidence.

The prosecutor made no objection to this argument. [22] Police discovered a second man hiding in a rear bedroom of the dwelling and arrested him on an outstanding warrant. [23] We do not rely on the judge's finding that the juror had deceived the police regarding the nature of her relationship with the father of her child. While she indicated, in words and gestures, that they were in the midst of splitting up, she did not expressly say so, and we are not convinced that her expression of solidarity with the father of her child following his arrest and her assistance in paying his attorney demonstrated that they had not been in the process of splitting up prior to his arrest.

[24] There is also no merit to the defendant's ancillary claim that the judge's ruling must be reversed because the juror was not present at the second hearing where the judge reviewed the recorded telephone calls and made his findings.

The defendant, defense counsel, and the prosecutor were all present at this hearing. The defendant did not request that the juror be given an opportunity to explain her statements on the telephone recordings, and the judge reasonably could have concluded that nothing she would say in explanation would affect his decision to discharge her from the jury.

The judge acted within his discretion in conducting the hearing without the juror present. See *Commonwealth v. Haywood*, 377 Mass. 755, 769-770 (1979) ("Depending on the nature of the reason why replacement of the juror is being considered, the juror's presence may or may not be required...").

[25] The defendant makes similar allegations regarding the prosecution's failure to disclose information concerning the criminal records of four other individuals listed as potential Commonwealth witnesses (only one of whom actually testified at trial).

We agree with the judge that, for similar reasons, this information was inadmissible at trial. [26] The juror making this allegation described Juror Z as "black" in her affidavit. The judge in his findings of fact declared: "Casting aside for the moment the futility and folly of pigeonholing individuals racially, by physical appearance one might say the gentleman is black.

To this jurist, as a man who has lived his life entirely in Southeastern Massachusetts where Cape Verdeans are a major component of the minority community, [Juror Z] appears to be Cape Verdean." [27] The affiant who made this allegation was the discharged juror, whom the judge after hearing did not find credible. From the allegation in her affidavit, one would infer that Juror Z was referring to the defendant and the crimes he was alleged to have committed, but the discharged juror at the hearing testified that Juror Z was referring to the black female juror who had called Juror X a racist for her comment in the jury room.

[28] The judge treated the defendant's motion as, in substance, a motion for a new trial. The motion also alleged that one of the alternate jurors had participated in, and impermissibly influenced, jury deliberations.

On appeal, the defendant does not challenge the judge's finding that there was no factual basis to support this allegation. [29] The remaining two deliberating jurors were excused, without objection by counsel, because of health and travel issues.

[30] The judge found that Juror X had expressed fear of the defendant, but not because of his race.

[31] While the discharged juror and a deliberating juror testified that they heard Juror Z say that he did not like blacks, the judge did not find the discharged juror to be credible and found that the deliberating juror had been told about the statement by the discharged juror and had not heard it said by Juror Z. The judge did not credit any of the testimony of the discharged juror and found that her claims were refuted by others whose testimony he did credit.

The judge also did not credit the testimony of Juror Z's great-aunt that Juror Z had previously articulated his racial prejudice. He concluded that she "has proved to be a storyteller, perhaps someone seeking her fifteen minutes of fame."

The judge concluded, based on his voir dire of Juror Z during jury selection, Juror Z's testimony at the postverdict hearing, and the judge's observation of the juror throughout the trial, that Juror Z "did not express prejudice towards blacks but instead served as an impartial juror."

The judge added, "Nothing in [Juror Z's] demeanor suggested a closed mind." [32] The judge found that it was impossible to determine the precise language used by the juror but it was clear that, in discussing the severity of the victim's injuries, she had spoken of their source as either "a big black man" or "this big black man."

After weighing conflicting testimony, the judge concluded that the juror was referring to the defendant specifically rather than to black men as a class. [33] The judge also concluded that, even if the defendant had met this burden, the Commonwealth had proved the absence of prejudice to the defendant beyond a reasonable doubt based on the totality of the evidence.

[34] The judge characterized the black female juror's role in this interchange as "honorable," finding that she "was appropriately vigilant in keeping racial bias from infecting the deliberations" and that her "ire" served "as a warning flag that careful scrutiny must be given to [Juror Y's] words."

The judge also noted that each juror was selected after a voir dire that explored racial bias, that the judge's final instructions directed the jury to remove bias from their deliberations, that fellow jurors reminded the jury to be on guard for racial bias, and that the offending statement was uttered once during eight days of deliberations.

We share the concurrence's recognition of and concern with the risk of unconscious racial bias among jurors. We also agree with the concurrence that unconscious racial bias is most effectively addressed by recognizing it and addressing it, as was done in this case by the judge in his voir dire questions and jury instructions, and by the jurors during deliberations.

[35] Where juror testimony is needed to ascertain whether the racist statement was made, a judge may inquire of the jurors whether the statement was made but may not inquire into their subjective thought process, such as their reasons for concluding that the defendant was guilty, the content of their deliberations, or the effect of the statement at issue on their thought process.

See *Commonwealth v. Laguer*, 410 Mass. 89, 96-97 (1991). See also *Commonwealth v. Tavares*, 385 Mass. 140, 155 n.25, cert. denied, 457 U.S. 1137 (1982); *Commonwealth v. Fidler*, 377 Mass. 192, 197 (1979) (inflexible rule excluding all juror testimony offered to impeach verdicts would achieve stability at expense of doing justice). See generally Mass. G. Evid. § 606(b) (2010).

This is consistent with our broader rule that we will permit juror testimony regarding "overt factors... by which the verdict's validity can be objectively assessed," *Commonwealth v. Fidler*, supra at 198, quoting 3 J. Weinstein & M. Berger, *Evidence* par. 606[03], at 606-25 (1978), such as extraneous influences on the jury, but not regarding "the subjective mental processes of jurors, such as the reasons for their decisions."

Commonwealth v. Fidler, supra. The defendant on appeal does not challenge the manner in which the judge conducted the postverdict hearing or the scope of the juror testimony. [36] We do not suggest that a judge may find that a juror was actually biased only where the prospective jurors during voir dire were asked about racial or ethnic bias; a judge may make such a finding even where no such inquiry was made during voir dire.

Here, however, the judge asked each prospective juror whether the race of the defendant or victim would affect the juror's ability to be fair and impartial. [37] The judge here characterized this question as whether the jury were "exposed to racial bias" from the exchange of words between Juror Y and the black female juror.

[38] "[W]e emphasize that not every stray or isolated off-base statement made during deliberations requires a hearing at which jury testimony is taken." *United States v. Villar*, 586 F.3d 76, 87 (1st Cir. 2009). [39] The judge in his findings referred to the testimony of the defendant's social science expert that people have the ability to rise above racial stereotypes where they make a conscious effort to do so.

[1] To support her statement, Justice O'Connor cited *Developments in the Law Race and the Criminal Process*, 101 Harv. L. Rev. 1472, 1559-1560 (1988); Colbert, *Challenging the Challenge: Thirteenth Amendment as a Prohibition against the Racial Use of Peremptory Challenges*, 76 Cornell L. Rev. 1, 100-112 (1990). A more recent study concluded that judges and jurors unknowingly "misremember" facts in a case in racially biased ways.

Levinson, *Forgotten Racial Equality: Implicit Bias, Decisionmaking, and Misremembering*, 57 Duke L.J. 345, 373-374 (2007). [2] Although, as the judge pointed out, judges are free to reject expert testimony, I note that the role of experts in assisting the court in understanding unconscious racism in all its forms could be critical.

Although Samuel Sommers testified that, for obvious reasons, research about juror behavior and attitudes has been conducted with mock juries and trials, he conducted at least one study in which he chose his test subjects from a "jury-eligible community." See Sommers, *On Racial Diversity and Group Decision Making: Identifying Multiple Effects of Racial Composition on Jury Deliberations*, 90 J. Personality & Soc.

Psychol. 597, 601-602 (2006). [3] The judge stated that the case involved an allegation that the defendant, who is black, raped and killed a white woman and asked whether this information

about race would affect the juror's ability to be fair and impartial. He also asked whether the juror would believe the testimony of a white person over a black person and vice versa, and whether the juror believed that blacks are more likely to commit crimes than whites.

According to at least one study, simply asking jurors these types of questions calls the issue of race to their attention, what they call "race salience," making it more likely that juror bias will be reduced. Sommers, 90 J. Personality & Soc. Psychol., *supra* at 601, 607. See Sommers, *White Juror Bias: An Investigation of Prejudice Against Black Defendants in the American Courtroom*, 7 Psychol., Pub.

Pol'y & L. 201, 220-222 (2001). [4] According to one study, "[R]acially diverse juries deliberated longer, discussed more trial evidence, and made fewer factually inaccurate statements in discussing the evidence than did all-White juries. Interestingly, these effects, too, cannot be explained solely in terms of the performance of Black jurors, as White jurors were more thorough and accurate during deliberations on diverse vs. all-White juries.

A potential implication of these findings is that one process through which a diverse jury composition exerts its effects is by leading White jurors to process evidence more thoroughly." Sommers, *Race and the Decision Making of Juries*, Legal & Criminological Psychol. 171, 181 (2007), citing Sommers, 90 J. Personality & Soc. Psychol., *supra* at 612.

[5] Defense counsel argued in his opening, during examination of witnesses, and in closing that jurors needed to put aside hasty conclusions and consider the possibility that the defendant and the victim had a consensual relationship and that she was killed by a third party.

In his articles about race salience, see note 3, *supra*, the defense expert Sommers found that when the issue of race is brought to the attention of mock jurors, white jurors were less likely to demonstrate bias in their decision making. Somers, 7 Psychol., Pub. Pol'y & L., *supra* at 220, 225.

[6] Here, as the judge found, several jurors, including juror A and the foreperson, more than once reminded jurors that race should play no role in deliberations that should be focused on the evidence. See note 4, *supra*, discussing that racially diverse mock jurors were more thorough in their deliberations than all white mock juries.

[7] In fact, Juror Y testified that she was using the phrase because defense counsel did and another juror testified that race was mentioned in the context of argument by defense counsel. [8] Juror A's reaction is not unusual. Studies show that blacks and whites perceive incidents of discrimination differently. Whites expect discrimination to be explicit whereas blacks are more aware of implicit discrimination.

See Robinson, *Perceptual Segregation*, 108 Colum. L. Rev. 1093, 1127-1128 (2008) (Robinson), quoting Sommers, *Lay Theories About White Racists: What Constitutes Racism (and What*

Doesn't), 9 Group Processes & Intergroup Rel. 117, 132 (2006), ("white and nonwhite respondents [were asked] to review a list of behaviors and report whether the behavior was typical of white racism.

[Researchers] found that 'non-Whites are more likely to consider subtle forms of bias to be indicative of racism than are Whites'); Chew, Judicial Decisions Pitt Law Magazine 8, 9 (2010) (race of judge affected likelihood that plaintiff would prevail in employment discrimination claim and that most successful claims involved supervisors and coworkers "using racial slurs or by 'ganging up' on the plaintiff") According to Chester Pierce, a graduate of Harvard College and Harvard Medical School, and Emeritus Professor of Education and Psychiatry at the medical school, Graduate School of Education and School of Public Health at Harvard University, a psychiatrist at Massachusetts General Hospital, and author of over 200 articles, who has served as president, chairperson, advisor, and consultant to numerous organizations, the interactions between white and black individuals in the larger society is marked by what he calls "offensive mechanisms" which are made automatic by the culture and "stem[] from the need of whites to reaffirm and reassert feelings and ideas of racial superiority."

C. Pierce, Offensive Mechanisms, *The Black Seventies*, 265, 277 (F. B. Barbour, ed. 1970). He relates the following experience as an illustration: "I notice in a class I teach that after each session a white, not a black, will come up to me and tell me how the class should be structured or how the chairs should be placed or how there should be extra meetings outside the classroom, etc. [It is possible that I am hypersensitive.]

What I cannot explain... is that it is not what the student says in this dialogue, it is how he approaches me, how he talks to me, how he seems to regard me.... I was told... that although I am a full professor on two faculties at a prestigious university, to him... I had to be instructed and directed as to how to render him more pleasure!" *Id.* at 277. Two studies have demonstrated that white test subjects minimize charges of racial discrimination.

In sum, in each test, one concerning employment and one concerning grading a college student's essay, whites were informed that the person who could have evaluated a mock black subject was prejudiced. Nevertheless, they were more likely to call the black subject who asserted discrimination a "complainer" or "troublemaker." See Robinson, *supra* at 1148-1151.

GANTS, J.

Gants, J. A jury convicted the defendant of murder in the first degree on theories of extreme atrocity or cruelty and felony-murder, of aggravated rape, and of aggravated burglary. The defendant appeals from his convictions and from the trial judge's denial of his motions for a new trial.

On appeal, the defendant argues that (1) the judge erred in ruling that the defendant knowingly, intelligently, and voluntarily waived his Miranda rights after his arrest, and that his postarrest statements to the police were made voluntarily; (2) the indictments should have been dismissed because a grand juror knew the victim, and because the Commonwealth concealed exculpatory information from the grand jury; (3) the judge erred in denying the defendant's pretrial motions seeking a change in venue or, in the alternative, sequestration of the jurors for the entire trial; (4) the judge made various evidentiary rulings at trial that constituted reversible error; (5) the judge erred in discharging a deliberating juror without good cause; (6) the judge erred in denying the defendant's motion for a new trial because the prosecutor failed to disclose exculpatory information to the defendant; and (7) the judge erred in denying another motion for a new trial because the defendant was denied his right to an impartial jury by the racial bias of certain jurors.

The defendant also asks us to exercise our power under G. L. c. 278, § 33E, to reverse the convictions. We affirm the convictions and the judge's denial of the motions for a new trial. After a complete review of the record, we find no basis on which to reduce the degree of guilt or order a new trial under G. L. c. 278, § 33E. 1. Evidence at trial.

We summarize the facts the jury could have found from the evidence at trial, reserving certain details for our analysis of the issues raised on appeal. In the late afternoon of Sunday, January 6, 2002, Christa Worthington (victim) was found dead in her home in Truro by Tim Arnold, a former boy friend, who had stopped by the victim's *464 home to return a flashlight.

The victim was naked from the waist down, and her legs were spread apart. Her face was badly bruised, and her torso was splattered with blood. A vaginal swab indicated the presence of semen. The victim's two year old daughter was alive beside her, but she was unable to tell police investigators anything about her mother's death.

The exterior door leading from the driveway into the kitchen area and passageway where the victim was found was ajar, and damage to the door and deadbolt indicated that it had been forced open. The Commonwealth's medical examiner testified that the cause of death was a stab wound to the victim's chest; the knife had entered the front of the victim's chest and penetrated her left lung, and the tip of the blade had exited through her back.

The victim had also suffered contusions to her nose and chest, abrasions on her face, hands, arms, and legs, and internal hemorrhaging in her skull. The medical examiner testified that these injuries were consistent with blunt impact. Evidence presented at trial suggested that a struggle had occurred outside the house. Trace amounts of dried blood were found under the fingernails of the victim's left and right hands.

Small pieces of grass or other vegetative material were found entwined in the victim's hair, both on her head and in her pubic area. Outside on the ground between the house and the victim's

automobile, crime scene investigators found a pair of woman's eyeglasses and barrette, a pair of socks, and the victim's keys. Near where the keys were discovered, just beside the victim's automobile, the dirt driveway had been disturbed.

Two long, irregularly parallel, furrow-like tracks led from the back of the automobile toward the entrance to the house. Police investigators were able to recreate similar markings by dragging a person across the driveway. Apart from the medical examiner's testimony as to time of death, which we will address later, the evidence would have allowed the jury reasonably to infer that the victim was killed after 8 p.m. on Friday, January 4, when she telephoned a babysitter, and before noon on Saturday, January 5, when she missed a hairdressing appointment.

Both the Saturday and Sunday newspapers were sitting uncollected at the bottom of her driveway when her body was discovered on Sunday afternoon. *465In the course of their investigation of the murder, police detectives interviewed people who had known the victim or visited her property, including the defendant, who was employed by a private disposal company that removed the trash she left each week outside her residence.

On April 3, 2002, the defendant told State Troopers Christopher Mason and William Burke that he did not know the victim, had never spoken with her, and had no contact with her beyond an occasional wave as he picked up the garbage from a wooden bin in the yard.

The troopers told the defendant that they had recovered certain items from the crime scene and asked if the defendant would be willing to provide fingerprint or deoxyribonucleic acid (DNA) samples in the future. The defendant told them he would have no problem providing these samples.

On March 18, 2004, after the State police crime laboratory identified a deoxyribonucleic acid (DNA) profile from various swabbings taken from the victim's vagina and breasts, Troopers Mason and Burke conducted a second interview with the defendant as part of a larger effort to collect DNA samples from men interviewed during the investigation.² The defendant repeated his assertions that he did not know the victim, had never spoken to her, and had never been inside her house.

He agreed to provide a DNA sample, and police swabbed the inside of his cheek. The defendant's DNA sample was sent to the State police crime laboratory in July, 2004, with a batch of DNA samples from other persons. After receiving a written report on April 13, 2005, that the defendant "matched the major profile" in the DNA mixture taken from the victim's right breast and was "included as a potential contributor of the minor profile" in the DNA mixture taken from the sperm in her vagina, the State police obtained warrants for the defendant's arrest and the search of his residence.

Police officers arrested the defendant at his home in Hyannis shortly after 7 p.m. on April 14, 2005, and transported him to *466the South Yarmouth State police barracks for questioning and booking. After the defendant waived his Miranda rights, Troopers Mason and Burke conducted a six-hour interview of the defendant, which the defendant declined to allow to be recorded.

The defendant again said that he had never been in the victim's home and had never spoken with her. He admitted to having sex with some women on his trash route but said that the victim had not been one of those women. He said the last time he picked up trash at the victim's home was the Thursday before her body was discovered, and that he had not been there since this last pickup.

When Trooper Mason showed the defendant the DNA report and told him that the crime laboratory had concluded that it was his DNA on the body of the victim, the defendant looked at the report for approximately one minute and said, "It could have been me." The defendant then told the officers that, on Friday night, January 4, 2002, he was with Jeremy Frazier and had gotten "piss ass drunk" in the parking lot of the Juice Bar, an Orleans club.³ Frazier drove him to Dennis, where the defendant visited with the mother of his baby for about forty to sixty minutes, and then they returned to the Juice Bar.

He said he drank to "blackout" that evening, did not recall what he did after returning to the Juice Bar, and did not "remember having sex with this lady." When Trooper Mason told him that recalling one small event will often trigger a recollection of the surrounding events, the defendant admitted that he had had consensual sex with the victim that night. He added that "[a]nything could have happened.

I know I didn't kill her." The defendant then recalled that Frazier had driven him to the victim's home, following the defendant's directions, and that Frazier had accompanied him inside the house when they arrived. He said he and the victim had engaged in vaginal sex on the floor in the hallway off the kitchen (where the victim's body was found), but then said they may have had sex in an office or the living room.

Initially, he said everything was "cool." He said that, as he and the victim parted, he gave the victim his telephone number, and then left, but he later said that the victim "flipped" *467when she saw Frazier going through her belongings and began screaming at them as they were leaving.

The defendant gave various versions as to what happened next. He first said that when the victim angrily confronted Frazier, Frazier started punching the victim and followed her as she ran back to her house, while the defendant remained in Frazier's automobile. He then said that he told Frazier that the victim had a telephone to her ear and was contacting the police from the house,⁴ that Frazier ran to the residence and kicked in the front door while the defendant remained in the automobile, and that Frazier was in the residence for approximately ten minutes before returning

to the automobile.⁵ After Troopers Mason and Burke told him that they felt he still had more to say, the defendant said, "It was a mistake." He then told the troopers that, after Frazier struck the victim, he (the defendant) "automatically started firing on her" and punched the victim in the face and chest once, knocking her out.

He said that when the victim fell, her head hit the gravel driveway "so hard that he could still hear it to this day." After she was on the ground, the defendant said, "We put the boots to her." He and Frazier then dragged the victim inside the residence, and he watched as Frazier took a knife from the kitchen and stabbed her in the chest.

As if in conclusion, the defendant stated, "I had sex with her... I beat her ass, but it was [Frazier] that stabbed her." He told the officers, "I never meant for that lady to get killed. It's a nightmare after nightmare. And not a day goes by that I don't think about it." When asked what he would say if the troopers determined that Frazier was somewhere else that evening, the defendant responded, "Then it's all on me..." Frazier testified that he was with the defendant at the Juice Bar that night and drove him to Dennis to visit the mother of his baby, but said that he later returned to the Juice Bar and went to a house party in Eastham in a vehicle driven by a friend, Shawn Mulvey.

According to Frazier, the defendant followed them to the party in a separate vehicle that he drove. Frazier *468 testified that after the house party broke up, he left with Mulvey and spent the night at Mulvey's house. Mulvey testified that "[t]here is no doubt in my mind" that Frazier spent the night at his house. Both Frazier and Mulvey testified that the defendant was at the house party but did not leave with them.⁶ The Commonwealth's DNA analyst, Christine Lemire, testified that the DNA profile obtained from the swabbing of the victim's right breast was a mixture of DNA from more than one source, with the defendant's DNA matching "the major profile" and the victim "included as a potential contributor of the minor profile in this mixture." Lemire testified that the statistical probability of such a match occurring in the major profile was one in 5.2 trillion among the Caucasian population, one in 99.8 billion among the African-American population, and one in fifteen trillion among the Hispanic population.

The DNA profile obtained from the swabbing of the victim's vaginal cavity was also a mixture of DNA from more than one source, with the victim's DNA matching "the major profile" and the defendant "included as a potential contributor" of the minor profile. Lemire testified that the statistical probability of such a match occurring in the minor profile was one in 7.2 billion among the Caucasian population, one in 1.1 billion among the African-American population, and one in 10.2 billion among the Hispanic population.

The DNA profile obtained from a swabbing of the victim's left breast was also a mixture of DNA from more than one source, with the victim's daughter's DNA matching "the major profile"⁷ and the victim and defendant included as potential contributors of the minor profile.

The probability of a randomly selected unrelated individual having contributed DNA to this mixture was approximately one in sixty-two among the Caucasian population, one in 769 among the African-American population, and one in 124 among the Hispanic population.⁸ The testing done on the male DNA detected in the fingernail clippings *469 taken from the victim's right hand did not allow for as definitive a conclusion.

The analyst testified that the defendant was a potential contributor to this DNA sample and that the frequency of occurrence of this DNA profile was one in six among the Caucasian population, one in twelve among the African-American population, and one in eight among the Hispanic population. 2. Motion to suppress the defendant's postarrest statements.

Before trial, the defendant moved to suppress his postarrest statements to Troopers Mason and Burke. The judge denied the motion following an evidentiary hearing. On appeal, the defendant renews his argument that he did not knowingly, intelligently, and voluntarily waive his Miranda rights, and that his statements were not made voluntarily.

Although the voluntariness of the defendant's statements was decided by the jury under the humane practice rule, see *Commonwealth v. Cryer*, 426 Mass. 562, 571 (1998), the defendant directs his challenge on appeal primarily to the judge's pretrial ruling.

Therefore, in considering the defendant's present challenge, we rely on the findings of fact made by the judge following the suppression hearing, recognizing that the testimony presented at trial concerning the voluntariness of the defendant's statements was in all significant respects identical to that presented at the motion hearing.

We accept as true the subsidiary findings of fact made by the judge in the absence of clear error and give deference to his credibility findings, because he had the opportunity to observe and evaluate the witnesses as they testified. See *Commonwealth v. Peters*, 453 Mass. 818, 822-823 (2009).

We do, however, "make our own independent determination on the correctness of the judge's application of constitutional principles to the facts as found." *Commonwealth v. Tavares*, 385 Mass. 140, 145, cert. denied, 457 U.S. 1137 (1982), quoting *Brewer v. Williams*, 430 U.S. 387, 403 (1977).

The judge found that around 7 p.m. on April 14, 2005, the defendant was arrested, handcuffed, and led from his home to a police cruiser. There, Trooper Mason advised the defendant that he was under arrest for the murder of the victim and read him his Miranda rights from a standard waiver of rights form.

The defendant said that he understood his rights and wanted to discuss the case, but Trooper Mason told him to wait until their arrival at the State police barracks where recording equipment

would be available. *470At the State police barracks, the defendant was taken to a conference room, where he sat with Troopers Mason and Burke, and his handcuffs were removed.

At 7:32 p.m., he was again read his Miranda rights from a waiver of rights form, which the defendant signed first to acknowledge receipt of his rights and then to waive them. Trooper Mason asked the defendant if he would consent to having the interview recorded, and the defendant said he did not want to be recorded unless his refusal would “make me look like an asshole.” Trooper Mason informed him that courts preferred that interviews be recorded but that the decision belonged to the defendant.

The defendant declined to be recorded and signed a standard form declaring his unwillingness to consent to a recording. Trooper Mason also advised the defendant of his right to make a telephone call and told the defendant that a telephone was available whenever he wanted to use it.

The defendant said that he wanted to talk with the officers first “to straighten everything out” and that later he would telephone his girl friend. Trooper Mason offered the defendant medical attention, but the defendant did not ask to see a doctor or appear to be in physical or mental distress. Troopers Mason and Burke conducted the interview in “a loose format,” without raising their voices, and the defendant was talkative.

As described earlier, the defendant initially restated his denial of any involvement with the victim and then, after being confronted with the DNA report, gave multiple versions of the events of the night of Friday, January 4, 2002. At 11:20 p.m., pizza and soda were brought to the interview room; the defendant accepted a soda but declined the food.

After the defendant gave his final version of events, in which he admitted that he had joined Frazier in hitting and kicking the victim, and that Frazier had stabbed her in the chest, Trooper Burke stepped out of the interview room and the interview stopped. During the break, the defendant said that he knew he could have a lawyer but wanted to cooperate instead.

He said he wanted to contact his attorney to arrange for the attorney to meet him at court in the morning, and he placed a telephone call to his attorney at 12:09 a.m., leaving a voice mail message. Trooper Mason told the defendant that they would proceed with booking, but the defendant said that he was not finished discussing the case. Trooper Mason twice expressed *471his willingness to wait for the defendant’s attorney, but the defendant said he wanted “to clear things up,” and they returned to the interview room.

The defendant provided no significant new information in the discussion that followed. At 12:40 a.m., Trooper Burke advised the defendant of his right to a prompt presentment through a standard form, and the defendant waived his right. At 1:15 a.m., the defendant asked to telephone his girl friend, and he was allowed to make the call. At 1:35 a.m., after the defendant said that his story was not going to change, the interview terminated.

During the interview, the defendant was sober and not under the influence of marijuana, Percocet, or alcohol. Nor did he suffer “from any defect of intellect or mental disorder.” He was responsive to the questions and gave “rational, cogent answers,” at times “in a narrative form.” His signatures on the various rights forms were “firm, clear and consistent,” and his diagrams of the crime scene were “accurate.” The troopers’ interrogation was “not heavy-handed but more in the nature of guiding a cooperative, albeit cagey, witness.” The judge’s findings of fact are fully supported by the evidence in the motion hearing record and are not clearly erroneous.

We conclude, as did the motion judge, that the defendant was twice advised of his Miranda rights and twice waived them, first in the police cruiser and later at the commencement of the interview in the conference room.

We also conclude that the defendant’s waivers were knowingly, intelligently, and voluntarily made. The defendant wished to speak to the troopers in an attempt, in his words, “to straighten everything out” following his arrest for the victim’s murder. His refusal to be recorded, which immediately followed his second waiver of his Miranda rights, demonstrated that he could say “no” to the police when he wished.

The test for voluntariness of a defendant’s statement is “whether, in light of the totality of the circumstances surrounding the making of the statement, the will of the defendant was overborne to the extent that the statement was not the result of a free and voluntary act.” *Commonwealth v. Selby*, 420 Mass. 656, 663 (1995).

In addressing the voluntariness of the defendant’s statement, the judge carefully weighed the evidence before *472him, which, in addition to the facts we have discussed, included a videotaped record of the arrest itself, the defendant’s booking photograph, and extensive testimony from multiple witnesses on the question of the defendant’s demeanor and sobriety.

There is nothing in the record that leads us to question the judge’s determination that the defendant’s statement was voluntary beyond a reasonable doubt. Although the six-hour period over which the interview unfolded was lengthy, there is nothing in the judge’s findings or our own independent review of the record to suggest that the defendant’s will was overborne to the extent that his statement was not the result of his free and voluntary act.

See *id.* at 662-663. Despite the defendant’s contention that he is “marginally retarded,” the judge was entitled to rely on the testimony of the troopers who conducted the interview in finding that the defendant gave “rational, cogent answers” during the extended interview, and that the defendant attempted “to talk his way out of his predicament.” See *Commonwealth v. Brown*, 449 Mass. 747, 766-768 (2007) (where defendant raised claim of mental illness, finding of voluntariness supported by testimony that he did not appear to have difficulty understanding and responding to questions); *Commonwealth v. Beland*, 436 Mass. 273, 281-282 (2002) (even though

defendant suffered from mental deficiencies, statements made voluntarily where judge credited police testimony that defendant's statements were "articulate and coherent," and where defendant gave exculpatory explanation of events to police officers).^{9 3}.

Motions to dismiss the indictments. Both before and during trial the defendant moved to dismiss the indictments based on *473claims that the integrity of the grand jury had been violated. On appeal, the defendant argues that it was error for the judge to have denied these motions.

We disagree. The defendant contends first that the indictments should have been dismissed when it became apparent, days after the indictments issued, that one of the grand jurors knew the victim, the victim's child, and the child's father.

The defendant argues that this grand juror could not have been impartial, and that her presence compromised the integrity of the grand jury. Before the motion was filed, the grand juror was questioned by a judge (who was not the motion judge¹⁰) without the presence of counsel, and a transcript was made of the interview.

The grand juror acknowledged that she knew the victim, the victim's child, and the child's father, and stated that she had been "totally destroyed" by what she saw and learned while on the grand jury.¹¹ She also said that, when the grand jury were selected, she felt it was "okay for me to sit" as a grand juror because, when asked if she could put her feelings aside, she felt that she could and believed she had done so. "It is clear that a grand jury must act in a manner consistent with their oath," which includes the obligation to indict no one "based on 'hatred or malice.' " Commonwealth v. McLeod, 394 Mass. 727,733-734, cert, denied sub nom.

Aiello v. Massachusetts, 474 U.S. 919 (1985), quoting G. L. c. 277, § 5 (grand juror's oath). Where a defendant makes a prima facie showing of grand jury bias or prejudice so egregious that it suggests that the grand jury returned an indictment based on "envy, hatred or malice" rather than the evidence in the grand jury record, further inquiry is warranted.

See Commonwealth v. McLeod, supra at 733-734 & n.10. Evidence that a grand juror knew the victim and members of her family falls well short of the showing of bias or prejudice necessary to require such an inquiry, especially where, as here, the grand juror had said that she put her personal feelings aside during the proceedings and there is no evidence to the contrary.

See id. at 734 ("fact that grand jurors may have some familiarity with an alleged crime, bring this information into the grand jury *474room, and act on it, is not sufficient to require either further inquiry into alleged prejudice or the automatic dismissal of an indictment"); Commonwealth v. McNary, 246 Mass. 46,54 (1923) ("It is an ancient principle of grand jury procedure that [grand jurors] may act on personal knowledge...").

Cf. *Commonwealth v. Monahan*, 349 Mass. 139, 155-156 (1965) (grand jurors' exposure to extensive, adverse publicity implicating defendant in case provides no basis to conclude grand jury were biased against defendant).

The motion judge correctly ruled that the grand juror's personal knowledge of those affected by the crime did not require her disqualification or otherwise impair the integrity of the grand jury. See *Commonwealth v. O'Dell*, 392 Mass. 445, 449-451 (1984) (dismissal of indictment required only where defendant has shown impairment of integrity of grand jury proceedings).

The defendant also argues that the prosecution knowingly presented false evidence to the grand jury that "so seriously tainted the presentation to that body that the indictment should not have been allowed to stand." *Id.* at 447. Frazier testified before the grand jury that, after a fight broke up the house party that followed the event at the Juice Bar on the night of January 4, 2002, Shawn Mulvey drove him to Mulvey's house, where he spent the night.

The defendant contends that Frazier's account was false and that the prosecutor presented Frazier's testimony to the grand jury knowing it to be false. The defendant also contends that the prosecutor concealed exculpatory evidence by failing to reveal to the grand jury that Mulvey (who did not testify before the grand jury) initially had denied to police that Frazier slept at his house that night.

To justify dismissal of an indictment, a defendant must show not only that false or deceptive evidence was given to the grand jury knowingly and for the purpose of obtaining an indictment, but also that on the entire grand jury record, the false or deceptive evidence was material to the question of probable cause and probably made a difference in the grand jury's decision.

Commonwealth v. Mayfield, 398 Mass. 615, 621-622 (1986). The defendant has failed to show that Frazier's grand jury testimony was false, much less that the prosecutor knew that it was false. After the indictments were returned, Shawn Mulvey admitted to police that he drove Frazier home with him after the house party and that Frazier spent the night at Mulvey's home.

At trial, Mulvey testified that he had initially claimed to have no memory of the evening in the hope of avoiding any involvement in the case, but that he was in fact "one hundred percent sure" that Frazier had spent the night at his house. Nor was Mulvey's earlier false statement to police investigators exculpatory.¹² In his initial statement, Mulvey had not contradicted Frazier's testimony that he had spent the night of January 4, 2002, at Mulvey's house; he had only told police that he could not recall anything about that night.

Moreover, as the judge recognized, the DNA evidence tying the defendant to the victim, along with the defendant's various statements to the police, provided the grand jury with more than sufficient evidence to support a finding of probable cause.

The failure to disclose Mulvey's initial statement to the police therefore could not have affected the grand jury's decision to indict. See *id.* at 621. 4. Motion for change of venue or juror sequestration. In light of extensive media coverage of the murder, the three-year police investigation, and the pretrial proceedings, the defendant sought a change of venue pursuant to Mass. R. Crim.

P. 37 (b), 378 Mass. 914 (1979), or, in the alternative, sequestration of the jurors. The judge denied the motion for a change of venue before commencing jury selection but said that he would reconsider his ruling if he determined during jury selection that it would not be possible to seat a fair and impartial jury. He also denied the motion for sequestration of the jurors but said that he would reconsider that ruling if developments during trial suggested that the media were disregarding his order not to communicate with the jury or that the jury were disobeying his order to avoid exposure to media coverage of the trial.

The defendant contends that these rulings deprived him of his right to a fair and impartial jury. A judge has substantial discretion in deciding whether to grant a motion for a change of venue or whether to sequester jurors. See *Commonwealth v. Clark*, 432 Mass. 1, 10 (2000); *Commonwealth v. James*, 424 Mass. 770, 775 (1997), and cases cited.

The judge did not abuse that discretion here. *476A trial judge may order a change of venue if "there exists in the community where the prosecution is pending so great a prejudice against the defendant that he may not there obtain a fair and impartial trial." Mass. R. Crim. P. 37 (b) (1). "A trial judge should exercise his [or her] power to change the venue of a trial 'with great caution and only after a solid foundation of fact has been first established.' " *Commonwealth v. Clark*, *supra* at 6, quoting *Commonwealth v. Colon-Cruz*, 408 Mass. 533, 551 (1990). "The mere existence of pretrial publicity, even if it is extensive, does not constitute a foundation of fact sufficient to require a change of venue." *Commonwealth v. Colon-Cruz*, *supra*. "Rather, a defendant must show that in the totality of the circumstances, 'such publicity deprived him of his right to a fair trial.' " *Commonwealth v. James*, *supra* at 776, quoting *Delle Chiaie v. Commonwealth*, 367 Mass. 527, 532 (1975).

In evaluating the risk of prejudice posed by pretrial publicity, we give careful attention to the evaluation of the trial judge, especially one who, as here, presides in the county where the crime occurred and is familiar with the nature and pervasiveness of the pretrial publicity.

Here, the defendant has shown nothing more than the existence of substantial pretrial publicity surrounding the murder of the victim and the arrest of the defendant. In selecting the jury, the judge conducted an individual voir dire where he asked each prospective juror whether he or she had read, seen, or heard anything about the case from any source and, if so, whether this information would affect the prospective juror's ability to render a fair and impartial verdict.

The judge, after appropriate inquiry, properly excused the one prospective juror who indicated that he could not be fair and impartial as a result of the media coverage. We have carefully examined the transcript of the jury selection and conclude, as did the judge, that the pretrial publicity did not prevent the selection of a fair and impartial jury.

The record reflects that the judge also properly exercised his discretion in initially refusing to sequester the jury, and in taking appropriate steps to ensure that the jury were shielded from media reporting of the trial.

Before empanelment of the jury, the judge issued orders protecting the jury from being photographed by the media and prohibiting reporters from contacting *477or communicating with jurors before they reached their verdicts; he enforced these orders aggressively during the course of the trial.

The judge repeatedly questioned the jury throughout the course of the trial to determine whether any juror had learned anything about the case outside the court room, and he carefully instructed jurors to avoid media reports about the case and to refrain from discussing the case with friends and family members.

The judge was entitled to assume that the jurors would follow his instructions. *Commonwealth v. Clark*, supra at 10. When, during jury deliberations, a juror's involvement in a criminal matter unrelated to the defendant's case, see *infra* at 486-489, increased the risk that media coverage would affect those deliberations, the judge appropriately exercised his discretion once again and sequestered the jurors in order to address the changed circumstances.

We conclude that the judge acted reasonably within his discretion both when he decided not to sequester the jury at the commencement of trial and when he decided to sequester them during their deliberations. 5. Evidentiary rulings at trial.

The defendant claims the judge erred by admitting in evidence certain inculpatory information and excluding certain exculpatory information. He argues that these errors entitle him to a new trial. We consider each of these claims in turn. a. Prior bad acts evidence. Over the defendant's objection, the judge allowed Trooper Mason to testify during redirect examination that, apart from the contradiction between the laboratory report indicating that the defendant's DNA had been found on the victim's body and the defendant's denials that he had had any contact with the victim beyond picking up her garbage, two factors that weighed in his decision to seek an arrest warrant against the defendant were that the defendant had five protective orders brought against him by five different women and a number of criminal charges in the Barnstable Division of the District Court Department.

The defendant argues that admission of this latter evidence unfairly invited the jury to convict him because of his bad character or his propensity to abuse women. While the prosecution "may not

introduce evidence that a defendant previously has misbehaved, indictably or not, for the purposes of showing his bad character or propensity to commit *478the crime charged,” such evidence may be admitted if relevant for some other purpose, and if the probative value of the evidence outweighs the risk of unfair prejudice.

Commonwealth v. Helfant, 398 Mass. 214, 224-225 (1986). The judge instructed the jury immediately after the admission of this bad act evidence (and again in his final charge) that this evidence was admitted for the limited purpose of explaining the trooper’s decision to obtain an arrest warrant and to confront the defendant with the DNA report after he was arrested rather than before his arrest.¹³ The judge also told the jury that they were not permitted to use the information to infer that “if somebody did something in the past, then they must have done the matter that we’re now on trial for.

That’s never allowed.” Whether evidence of prior bad acts is relevant, and whether the probative value of such evidence is outweighed by its potential for unfair prejudice, are determinations committed to the sound discretion of the trial judge and will not be disturbed by a reviewing court absent “palpable error.” *Commonwealth v. Fordham*, 417 Mass. 10, 23 (1994).

Commonwealth v. Robertson, 408 Mass. 747, 750 (1990). To evaluate whether the judge abused his discretion in allowing this testimony, we examine his decision in the context of the trial. During the direct examination of Trooper Mason, the judge sustained the defendant’s objection to the admission of evidence regarding the prior protective orders issued against the defendant and his denial that he had an anger management problem.

The judge asked defense counsel whether he intended to bring up these issues on cross-examination, and defense counsel assured him he would not. On cross-examination, however, defense counsel repeatedly questioned Trooper Mason concerning the adequacy of the evidence supporting the defendant’s arrest.

The inference the defense attorney sought the jury to draw from this line of questioning was that Trooper Mason had decided to arrest the defendant based solely on the DNA report and the defendant’s prior denials of any personal contact with the victim, and that *479this was “a pretty thin case.” Trooper Mason mentioned that there was additional information in the arrest warrant affidavit, but did not describe that information.

Defense counsel also elicited from Trooper Mason that Tim Arnold had not been arrested for the victim’s murder, even though Arnold’s semen and hair were found at the crime scene and Arnold had a “rocky relationship” with the victim.¹⁴ He asked why the defendant was not “allowed the luxury of being brought in for an interview as opposed to being arrested.” Trooper Mason answered that there were “were other things that I considered.” When the prosecutor attempted to rebut the suggestion that Trooper Mason had acted unfairly through a series of questions to

Trooper Mason on redirect examination, the judge agreed with the prosecutor that, by pursuing a “fundamental theme” in cross-examination that “the lead investigator has been less than scrupulously fair,” the defendant had “opened the door” to the admission of the bad act evidence for the limited purpose of explaining Trooper Mason’s state of mind in arresting the defendant.

The judge did not abuse his discretion in admitting the evidence subject to his firm limiting instructions. By challenging the good faith of the lead investigator in the case, defense counsel invited a fuller explanation of the investigator’s reasons for applying for an arrest warrant against the defendant.¹⁵ We also note that the evidence admitted regarding these prior bad acts was limited.

The prosecutor did not elicit any testimony about the conduct that resulted in the protective orders or when they had issued. Nor did the prosecutor elicit any description of the District Court charges against the defendant or of their disposition. No *480further mention was made of these prior bad acts during the trial or in closing arguments. They were referred to again, at the request of the defendant, only during the judge’s charge to the jury for the sole purpose of reminding the jury of the limited purpose for which the evidence was admitted. b. Medical examiner testimony.

The autopsy of the victim was conducted by Dr. James Weiner, but Dr. Weiner was unavailable to testify at trial due to illness; in his place, the prosecution called Dr. Henry Nields, whose knowledge of the case derived solely from his review of the reports, notes, and charts prepared by Dr. Weiner.

The defendant argues that his right to confrontation, as guaranteed by the Sixth and Fourteenth Amendments to the United States Constitution, was violated by the admission of testimonial hearsay — the opinions and factual findings in Dr. Weiner’s reports and notes — through the testimony of Dr. Nields.

In his direct examination, Dr. Nields testified in detail from Dr. Weiner’s notes and reports as to Dr. Weiner’s observations of the victim’s body and his findings as to the nature of her wounds when he arrived at the scene of the crime at 7:55 p.m. on January 6, 2002, and when he conducted the autopsy on January 7. Three charts prepared by Dr. Weiner documenting the location and nature of the wounds on the victim’s body were admitted in evidence.

Dr. Nields also testified to Dr. Weiner’s opinion as to the time of death of the victim, which was “an estimated postmortem time of twenty-four to thirty-six hours.”¹⁶ The observations, findings, and opinions of Dr. Weiner reflected in his notes and reports were testimonial hearsay, because a reasonable person in his position would anticipate that they would be used against the accused in investigating and prosecuting a crime, and they were offered for the truth of the matters asserted.

See *Commonwealth v. Nardi*, 452 Mass. 379, 392-394 (2008). As the Commonwealth concedes, it was error for the judge to permit Dr. Nields to testify to what Dr. Weiner saw, found, and opined.

See *Commonwealth v. Durand*, 457 *481 Mass. 574, 585 (2010) (substitute medical examiner may not testify to factual findings made at autopsy by unavailable medical examiner); *Commonwealth v. Nardi*, supra at 392, 394 (same).

Because the defendant failed to object at trial to the admission of this testimonial hearsay, we consider whether its admission resulted in a substantial likelihood of a miscarriage of justice. See *Commonwealth v. Nardi*, supra at 394.

We conclude that it did not. The facts that Dr. Nields recited from Dr. Weiner's notes and report concerning the physical condition of the victim's body at the crime scene had already been admitted in evidence through the testimony of multiple other witnesses who had observed the crime scene and gave nearly identical firsthand descriptions of the victim's body after she was found.

The facts concerning the location and nature of the victim's injuries that Dr. Nields recited from Dr. Weiner's notes and reports had been previously admitted in evidence through the testimony of State Trooper Carol Harding, who attended the autopsy, testified to each injury Dr. Weiner examined during the autopsy, and authenticated ten photographs from the autopsy that documented the victim's injuries and that were admitted in evidence.¹⁷ As to these facts, the testimonial hearsay erroneously admitted in evidence added nothing of significance to the evidence properly admitted.

Dr. Weiner's opinion as to the estimated time of death of the victim, however, was not in evidence except through the erroneously admitted testimonial hearsay. See *Commonwealth v. Nardi*, supra at 394. Although Dr. Nields properly could have testified to his own opinion as to time of death, based on his forensic expertise as a medical examiner and his review of Dr. Weiner's notes and reports, see *Commonwealth v. Avila*, 454 Mass. 744, 761-762 (2009), he did not do so.

The erroneously admitted evidence of Dr. Weiner's estimate of the victim's time of death, however, favored the defendant, because it suggested that the victim most likely had been killed between 8 a.m. and 8 p.m. on *482 Saturday, January 5, rather than late Friday night or shortly after midnight on Saturday morning, as indicated by the defendant's statement.

As a result, on cross-examination, defense counsel attempted to elicit from Dr. Nields that, if Dr. Weiner's outside estimate of thirty-six hours were accepted, the earliest possible time of death would have been 8 a.m. on Saturday, January 5.¹⁸ After the prosecution rested, the defendant called Gerard Smith, a neighbor of the victim, who testified that at approximately 1 p.m. on January 5, he saw a dark "work type van" depart the driveway of the victim's house "at a very fast speed" driven by a dark-skinned Caucasian man.¹⁹ In his closing argument, defense counsel argued that the victim died on Saturday, and suggested that the person in the van seen by Smith, and not the defendant, had killed her.

He reminded the jury that the Commonwealth's "own medical examiner puts the time of death on Saturday." There can be no substantial likelihood of a miscarriage of justice where the defendant fails to object to the admission of testimonial hearsay and then relies on that erroneously admitted hearsay to challenge the prosecution's theory of the case as to the time of death, the reliability of the defendant's confession, and ultimately the defendant's guilt.

See *Commonwealth v. Nardi*, supra at 395-396 (no substantial likelihood of miscarriage of justice where defense strategy relied on factual findings erroneously admitted in testimony of substitute medical examiner). c. DNA expert testimony.

The defendant raises a similar confrontation clause challenge to the admission of testimony by the Commonwealth's DNA analyst, Christine Lemire, regarding the results of DNA testing generated by another analyst. Lemire testified that the analysis employed by her laboratory assigned numbers to specific locations, or allele sites, on DNA extracted from the known sample provided by the defendant and from the unknown samples drawn from swabbings and fingernail scrapings recovered from the victim's body.

Lemire herself developed *483the DNA profile from the unknown samples recovered from the victim's vaginal cavity, her right and left breasts, and beneath her fingernails. Lemire then performed the comparative analysis that enabled her to offer the opinion that the defendant was a potential contributor of the DNA profile developed from the unknown samples taken from the victim's right and left breasts, her vaginal cavity, and the fingernail clippings, and to opine as to the frequency of that DNA profile being found in various population groups.

Lemire illustrated her analysis for the jury with an over-sized chart that made a side-by-side comparison of the allele numbers generated from the defendant's known sample with the allele numbers generated from the unknown samples; the chart was admitted in evidence. Lemire's testimony regarding the DNA testing she performed on the unknown samples was not hearsay.

Nor was her opinion testimony because, as an expert, she was entitled in reaching an opinion to rely on her own personal knowledge as well as facts or data that are themselves hearsay, provided this information is of a type reasonably relied on by experts to form opinions in the relevant field. See *Commonwealth v. Barbosa*, 457 Mass. 773, 783-784 (2010); *Commonwealth v. Nardi*, 452 Mass. 379, 390 (2008).

Therefore, Lemire's opinions whether the defendant was a potential contributor of the DNA profile in each unknown sample and the statistical likelihood that an individual in various population groups could have been a contributor of that DNA profile were not hearsay. See *Commonwealth v. Barbosa*, supra. But the allele numbers derived from the testing of the known samples by another analyst that were included in Lemire's chart were testimonial hearsay, because

these were factual findings made by a nontestifying witness for the purpose of investigating the murder.

See *Commonwealth v. Barbosa*, supra at 784; *Commonwealth v. Banville*, 457 Mass. 530, 540-541 (2010). The allele numbers produced by the nontestifying analysts were therefore admitted in error. Because the defendant did not object at trial to the admission of the other analyst's factual findings or to the chart that included these findings, we consider whether the admission of this evidence resulted in a substantial likelihood of a miscarriage of justice.

See *Commonwealth v. Nardi*, supra at 394. We conclude that it did not. *484 In *Commonwealth v. Barbosa*, supra at 789, we noted that without an expert's interpretation and analysis, the admission of the raw DNA testing results alone, even where the allele numbers match, is meaningless to a jury.

Because the human genome sequence is almost exactly the same (99.9%) in all people, "the mere fact that the characteristics of certain alleles of a defendant's DNA matches the characteristics of alleles of DNA found at a crime scene says almost nothing about the likelihood that the defendant was present at the crime scene unless the jury learn from an expert about the nature of the DNA profile used." *Id.*,, citing Human Genome Program, U.S. Dep't of Energy, *Genomics and Its Impact on Science and Society: A 2008 Primer* 3 (2008).

For a jury, the compelling information is an expert's properly admitted opinion testimony regarding the statistical likelihood that the defendant was the source of the unknown DNA sample recovered from a crime scene. See *Commonwealth v. Barbosa*, supra.

Here, the probative testimony given by Lemire was not the allele numbers generated by the other analyst's testing, which were inadmissible in evidence, but her opinions, which were admissible in evidence, that there was an infinitesimal likelihood that someone other than the defendant could have been the source of the male DNA found on the victim's right breast and in her vaginal cavity.

Because Lemire was permitted to use the other analyst's findings in reaching her own opinion, *Commonwealth v. Nardi*, supra at 390, and because these findings had no meaningful probative value without her expert testimony, the erroneous admission of these underlying facts in evidence did not result in a substantial likelihood of a miscarriage of justice. See *Commonwealth v. Barbosa*, supra at 792-793. d. Exclusion of defendant's statements made to defense expert psychologist.

At trial, the defense called Dr. Eric Brown, a clinical psychologist, who offered his expert opinion that, because of the defendant's low level of intelligence and limited cognitive abilities, the defendant lacked the "cognitive functioning" necessary to participate intelligently in the interview that resulted in his postarrest inculpatory statements to Troopers Mason and Burke.

On cross-examination, the prosecutor asked if, in making his evaluation, Dr. Brown had reviewed the diagrams that the defendant sketched for the troopers of the interior and exterior *485of the victim's home during the course of the interview. When defense counsel asked Dr. Brown on redirect examination whether the defendant had told him how he knew about the interior of the victim's house, the Commonwealth objected.

Defense counsel argued that the prosecutor had opened the door to this testimony by asking Dr. Brown about the diagrams in an attempt to show that the defendant had the intelligence to recall what he saw at the victim's house. During voir dire, Dr. Brown testified that the defendant had told him that he drew the diagram based on his memory of being in the house on Thursday afternoon, January 3, 2002, when he had a "sexual encounter" with the victim.²⁰ The judge found that the prosecutor had not opened the door to the admission of this evidence, and sustained the Commonwealth's objection.

The defendant argues that the judge's ruling was error. The trial judge is afforded substantial discretion in deciding whether, and for what purposes, evidence is relevant, see *Anthony's Pier Four, Inc. v. HBC Assocs.*, 411 Mass. 451, 477 (1991), and a trial judge's rulings on these questions are reversible only for an abuse of discretion. See *Cottam v. CVS Pharmacy*, 436 Mass. 316, 327 (2002).

If offered to prove that the defendant had a "sexual encounter" with the victim that Thursday afternoon, the defendant's statement to Dr. Brown was inadmissible hearsay, because the defendant made the statement outside the court room, the defendant was not subject to cross-examination regarding the statement, the statement was intended to prove the truth of the matter asserted, and the defendant, not an adverse party, was offering the statement in evidence.

See generally Mass. G. Evid. § 801 (2010). The defendant argued at trial that the purpose of offering the defendant's prior statement was not to prove that he was inside the victim's house that Thursday afternoon, but to explain how he had been able to draw the diagram of the interior *486of the house in spite of his low cognitive abilities.

However, the defendant's argument on appeal — that the judge's preclusion of this evidence left "the jury with the impression that [the defendant] knew the home because he committed the crime" — demonstrates that the evidence was offered for the truth of the matter asserted, that is, to explain the presence of the defendant's DNA on the victim's body and his familiarity with the interior of the victim's house as the result of his consensual sexual encounter with her on Thursday afternoon, not the result of an attack on her the evening she was killed.

The judge acted within his discretion in precluding the defendant's statement to Dr. Brown because it was offered for the truth of the matter asserted, and because the prosecutor had not

opened the door to the admission of this statement when he referenced the defendant's sketching of these diagrams.²¹ 6. Removal of deliberating juror.

The defendant argues that he is entitled to a new trial because the judge improperly removed a deliberating juror after the jury had informed the judge that they were deadlocked on each of the charges. We set forth the undisputed facts concerning this issue.

The jury commenced deliberations on Tuesday, November 7, 2006, and continued through Friday, November 10. During the weekend recess, one of the jurors became involved in a highly publicized police investigation unrelated to the defendant's case when the father of her child was arrested at her home in connection with a shooting in Falmouth.²² The juror was not implicated in the shooting.

Several of the jurors learned of the juror's connection to the arrest from news reports over the weekend, and more learned of it through discussions in the jury room on the following Monday. In accordance with the practice approved in *Commonwealth v. Jackson*, 376 Mass. 790, 800-801 (1978), the judge conducted an individual voir dire of each juror (including two alternate^{*487} jurors) to determine whether exposure to reports of the weekend arrest had affected any juror's ability to render an impartial verdict.

He found that, despite some knowledge of the weekend incidents, the other eleven deliberating jurors and the two alternates remained fair and impartial, free of taint, and capable of deliberating further. The juror assured the judge that she had not formed any prejudice or bias toward the Commonwealth or those arrested or involved with the criminal law, and could remain as fair and impartial as when she was first seated, despite the events of the weekend.

Neither the Commonwealth nor the defense moved to dismiss the juror based on this inquiry. After ordering her not to discuss the events of the weekend with anyone during the remainder of her jury service, the judge permitted the juror to continue to deliberate. Later that day, the jury informed the judge that they were deadlocked on all counts.

The judge issued a Tuey-Rodriguez charge and instructed the jury to return to deliberations. See *Commonwealth v. Rodriguez*, 364 Mass. 87, 101-102 (1973) (Appendix A); *Commonwealth v. Tuey*, 8 Cush. 1, 2-3 (1851). At the close of the day, the judge ordered the jury sequestered for the remainder of their deliberations in light of the increased media focus on the jury following the weekend arrest.

Before jury deliberations commenced the following day, the Commonwealth moved to dismiss the juror on the basis of two telephone conversations between the juror and the jailed father of her child that had been recorded by the Barnstable house of correction the previous afternoon following the judge's issuance of the sequestration order.

In a hearing attended by the defendant, defense counsel, and the prosecutor, the judge found on the basis of the recordings that she maintained a “strong ongoing relationship” with the father of her child. The judge further found that the recordings showed that the juror was disregarding his repeated orders to the jury not to communicate with others about the case and to avoid media reports concerning it.

Finally, he found that the juror’s representation that she remained fair and impartial “to be less than reliable” because “she clearly sides with [the father of her child]” and “expresses concern” about the conduct and integrity of the police involved in the shooting investigation.

The judge concluded “that the palpable conflict is not only one that can be inferred; it’s one that can be established *488by the direct evidence before the court.” On the basis of these findings and over the defendant’s objection, the judge discharged the juror.

The judge then informed the remaining members of the jury that he had removed the juror for reasons personal to her that had nothing to do with her view of the case. An alternate juror was then drawn by lot, and the judge instructed the reconstituted jury to begin their deliberations anew.

The jury returned their verdict three days later. Once a jury commence deliberations, a juror may be discharged if “unable to perform [her] duty” because of illness or “any other good cause shown to the court,” G. L. c. 234, § 26B; or, after a hearing, “upon a finding of an emergency or other compelling reason.” G. L. c. 234A, § 39.

The facts of *Commonwealth v. Garrey*, 436 Mass. 422 (2002), presented circumstances similar to those before the judge here. There, we concluded that “a palpable conflict existed” that justified the discharge of a deliberating juror where her son and husband were arrested, held in jail, and awaited prosecution by the same district attorney’s office prosecuting the defendant.

See *id.* at 430-431 & n.5. Here, a comparable “palpable conflict existed,” where the father of the deliberating juror’s child, with whom the juror had a “strong ongoing relationship,” was arrested on felony charges, held in jail, and awaited prosecution by the same district attorney’s office prosecuting the defendant. While that “palpable conflict” was sufficient to support the judge’s exercise of his discretion, there were additional reasons that supported the judge’s decision to discharge the juror here.

The juror’s statements in the tape-recorded telephone calls supported the judge’s findings that the juror was upset with the police and their conduct of the investigation of the child’s father, and that she had learned of media reports regarding the arrests for the shooting.²³ There is no evidence that the judge sought to affect the jury’s verdict by his discharge of the juror.

As the judge found, there *489was no information before him to suggest whether the juror favored the defendant’s conviction or acquittal. Nor was there any information before him whether one or

more jurors were the source of the jury's deadlock, or whether this juror was in the minority or majority. See *Commonwealth v. Olavarria*, 71 Mass. App. Ct. 612, 619-620 (2008) ("Even greater care [in deciding whether to discharge a deliberating juror] should be taken when the jury is at an impasse with a lone dissenting juror").

The judge here acted within his discretion in concluding that there was compelling reason to discharge the deliberating juror. See, e.g., *Commonwealth v. Garrey*, supra at 430-431 & n.5; *Commonwealth v. Olavarria*, supra at 620-622.²⁴ There was no error. 7. Motion for a new trial based on prosecutor's alleged failure to disclose exculpatory evidence.

The defendant argues that he is entitled to a new trial because the prosecutor failed to reveal to the defense that Jeremy Frazier had been charged with assault by means of a dangerous weapon in August, 2003; he contends that this information would have implicated Frazier in the stabbing of the victim. Defense counsel, however, had a copy of Frazier's board of probation record during his cross-examination of Frazier at trial and questioned him regarding the dismissal of various District Court charges, suggesting in his questioning that the charges had been dismissed in return for Frazier's testimony at the defendant's trial.

Defense counsel, therefore, knew of the charge and of its dismissal at the time of trial. Defense counsel did not attempt at trial to offer the underlying alleged incident — which involved the brandishing of a two-inch pocket knife against British tourists in an argument *490that ended without violence — as a prior bad act and, if he had, the judge would have acted within his discretion had he barred the evidence as too remote in time and too weak in probative value to support the inference that Frazier had participated in the brutal rape and murder of the victim more than one and one-half years earlier.²⁵ See *Commonwealth v. Graziano*, 368 Mass. 325, 329-300 (1975).

The defendant also contends that he is entitled to a new trial because the prosecutor failed to reveal administrative problems in the reporting of DNA test results at the State police crime laboratory that were documented in two official reports. These reports, however, were issued in 2007, after the conclusion of the defendant's trial, and there is no evidence that the prosecutor or his investigators were aware at the time of trial of the deficiencies at the laboratory. "It is clear that a 'prosecutor cannot be said to suppress that which is not in his possession or subject to his control.' " *Commonwealth v. Daye*, 411 Mass. 719, 734 (1992), quoting *Commonwealth v. Donahue*, 396 Mass. 590, 596 (1986).

Moreover, the 2007 reports focused on the backlog of unprocessed DNA samples held by the laboratory and administrative inefficiencies in the laboratory's handling of information in the DNA database used by law enforcement; they did not reveal any deficiencies in the quality of scientific work conducted at the crime laboratory that would put in question the analyst's opinion that the defendant was a contributor of DNA found on the victim's body.

The judge did not err in denying this frivolous motion for a new trial. 8. Allegations of juror misconduct. Approximately one month after the conclusion of trial, the defendant moved for a postverdict inquiry of the jurors based on information contained in affidavits from the discharged juror and two other deliberating jurors that the jury's deliberations had been infected by racial prejudice.

The claims of racial prejudice were based on three separate incidents and alleged (1) that one juror (Juror X) had *491said that she was frightened of the defendant because he was "big" and "black" and had been trying to "intimidate" her by staring at her in the court room; (2) that another juror (Juror Y) said that bruises like those found on the victim's body would result "when a big black guy beats up on a small woman"; and (3) that a third juror (Juror Z) said that he had always been around white people and did not like black people because "look at what they are capable of."26'27 The defendant asked for a hearing to determine if the allegations of racial bias were true and for a new trial if the inquiry determined that they were.28 The judge conducted a postverdict evidentiary hearing in open court where he questioned ten of the twelve jurors who deliberated to verdict, the discharged juror, and the alternate juror concerning the allegations in the affidavits.29 The judge also permitted the defendant to call and question two additional witnesses: a great-aunt of Juror Z, who testified regarding statements she claimed Juror Z had made expressing animus toward African-Americans, and a social psychologist who offered expert testimony regarding the influence of race on juries.

Following the hearing, the judge made detailed findings of fact in which he concluded that there was "no factual basis" to support the allegation that Juror X had tied her fear of the *492defendant to race30 or that Juror Z had expressed racial animus toward African-Americans.31 As to Juror Y, the judge found that, at one point during the deliberations, she stood at the easel in the jury room explaining her view of the evidence, which was challenged by other jurors in a heated discussion.

In defense of her position, Juror Y blurted out that the victim's injuries were the result of a beating administered by a big black man.32 Juror Y's words provoked an immediate reaction from the black female juror, who asked Juror Y what being black had to do with it and called her a racist. Juror Y denied she was racist, responding that the defendant was a big black man and that her words were an accurate description.

The two swore at each other, and the black female juror approached the easel while Juror Y returned to her seat. A juror put a leg up to separate them, but the judge found that this gesture was unnecessary as the two remained apart and their disagreement remained verbal, not physical.

The confrontation ended when Juror Y said she meant no harm, and the jury foreperson called for a break in the deliberations. After considering whether Juror Y's statement reflected "overt prejudice" or "veiled or subconscious bias or stereotyping," the judge found that it "was descriptive in nature and intent and did *493not constitute racial bias on her part." He concluded

that the defendant had failed to prove by a preponderance of the evidence that Juror Y was not impartial.

The judge recognized that, regardless of Juror Y's "innocent intention, the image of a big black man beating on a small woman dovetails into a common racial stereotype that black men are prone to violence," and considered whether "the remaining jurors perceived such a stereotype from the words spoken." The judge concluded that the defendant had failed to prove by a preponderance of the evidence that the jurors were exposed to racial bias from the statement of Juror Y, or the resulting interchange between Juror Y and the black female juror.³³ He declared that this racial stereotype was "inherent in the facts of the case," and that interchange between Juror Y and the black female juror "served the salutary purpose of exposing the jurors to a healthy, albeit heated, discussion about identifying the defendant by the color of his skin, thereby blunting the effect of the stereotype."³⁴ Because "[t]he determination of a juror's impartiality 'is essentially one of credibility, and therefore largely one of demeanor,' " *Commonwealth v. Ferguson*, 425 Mass. 349, 352-353 (1997), quoting *Patton v. Yount*, 467 U.S. 1025, 1038 (1984), we give a trial judge's determination of impartiality great deference.

See *Commonwealth v. Ferguson*, *supra* at 353, and cases cited. We will not disturb a judge's findings that a juror is unbiased absent a showing that the judge's conclusion was clearly *494erroneous. See *Commonwealth v. Amirault*, 399 Mass. 617, 626 (1987).

We recognize the difficulty of the judge's task in ascertaining the facts here and the extraordinary care he took in setting forth in detail his findings. Having taken similar care in examining the record, we conclude there was no clear error in his findings of fact.

We therefore turn to the question whether the judge erred as a matter of law in denying the defendant a new trial based on the facts that the judge found. Article 12 of the Declaration of Rights of the Massachusetts Constitution and the Sixth Amendment to the United States Constitution, applied to the States through the due process clause of the Fourteenth Amendment, guarantee the right of a criminal defendant to a trial by an impartial jury.

Commonwealth v. Vann Long, 419 Mass. 798, 802 (1995). "The presence of even one juror who is not impartial violates a defendant's right to trial by an impartial jury." *Id.* See *Aldridge v. United States*, 283 U.S. 308, 314 (1931) ("if any [juror] was shown to entertain a prejudice which would preclude his rendering a fair verdict, a gross injustice would be perpetrated in allowing him to sit").

Where a defendant files an affidavit from a juror (or, as here, from more than one juror) alleging that a juror (or more than one juror) made a statement to another juror that reasonably demonstrates racial or ethnic bias, and the credibility of the affidavit is in issue, the trial judge should conduct a hearing to determine the truth or falsity of the affidavit's allegations, because

“the possibility raised by the affidavit that the defendant did not receive a trial by an impartial jury, which was his fundamental right, cannot be ignored.” *Commonwealth v. Laguer*, 410 Mass. 89, 97 (1991).

See *Commonwealth v. Amirault*, *supra* at 625-626 (where defendant after verdict raises “reasonable claim” that juror in child rape case failed during voir dire to reveal that juror had been victim of rape during childhood, defendant entitled to hearing conducted by trial judge to determine whether juror was actually biased).³⁵ In evaluating claims of juror bias, a judge, as the judge did ^{*495}here, must first determine whether the defendant has satisfied his burden of proving by a preponderance of the evidence that the challenged statements that possibly reflect racial or ethnic bias were actually made by the juror.

See *Commonwealth v. Laguer*, *supra* at 98-99; *Commonwealth v. Amirault*, *supra* at 626; *Commonwealth v. Laguer*, 36 Mass. App. Ct. 310, 314 (1994). If the judge finds that the statements were not made, the judge need make no further findings. See *id.* Where one or more of the challenged statements are shown to have been made, the judge must then determine whether the defendant has proved by a preponderance of the evidence that the juror who made the statements was actually biased because of the race or ethnicity of a defendant, victim, defense attorney, or witness.

See *United States v. Henley*, 238 F.3d 1111, 1121 (9th Cir. 2001). See also *Commonwealth v. Tavares*, 385 Mass. 140, 156 (1982) (finding that alleged statement suggesting racial prejudice had been made but determining that statement considered in context did not show actual bias). A juror is actually biased where her racial or ethnic prejudice, had it been revealed or detected at voir dire, would have required as a matter of law that the juror be excused from the panel for cause.

Cf. *McDonough Power Equip., Inc. v. Greenwood*, 464 U.S. 548, 556 (1984) (where civil litigant seeks new trial because of alleged juror bias, “a party must first demonstrate that a juror failed to answer honestly a material question on voir dire, and then further show that a correct response would have provided a valid basis for a challenge for cause”); *Commonwealth v. Amirault*, *supra* ^{*496}at 625.

Cf. also *Patton v. Yount*, *supra* at 1036 (where partiality of individual juror is at issue, question is: “did a juror swear that he could set aside any opinion he might hold and decide the case on the evidence, and should the juror’s protestation of impartiality have been believed”).³⁶ In some instances, the statement made by the juror may establish so strong an inference of a juror’s actual bias that proof of the statement alone may suffice.

See *Commonwealth v. Laguer*, 410 Mass. at 94, 98-99 (if alleged statement — “[T]he goddamned spic is guilty just sitting there; look at him. Why bother having the trial” — were made by juror, judge must find actual ethnic bias). See also *Commonwealth v. Amirault*, *supra* at 628 & n.5 (“in

certain exceptional circumstances implied bias may be applicable”). Generally, though, the judge must determine the precise content and context of the statement to determine whether it reflects the juror’s actual racial or ethnic bias, or whether it was said in jest or otherwise bore a meaning that would fail to establish racial bias.

See *Commonwealth v. Tavares*, supra at 153 n.21, 154 (jurors referred to witness as “Sapphire,” a reference to shrewish wife on “Amos ‘n Andy Show” on radio and television, but record supported judge’s findings that “this term had been used in a jocular manner without any racial prejudice”).

Because actual juror bias affects the essential fairness of the trial, a defendant who has established a juror’s actual bias is entitled to a new trial without needing to show that the juror’s bias affected the jury’s verdict. See *Commonwealth v. Hampton*, 457 Mass. 152, 163 (2010); *Commonwealth v. Vann Long*, 419 Mass. 798, 802-805 (1995). See *Commonwealth v. Laguer*, supra at 98-99.

Where statements suggesting juror bias are shown to have been made but the defendant has failed to prove that the statements reflect actual bias by the juror who made the statements, the judge still must determine whether the statements so infected the deliberative process with racially or ethnically charged *497language or stereotypes that it prejudiced the defendant’s right to have his guilt decided by an impartial jury on the evidence admitted at trial.³⁷ See *Commonwealth v. Tavares*, supra at 155-156.

See also *United States v. Villar*, 586 F.3d 76, 81, 87 (1st Cir. 2009) (judge has discretion to hear juror testimony “to determine whether ethnically biased statements were made during jury deliberations and, if so, whether there is a substantial probability that any such comments made a difference in the outcome of the trial”).³⁸ Although juror statements that may reflect juror bias are not extraneous matters in jury deliberations, see *Commonwealth v. Laguer*, supra at 97, we conclude today that this evaluation requires the same two-step process that we apply where jury deliberations have allegedly been compromised by exposure to improper outside influences.

See *Commonwealth v. Kincaid*, 444 Mass. 381, 386 (2005); *Commonwealth v. Fidler*, 311 Mass. 192, 201 (1979). The defendant therefore bears the initial burden of proving, by a preponderance of the evidence, that the jury were exposed to statements that infected the deliberative process with racially or ethnically charged language or stereotypes. See *Commonwealth v. Kincaid*, supra.

If the defendant meets this burden, the burden then shifts to the Commonwealth to show beyond a reasonable doubt that the defendant was not prejudiced by the jury’s exposure to these statements. See *id.*, quoting *Commonwealth v. Fidler*, supra.

In making this determination, “[t]he judge may not receive any evidence concerning the actual effect of the matter on the juror’s decision, for this would involve probing the juror’s thought processes.” *Commonwealth v. Fidler*, supra. Rather, the judge must focus on “the probable effect”

of the statements “on a hypothetical average jury.” Id. See 3 J. Weinstein & M. Berger, Evidence par.

606.05 [2] [b] (2010), and cases cited. The judge here correctly applied the law and made the necessary findings of fact, which were supported by the record and not clearly erroneous. While the judge found that Juror Y did not *498hold actual racial bias, he recognized that Juror Y’s reference to the race of the defendant potentially communicated such a bias to the jury and concluded that the black female juror’s appropriate response to the statement served the beneficial purpose of exposing and “blunting the effect” of the racial stereotype, and of warning the jury of the risk of racial stereotypes infecting their deliberations.³⁹ See *Commonwealth v. Kincaid*, supra at 389, quoting *Commonwealth v. Fidler*, supra at 201 n.8 (judge may consider whether “improper remark prompted an immediate reprimand from another juror”).

We conclude that the judge did not err in finding that the defendant was not denied his due process right to an impartial jury because of a juror’s racial bias. 9. Review under G. L. c. 278, § 33E. Having reviewed the entire record pursuant to our duty under G. L. c. 278, § 33E, we discern no error, considered alone or collectively, that provides a just basis to set aside or reduce the verdict of murder in the first degree.

Judgments affirmed. Orders denying motions for a new trial affirmed. At the time of the March, 2004, meeting with the defendant, thirty to thirty-five other men had provided DNA samples to investigators. At a later point in the investigation, police conducted a public “DNA roundup” in Truro in which police officers asked men voluntarily to provide DNA samples to assist in their investigation.

Approximately 150 to 200 men provided samples. The police confirmed that the Juice Bar in Orleans held a “rap night” on Friday night, January 4, 2002, and a videotape taken that night showed that both the defendant and Jeremy Frazier attended the event.

The police found the victim’s cellular telephone in her home; the number nine appeared on the screen, indicating that that digit had been pressed. The defendant later provided a variation on this account in which Frazier kicked in the door when he left the house, after earlier having chased the victim inside. Another witness, Christopher Bearse, testified that he saw Frazier and Mulvey leave the house party together and enter the same automobile.

He acknowledged that the defendant was “nowhere in sight” when Frazier and Mulvey departed. Christine Lemire testified that this was consistent with the victim’s daughter attempting to nurse from the victim’s breast.

The defendant is African-American. Because the voluntariness of the defendant’s statements was a live issue at trial, the judge properly submitted the issue to the jury by providing the humane practice instruction. See *Commonwealth v. Cryer*, 426 Mass. 562, 571 (1998).

The judge's instructions on voluntariness adhered to the requirement in *Commonwealth v. DiGiambattista*, 442 Mass. 423, 447-448 (2004), that the absence of an electronic recording of a custodial interrogation permits the jury to conclude that the Commonwealth has failed to prove voluntariness beyond a reasonable doubt.

The defendant urges us to go beyond that ruling to hold that the fruits of an unrecorded interrogation may not be admitted at trial and that the defendant's statement here must be suppressed. We decline to revisit the holding of the *DiGiambattista* case and note that the present appeal presents a singularly unlikely occasion on which to do so, where, even after being informed by Trooper Mason that courts prefer the electronic recording of interviews, the defendant declined in writing to consent to such a recording.

The motion judge was also the trial judge. The evidence presented to the grand jury included a videotape that showed the victim as she was discovered. The record before us does not include any police reports documenting Mulvey's statements in the course of the investigation.

We therefore rely on uncontested testimony at trial concerning these statements. The judge explained to the jury, "To the extent that it's a live issue in this trial as to whether the police have acted fairly or appropriately or as to whether statements are or not voluntary, then perhaps this trooper's thought process leading up to taking the statement is fair game." Arnold and the victim lived together in the victim's home for approximately one year while they were romantically involved.

He had moved out of the house when the romantic relationship ended sometime in the early months of 2001. His semen was found on a blanket that had been taken from a couch by one of the emergency responders to cover the victim after she was found.

The DNA analyst, Christine Lemire, testified that DNA may remain on an item for twenty to thirty years. We caution defense counsel, in preparing cross-examination, to consider the risk that their inquiry may open the door to the admission of evidence that would otherwise not have been admitted.

We also caution judges that evidence that poses a risk of unfair prejudice need not always be admitted simply because a defendant has opened the door to its admission; the judge still needs to weigh the probative value of the evidence and the risk of unfair prejudice, and determine whether the balance favors admission.

On cross-examination, Dr. Niels indicated that the twenty-four to thirty-six hour period was measured from the time Dr. Weiner observed the body on the evening of January 6, not from the time of the autopsy on January 7.

In addition, Dr. Nields, using the photographs admitted in evidence, properly testified to the location and nature of the victim's injuries based on his expertise as a forensic examiner. Dr. Nields also properly offered his own opinion as to the cause of the victim's death — a stab wound to the chest — and as to her death from that wound not being instantaneous.

See *Commonwealth v. Avila*, 454 Mass. 744, 761-762 (2009). Defense counsel failed to elicit this concession from Dr. Nields, who testified that Dr. Weiner's estimate did not set "an outside time limit for time of death." Gerald Smith testified that he told the police that the driver was the sole occupant of the vehicle.

The defendant in his statement to the police in April, 2005, did not speak of a sexual encounter with the victim on Thursday, January 3, 2002; he claimed that his first and only sexual encounter with her was on Friday night, January 4. But the defendant at trial called a social psychologist, Dr. Richard Ofshe, who, while he did not offer an opinion whether the defendant's statement to police in April, 2005, was false, offered expert testimony regarding the existence of false confessions and the circumstances that increase the risk of a false confession.

Although the defendant did not testify and defense counsel never found a permissible basis to introduce evidence that the defendant had a sexual encounter with the victim that Thursday afternoon, he suggested in closing argument that it was a "reasonable inference" the jury could draw from the facts in evidence.

The prosecutor made no objection to this argument. Police discovered a second man hiding in a rear bedroom of the dwelling and arrested him on an outstanding warrant. We do not rely on the judge's finding that the juror had deceived the police regarding the nature of her relationship with the father of her child. While she indicated, in words and gestures, that they were in the midst of splitting up, she did not expressly say so, and we are not convinced that her expression of solidarity with the father of her child following his arrest and her assistance in paying his attorney demonstrated that they had not been in the process of splitting up prior to his arrest.

There is also no merit to the defendant's ancillary claim that the judge's ruling must be reversed because the juror was not present at the second hearing where the judge reviewed the recorded telephone calls and made his findings.

The defendant, defense counsel, and the prosecutor were all present at this hearing. The defendant did not request that the juror be given an opportunity to explain her statements on the telephone recordings, and the judge reasonably could have concluded that nothing she would say in explanation would affect his decision to discharge her from the jury.

The judge acted within his discretion in conducting the hearing without the juror present. See *Commonwealth v. Haywood*, 377 Mass. 755, 769-770 (1979) ("Depending on the nature of the

reason why replacement of the juror is being considered, the juror's presence may or may not be required...").

The defendant makes similar allegations regarding the prosecution's failure to disclose information concerning the criminal records of four other individuals listed as potential Commonwealth witnesses (only one of whom actually testified at trial).

We agree with the judge that, for similar reasons, this information was inadmissible at trial. The juror making this allegation described Juror Z as "black" in her affidavit. The judge in his findings of fact declared: "Casting aside for the moment the futility and folly of pigeonholing individuals racially, by physical appearance one might say the gentleman is black.

To this jurist, as a man who has lived his life entirely in Southeastern Massachusetts where Cape Verdeans are a major component of the minority community, [Juror Z] appears to be Cape Verdean." The affiant who made this allegation was the discharged juror, whom the judge after hearing did not find credible. From the allegation in her affidavit, one would infer that Juror Z was referring to the defendant and the crimes he was alleged to have committed, but the discharged juror at the hearing testified that Juror Z was referring to the black female juror who had called Juror X a racist for her comment in the jury room.

The judge treated the defendant's motion as, in substance, a motion for a new trial. The motion also alleged that one of the alternate jurors had participated in, and impermissibly influenced, jury deliberations. On appeal, the defendant does not challenge the judge's finding that there was no factual basis to support this allegation.

The remaining two deliberating jurors were excused, without objection by counsel, because of health and travel issues. The judge found that Juror X had expressed fear of the defendant, but not because of his race. While the discharged juror and a deliberating juror testified that they heard Juror Z say that he did not like blacks, the judge did not find the discharged juror to be credible and found that the deliberating juror had been told about the statement by the discharged juror and had not heard it said by Juror Z. The judge did not credit any of the testimony of the discharged juror and found that her claims were refuted by others whose testimony he did credit.

The judge also did not credit the testimony of Juror Z's great-aunt that Juror Z had previously articulated his racial prejudice. He concluded that she "has proved to be a storyteller, perhaps someone seeking her fifteen minutes of fame." The judge concluded, based on his voir dire of Juror Z during jury selection, Juror Z's testimony at the postverdict hearing, and the judge's observation of the juror throughout the trial, that Juror Z "did not express prejudice towards blacks but instead served as an impartial juror." The judge added, "Nothing in [Juror Z's] demeanor suggested a closed mind." The judge found that it was impossible to determine the precise language used by the juror but it was clear that, in discussing the severity of the victim's injuries,

she had spoken of their source as either “a big black man” or “this big black man.” After weighing conflicting testimony, the judge concluded that the juror was referring to the defendant specifically rather than to black men as a class.

The judge also concluded that, even if the defendant had met this burden, the Commonwealth had proved the absence of prejudice to the defendant beyond a reasonable doubt based on the totality of the evidence. The judge characterized the black female juror’s role in this interchange as “honorable,” finding that she “was appropriately vigilant in keeping racial bias from infecting the deliberations” and that her “ire” served “as a warning flag that careful scrutiny must be given to [Juror Y’s] words.” The judge also noted that each juror was selected after a voir dire that explored racial bias, that the judge’s final instructions directed the jury to remove bias from their deliberations, that fellow jurors reminded the jury to be on guard for racial bias, and that the offending statement was uttered once during eight days of deliberations.

We share the concurrence’s recognition of and concern with the risk of unconscious racial bias among jurors. We also agree with the concurrence that unconscious racial bias is most effectively addressed by recognizing it and addressing it, as was done in this case by the judge in his voir dire questions and jury instructions, and by the jurors during deliberations.

Where juror testimony is needed to ascertain whether the racist statement was made, a judge may inquire of the jurors whether the statement was made but may not inquire into their subjective thought process, such as their reasons *495for concluding that the defendant was guilty, the content of their deliberations, or the effect of the statement at issue on their thought process.

See *Commonwealth v. Laguer*, 410 Mass. 89, 96-97 (1991). See also *Commonwealth v. Tavares*, 385 Mass. 140, 155 n.25, cert. denied, 457 U.S. 1137 (1982); *Commonwealth v. Fidler*, 377 Mass. 192, 197 (1979) (inflexible rule excluding all juror testimony offered to impeach verdicts would achieve stability at expense of doing justice). See generally Mass. G. Evid. § 606 (b) (2010).

This is consistent with our broader rule that we will permit juror testimony regarding “overt factors... by which the verdict’s validity can be objectively assessed,” *Commonwealth v. Fidler*, supra at 198, quoting 3 J. Weinstein & M. Berger, *Evidence* par. 606[03], at 606-25 (1978), such as extraneous influences on the jury, but not regarding “the subjective mental processes of jurors, such as the reasons for their decisions.” *Commonwealth v. Fidler*, supra.

The defendant on appeal does not challenge the manner in which the judge conducted the postverdict hearing or the scope of the juror testimony. We do not suggest that a judge may find that a juror was actually biased only where the prospective jurors during voir dire were asked about racial or ethnic bias; a judge may make such a finding even where no such inquiry was made during voir dire.

Here, however, the judge asked each prospective juror whether the race of the defendant or victim would affect the juror's ability to be fair and impartial. The judge here characterized this question as whether the jury were "exposed to racial bias" from the exchange of words between Juror Y and the black female juror. "[W]e emphasize that not every stray or isolated off-base statement made during deliberations requires a hearing at which jury testimony is taken." *United States v. Villar*, 586 F.3d 76, 87 (1st Cir.

2009). The judge in his findings referred to the testimony of the defendant's social science expert that people have the ability to rise above racial stereotypes where they make a conscious effort to do so.