due to contact with metallic fragments that would occur during preparation of the microscopic slides.

The paraffin blocks containing the tissues from the debridement were then subjected to energy dispersive X-ray analysis. No evidence of copper, lead, zinc, or nickel was found.

After preparation the paraffin blocks* containing the tissues removed at the time of debridement and still remaining following the preparation of microscopic slides were subjected to analysis using a scanning electron microscope fitted with a low angle detector for X-ray back scatter. No copper, lead, zinc, or nickel was found by means of this analysis. (*84*)

(See addendum H for the complete report.)

(414) The panel conclude that no metal fragments were present in the available tissues removed from the injured wrist and thigh for possible further analysis and comparison.

SUMMARY OF THE FORENSIC PATHOLOGISTS' PERSPECTIVE OF WOUND BALLISTICS

(415) To understand better the significance of the panel's observations and the bases for its conclusions, it is useful to review some of the terminology and basic concepts of wound ballistics and to indicate the limitations that certain variables impose on interpreting the findings. Some of these factors were considered and recorded in a reasonably accurate manner during the original autopsy and subsequent experimentation; others were not.

(416) The forensic pathologist is trained to observe the morphologic (structural) or physical effects of a missile or missiles on a body and to interpret these effects in order to provide an investigator with as much information as possible, as detailed in section V of this report, including: the distance or range of the weapon from the body; relationship of the weapon and trajectory of the missile to the body; approximate mass and velocity of the missile (which together characterize its kinetic energy); and the amount of this kinetic energy transferred from the missile to the body after striking, together with the results of such impact on, or perforation of, the tissues damaged and the body as a whole. These observations will be discussed separately, with particular emphasis on their relationship to specific evidentiary items examined.

Range of the weapon from the target

(417) A missile must have sufficient velocity (speed) to cause a particular wound. The velocity depends on the type of ammunition employed, including the type of powder and powder charge. Velocity drops off as the distance between the weapon and the target increases.

(418) The missile is not the only object that emanates from the firearm. Expanding gas produced by the burning of the powder, which actually pushes the missile out of the bore of the firearm, bursts forth from the muzzle with great velocity, causing the audible report associated with discharge. Powder grains are also blown out of the muzzle; these may be partially burned or completely unburned. Thus, gas,

powder and missile are all actually forced out of the bore of the weapon in any discharge of a firearm.

(419) The incandescent nature of the gas also causes flame and heat to emanate from the muzzle. In addition, small fragments of the missile itself and its coating are forced from the muzzle, together with any fragments of material that may have been in the bore of the weapon.

(420) The forensic pathologist estimates the range of fire and other particulars concerning injury from a firearm by examining the pattern of deposit of these substances about the bullet's point of impact on either the body or the clothing. Distance may be determined by comparing the pattern of these deposits with patterns produced by the same weapon fired with similar ammunition under similar environmental conditions at selected distances, with the weapon in a comparable position relative to the surface. Terms such as "contact," "close range" and "intermediate range" are used to characterize the shooting; characteristic details can vary from weapon to weapon and with various types of ammunition.

(421) When a weapon is fired close against the skin's surface, virtually all the substances, including those from the muzzle blast itself, penetrate the skin to the underlying tissues, where they may be detected by physical or chemical means. In addition to these deposits, the missile itself is often coated with a lubricant in which microscopic and macroscopic particles of primer or powder charge residue may be mixed, which, barring an intermediate target between the weapon and the body, are usually deposited at the margins of the perforation of the clothing or the skin. This residue is termed "bullet wipe" by the forensic pathologist.

(422) If all the above-mentioned residues are missing except "bullet wipe," the gunshot wound is characterized as a "distant" wound, meaning that the muzzle of the weapon was discharged at a distance from which it would cause no residue to be deposited on the target. Such a wound consists of a missle perforation about which there might be a deposit of bullet wipe on the clothing and/or in the superficial margins of the wound; this is in addition to the abrasion collar, described earlier, produced when the entering bullet rubs against the margins of the indented skin.

(423) Wound ballistics research has shown that a missile velocity of 125 to 170 feet per second is necessary for penetration of the human skin when using steel spheres varying from one-sixteenth to one-quarter inch in diameter. Clothing also impairs perforation, but is usually less efficient than skin in hindering penetration, depending on its nature. The size of the defect in the skin varies considerably depending on the size and velocity of the missile. Skin is extremely elastic; it often stretches considerably to allow missile penetration and then returns to its normal shape thereafter, leaving a defect smaller than the missile itself. Close proximity of the weapon to the skin or bone beneath the skin and the angle of impact may enlarge the entrance perforation.

(424) The characteristics of the abrasion collar surrounding the entrance perforation reflect the direction of the bullet at the instant of impact with the skin and the angle of the trajectory prior to contact with the skin, as well as the shape of the missile itself. If the trajectory is perpendicular to the surface of the skin, the hole is usually round

and the abrasion collar correspondingly symmetrical around it. (See fig. 45, a picture of an abrasion collar when the missile was perpendicular to the target.) If the angle of the trajectory of the missile to the skin surface is other than perpendicular, the abrasion collar may be asymmetrical, that is, more prominent on the surface with the most acute angle between the skin and the bullet, and less apparent on the opposite surface, where there may be undermining of the tissues. (See fig. 46, showing an abrasion collar produced by a missile striking at an acute area.)

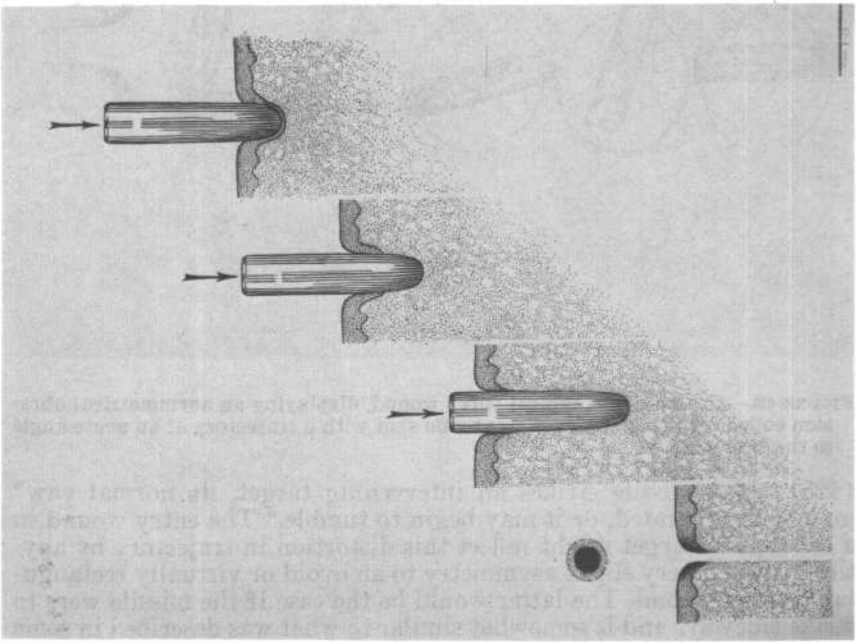

FIGURE 45.—Drawing of a typical entry wound, displaying a symmetrical abrasion collar resulting from a distant rifle shot with a trajectory at right angles to the skin surface.

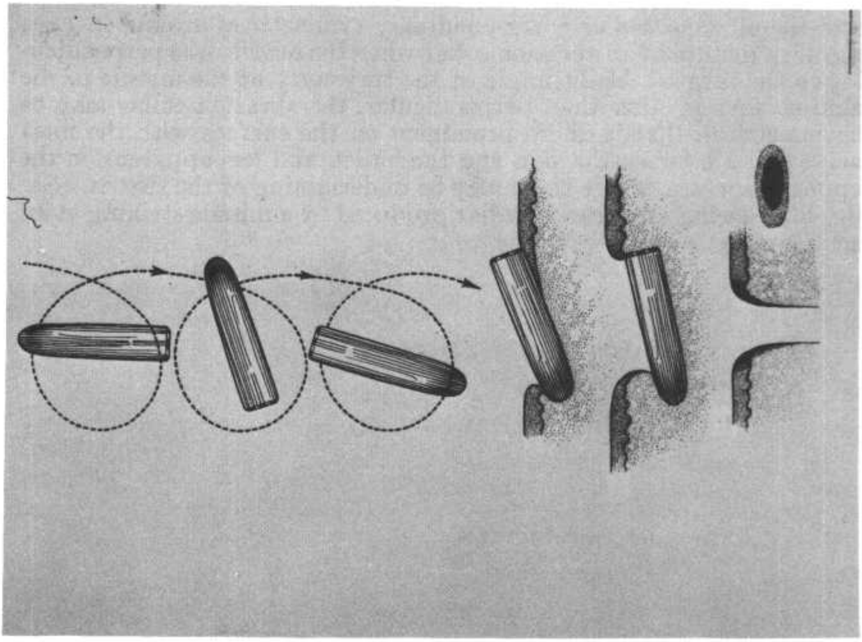

FIGURE 46.—Drawing of a typical entry wound, displaying an asymmetrical abrasion collar resulting from a distant rifle shot with a trajectory at an acute angle to the skin surface.

(425) If a missile strikes an intervening target, its normal yaw* may be exaggerated, or it may begin to tumble.* The entry wound in a subsequent target might reflect this distortion in trajectory by anything from a very slight asymmetry to an ovoid or virtually rectangular reentry wound. The latter would be the case if the missile were to strike sideways and is somewhat similar to what was described in some of the initial medical reports on the wound in the posterior thorax of Governor Connally. (See fig. 47, a drawing showing yawing or tumbling.) Such a subsequent entry wound might show no wipe residue in the skin because of the missile's prior passage through skin and tissue. Some small fragments of the metal from the missile's surface might break off as the missile strikes, however, and adhere to the margins of the defects in either the clothing or skin.

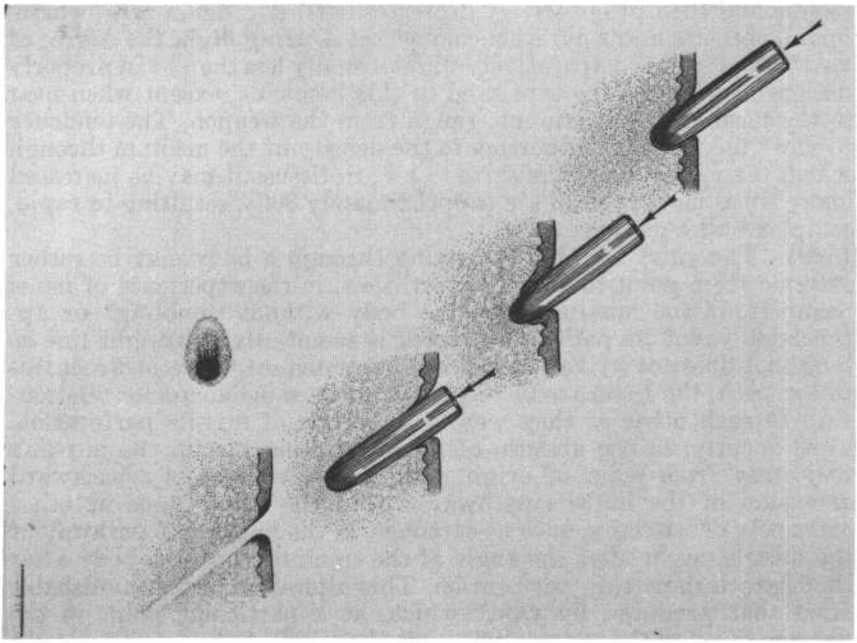

FIGURE 47.—Drawing of an entry wound caused by a tumbling or yawing missile.

(426) A missile's path may also be deflected from a true straight line by striking an intervening target, with the extent of deflection usually based on the mass of the intervening object. Slight deflection could result from striking a twig or small branch of a tree. The panel members fully considered the potential effects of intervening targets on yaw and deflection of the missiles and their possible significance to bullet paths and injury patterns.

Relationship of the weapon and missile trajectory to the target

(427) The accuracy of a weapon is provided by the spin imparted by the rifling* within the weapon and, to a lesser degree, the shape of the projectile. An elongated, symmetrically shaped missile is a more accurate than an irregular or spherical one. Other considerations in accuracy are distance to the target, effect of gravity on the missile while in flight, and effects of air resistance. Air resistance varies considerably with the speed of the missile. A very high velocity missile, after leaving the weapon, losses its speed at a much greater rate than does a low or intermediate velocity missile.

(428) A missile's pathway from the weapon to the target is known as its trajectory. A bullet should travel only a short distance after leaving the barrel before it stabilizes, minimizing the tendency to yaw.* During the first hundred yards or so, the bullet yaws* periodically, with its tip oscillating slightly from the line of flight. While in flight, the bullet's movement, although much quicker because of its high rate of spin, mimics that of a spinning top. At one instant the bullet is point on, at the next its axis is at a slight angle to the line of flight. These motions are periodic. This angle of yaw* increases to a certain

degree and then progressively decreases until it is again zero, whereupon another similar gyration commences. During flight the degree of yaw* is normally comparatively slight, usually less than 3° in properly designed bullets of the type used in this homicide, except when near to the terminal, or maximum, range from the weapon. The tendency to yaw* increases in proportion to the density of the medium through which the missile passes relative to air; in tissues it may be increased many times more than in air (approximately 800), resulting in rapid, complex bullet motions.

(429) The yaw* of a bullet passing through a body may be rather extreme from point to point. Nevertheless, in the experience of panel members, if the missile enters the body without tumbling* or appreciable yaw,* its pathway or track is essentially a straight line as long as it does not strike a significant bony surface. To reconstruct this linear path, the tissues may be placed in the same anatomic relationship to each other as they were at the time of missile perforation. Consequently, in the absence of an intervening target, the missile's trajectory from point of origin to the body represents a backward extension of the bullet's pathway within the body. Bone or other extremely dense tissue, such as cartilage, in the immediate pathway of the missile might alter the angle of the track through the body after the characteristic skin perforation. This alteration is distinguishable from that produced by yaw,* which, at a particular point in the passage through the body, might cause the missile to be out of line with its pathway, although the pathway itself remains straight.

(430) The panel believes that the difficulty which Drs. Humes, Finck, and Boswell experienced in trying to place a soft probe through the bullet pathway in President Kennedy's neck probably resulted from their failure or inability to manipulate this portion of the body into the same position it was in when the missile penetrated. Rigor mortis may have hindered this manipulation. Such placement would have enabled reconstruction of the relationships of the neck and shoulder when the missile struck. It is customary, however, to dissect missile tracks to determine damage and pathway. Probing a track blindly may produce false tracks and misinformation.

(431) The panel is concerned as to the degree of accuracy attainable in determining the missile trajectory based on backward extension of a bullet track from within the body, particularly if precision within the range of a few degrees is required. An intermediate or high velocity bullet creates a temporary bullet track relatively larger than that of the bullet itself. This precludes reconstruction within the required degree of accuracy.

(432) Another factor hampering precise determination of the bullet track by the backward extension method is imprecision in knowing the relative position of various portions of the body at the instant of missile penetration. For example, the placing of President Kennedy's arm in the position it was in at the instant the missile struck the back might not be important because the relatively medial location of the entrance wound probably would minimize significant interference by the shoulder movement. The exit wound in the neck, on the other hand, might move to either side as much as several centimeters if his head or neck were to be rotated normally.

(433) The alinement of missile tracks that passed through several parts of the same body enables recreation of the relationships of these structures at the moment when struck. This allowed Governor Connally's posture at the time he was struck to be recreated.

(434) The determination of the point of origin of a missile by backward extension from a bullet track through a body must take into account not only the above variable factors, but also requires knowing, reasonably precisely, the exact position of that portion of the body penetrated at the instant it was struck. Any motion of the body, no matter how slight, would alter the extended trajectory of the missile from the bullet track in the body considerably and thereby change the point of origin. The longer the distance of the trajectory, the greater the magnification of even the smallest error in determining body position or path in the body.

(435) In the panel members' experience, if a missile, having struck an intervening target, is tumbling* significantly at the time it strikes a target, the missile's course through the second target is much more unpredictable, both as a result of its exaggerated yawing* at the point of impact and its loss of kinetic energy prior to striking the second target. Thus, the track through the Governor is less reliable for use in determining origin than that through the President, if the bullet struck the President first.

(436) The panel members agree that in their experience, if a missile strikes an object capable of creating a shearing force, such as the skull, the bullet's pathway in the body might be significantly different from the line of its trajectory prior to impact. The missile fragment lodged within the margin of the entrance skull defect is evidence of obvious shearing force with lateral torque. The only conclusion that the panel members can reach as a group is that all of the missile's mass, small and large fragments alike, would have moved forward from the point of impact with such a bony surface. The degree of lateral movement of the pathway would be influenced by the surface's convexity, amount of kinetic energy propelling the missile forward, and nature of the tissue through which the missile fragments were traveling.

(437) In the present case, the anterior-posterior and lateral X-rays of the skull indicate that the vast majority of the missile fragments moved in a cylindrical, slightly coned, pathway, in the same direction as the bullet's path prior to its striking the skull.

Wounding capability of the missile

(438) A missile's wounding capability is a consequence of the transfer of kinetic energy from the missile to the body. A missile's kinetic energy is the same as that of any moving object: $KE = mv^2/2g$, where m is the weight in English pounds and v is the striking velocity in feet per second. The results in conventional foot-pounds are derived by dividing by 2 times the acceleration due to gravity (32.2 feet per second per second). From this formula it can be deduced that the missile's kinetic energy varies as the square of its velocity. Thus, doubling the velocity increases the kinetic energy by a factor of 4, while doubling the mass serves only to double the kinetic energy.

(439) A missile passing through a body produces, around the wound track, a hemorrhagic area composed of the tissues which have been torn by the direct impact of the bullet. The missile creates a permanent

cavity, the size of which is generally proportional to the missile's total loss of kinetic energy while in the wound. As the bullet passes through the tissue, considerable radial motion is imparted to the tissue elements and a large temporary cavity is formed. When the wound track is dissected, extensive bleeding and tissue injury may be found extending for a considerable distance away from the track produced by high velocity bullets. After sectioning the tissues, this hemorrhagic area is often well-defined; its extent is proportional to the missile's loss of kinetic energy while in the wound. High speed X-rays and motion pictures have also demonstrated the formation of this temporary cavity, with a volume that may be as much as 27 times that of the permanent cavity.

(440) The panel agrees that the tissue disruption due to the temporary cavity created by passage of a high or intermediate velocity missile might have produced fractures of the transverse processes of one or several of the lower cervical and/or upper thoracic vertebrae in President Kennedy's neck, as indicated by the postmortem X-rays. There are significant muscle masses attached to the vertebrae which would receive tremendous shock, even if several inches distant from such a missile. A direct grazing missile impact may have occurred, but it would not have been necessary to cause the damage visible in the X-rays.

(441) The missile's rate of energy loss in the wound and the consequent transfer of this energy to the body is dependent on several factors, including the amount of initial energy and the degree of retardation of the missile within the body. This retardation varies according to the missile's shape, the density of the tissues through which it is passing, and its degree of yaw while passing through the target. A soft-pointed hunting bullet loses a greater portion of kinetic energy than a full, metal-jacketed military bullet, the ammunition used in this instance. In the case of a full-jacketed, nondeforming bullet, yaw* is the most significant retarding factor as the bullet travels through the tissue. This yaw*, as previously indicated, varies along the bullet's path, producing maximum energy loss at points where it is greatest and minimum energy loss where it is absent. A small entry hole through the skin, extensive internal damage, and a relatively small exit hole indicate that the bullet had minimum yaw* at the moments of entrance and exit, with a release of energy, possibly due to yawing*, in between.

(442) The changes in density from air to skin, muscle, and bone may produce marked variations in yaw*. A bullet that is positioned appropriately relative to its trajectory on penetrating the skin may be tipped 90° to 100° within 3 inches of penetration, thus dramatically reducing speed, with a corresponding increase in energy transfer and tissue destruction. Subsequently its posture may again change, so that its long axis is in the line of flight and considerably less energy is lost and consequent tissue damage is minimized.

(443) The majority of the panel members, on the basis of the nature and extent of the Governor's chest injury alone, could not determine whether the missile that struck Governor Connally in the back had already passed through President Kennedy. They could, however, from the nature of the entrance wound in Governor Connally's back,

the nature of the damage to his wrist, and the limited penetration of his thigh, determine that the bullet which struck those areas had lost sufficient kinetic energy prior to inflicting these wounds to permit the conclusion that one bullet caused all of the wounds to the Governor. The panel cannot rule out the possibility, if confined only to the surgical evidence, that the wound to Governor Connally's wrist was caused by a large fragment of the bullet which struck the President's head.

(444) The majority of the panel members, after fully evaluating the objections of Dr. Wecht, believes that the medical evidence of a diminishing degree of injury to the chest, wrist and thigh, the ability to aline these body parts to conform to a single bullet track, provide strong support for the conclusion that all of the Governor's injuries were caused by one missile.

Effect of a missile on the body

(445) The effects of a missile striking a portion of the body will conform to the basic laws of motion, readily understood and often observed in everyday occurrences such as the collision of a moving with a stationary billiard ball. If the two balls are of equal mass and the energy of the first is transmitted on impact to the second, the first ball will stop completely, while the second will be propelled at a velocity comparable to the striking velocity of the first. If the second ball is twice the mass of the first and the transmitted kinetic energy is comparable to that of the first, it will be propelled forward at only half the velocity. Much of the kinetic energy transferred by the first ball is due to its velocity, since its mass, relative to that of the second ball, is insignificant. Nevertheless, the sum of mass and velocity will result in significant imparted velocity to the motionless target.

(446) This situation can be best observed using nonjacketed missiles designed to impart maximum transfer of kinetic energy to the target during and after striking, thereby maximizing the missile's "knock-down" capability and minimizing the possibility of exit from the target and the striking of a second target. A jacketed missile transfers significant, but considerably less, kinetic energy to the target. Instead, the energy transfer propels the target body or a portion of it in the same direction as the missile. The vector of propulsion might affect the body in its entirety if the victim were standing, or might affect only the upper portion of the body if the victim were seated depending on the site of impact. The movement of the body, or of a large portion of it, will be minimal because of the bullet's small mass, notwithstanding its high velocity. If the bullet strikes the head, an object of relatively low mass in comparison with the entire body, the movement of the head in the direction of missile travel may be considerable. Rotational movement of the head, or of a lightweight portion of the body may also occur.

(447) By comparing the bullet tracks, a forensic pathologist may be able to determine if the wounds were inflicted on a body in an unsupported position that would permit movement, and, if so, in what order the wounds might have occurred. In cases where the body was in a supported position that would preclude motion, such as lying against a firm surface, a transfer of kinetic energy from the missile to

the body will result but not cause motion. Transmission of such energy to the body will be manifest by injury to areas in contact with the supporting surfaces.

(448) Accurate determination of the bullet pathway and careful observation of the missile wounds themselves are useful in determining whether several wounds to different portions of a body were caused by the same missile. By placing a rigid probe through the bullet tracks after careful dissection and inspection and after evaluation of deflections possibly caused by striking bone and other tissues, and then attempting to aline the tracks by moving the body, a conclusion may be reached as to whether multiple perforations were caused by a single missile.

(449) Bullet reentry wounds are often of a different configuration than initial entry wounds as a consequence of the missile's deformation during penetration and the tumbling effects produced. When various portions of the body are in contact during multiple perforations, one surface may serve to shore another from which a missile exits, so that the exit wound, even from an intermediate or high velocity missile, may exhibit little of the damage and tearing usually seen in exit perforations. Reentry wounds may also show adjacent injuries incident to secondary missiles* from the primary injury. The primary wound or the reentry wound may contain fragments of clothing such as was present in the wound in Governor Connally's wrist.

Effect of the body on a missile

(450) The panel members individually have had considerable experience with how the various portions of the body affect missiles passing into or through them. Individually and collectively, they have seen the effects on missiles varying from .22 caliber long rifle bullets to those similar in size and velocity to the missiles used in this homicide—6.5 millimeters or 0.26 inch—and larger. In some cases the missiles had perforated similar portions of bodies—as in the upper back wound of President Kennedy, and thereafter penetrated significantly harder surfaces. These could not be distinguished from missiles fired through soft tissue alone. A bullet striking soft tissue decelerates so that if it then strikes a hard surface such as bone, it is appreciably less deformed than if it struck the hard surface directly. Dr. Wecht alone had had experiences contrary to this.

(451) Most panel members also agree that entrance penetrations of the skull by jacketed missiles, with the resultant shearing forces produced by impact with the sharp, rigid bone margins, often result in significant distortion of the missile, while perforation of the thorax or abdomen usually results in little or no deformation of the missile, except in those instances in which the missile hits a vertebra. Several members of the panel have investigated deaths in which missile impact resulted in deformation similar to the flattening noted in Warren Commission exhibit CE 399 and instances in which there was loss of the central core mass of a jacketed bullet as a result of deformation of the intact jacket and squeezing of the lead core backwards (a toothpaste effect).

(452) The panel members agree that in cases where jacketed missiles strike bony surfaces such as the skull, long bones or vertebra, a portion

or all of the jacket might separate at the point of initial missile deformation, with the central, heavy lead core continuing in a path usually in the same direction as that of the missile trajectory prior to entry into the target. It is not unusual for a portion of a missile to separate into additional fragments upon exiting from the skull or other part of the body and entering a second structure.

(453) Another consideration about missile wounds that has been emphasized by others(*85*) is the relatively short time that a missile is actually moving through tissue, usually less than a thousandth of a second. A bullet of 150-grains weight, passing through 8 inches of tissue, entering at 2,000 feet per second (approximately the velocity of the 6.5 millimeter Mannlicher-Carcano bullet) and exiting at 1,000 feet per second will pass through the body in 0.00045 second and impart to the tissue 998 foot-pounds of energy, the work equivalent of more than 4,100 horse power. This energy transfer produces a temporary cavity as described earlier, which actually develops after the bullet has passed through the tissue. Accordingly, a bullet can pass through a head and be about 100 feet further along before a photograph reveals the explosive destruction of the head. This also explains the presence of entry and exit bullet holes in bones and tissue even though the skull is extensively fragmented or blown apart by the subsequent formation of the temporary cavity. The velocity of the outward-moving tissue particles may be only 125 feet per second, far less than the 1,000 to 2,000 feet per second velocity of the bullet projectile. Thus, when the Zapruder film reveals the explosion of the skull, the bullet had already passed through.

(454) Finally, the panel members also discussed their experiences with the explosive effects of shotgun and, to a lesser extent, military rifle wounds to enclosed portions of the body such as the head. Rarely has any member observed photographs documenting the reactions of victims' bodies to being shot, although crime scene reconstruction has often enabled panel members to establish body position prior to the shooting. The panel members have critically evaluated the observations of Alvarez(*86*) and the physical principles he considers in explaining the President's head movements in the Zapruder film. The panel members took note of the differences between the missile and targets (melons) in Alvarez's work and the missile and targets in this homicide. The work of Lattimer and associates,(*87*) which addressed some of these differences by using a weapon and missiles similar to those used in the Kennedy assassination and which attempted to duplicate the injury pattern on skulls, was also critically reviewed, as were studies by Dr. John Nichols.(*88*)

(455) The panel members agree that the exit wound of a missile seriously deformed by initial penetration of the skull might be considerably larger than the entrance defect and that the forces related to yaw* and the large temporary cavity created by the missile would usually be transmitted fairly equally throughout a closed space such as the skull. The larger exit defect in the front of the skull would theoretically permit greater exodus of tissue under pressure, and a resulting backward movement of the head could occur.

(456) The panel is aware of the time interval between the backward motion of the President's head and the earlier, slight forward motion, possibly caused by the initial missile impact and transfer of energy

to the head, as recorded in frames 313–314 of the Zapruder film. The panel further recognizes the possibility of the body stiffening, with an upward and backward lunge, which might have resulted from a massive downward rush of neurologic stimuli to all efferent nerves (those which stimulate muscles). The disparity in mass and strength between those muscles supporting the body on the back (dorsal surface) of the spine and those muscles on the front (ventral) surface could account, at least partially, for this type of motion, although it would be reasonable to expect that all muscles would be similarly stimulated.

(457) The panel suggests that the lacerations of a specific portion of the brain—the cerebral peduncles* as described in the autopsy report(*89*)—could be a cause of decerebrate rigidity,* which could contribute to the President's backward motion. Such decerebrate rigidity as Sherrington(*90*) described usually does not commence for several minutes after separation of the upper brain centers from the brain stem and spinal cord. It is, however, most intense in those muscles which normally counteract the effects of gravity.

(458) The panel is also aware of possible effects on motion that could be caused by the moving car within which the President sat.

(459) The panel concludes that the backward movement of the head following its forward movement occurred after the missile had already exited from the body and had created a large exit defect in the skull, and that it was most probably due to a reverse jet effect,* or a neuromuscular reaction, or a combination of the two. The short interval between the two motions supports this explanation.

(460) One panel member, Dr. Wecht, suspects that the backward head motion might be explained by a soft-nosed bullet that struck the right side of the President's head simultaneously with the shot from the rear and disintegrated on impact without exiting the skull on the other side. The remaining panel members take exception to such speculation, since they are unaware of any missile with such capabilities. Further, the X-rays taken prior to the autopsy show no evidence of a second missile, nor do the photographs of the head and brain show evidence of any injury to the left side.

Summary of the Forensic Pathology Panel's Conclusions Concerning the Missile Wounds of President Kennedy and Governor Connally

(461) Pathology is that specialty of medicine concerned with the investigation and evaluation of disease and other abnormalities in the human body. Forensic pathology is that area of pathology concerned with the legal aspects of death and injury, and the ability to present and evaluate the manifestations of death in courts of law and legal proceedings. Forensic pathologists are routinely asked to evaluate or develop hypotheses that involve pathological abnormalities and to suggest circumstances that could have produced them. Although it is often hoped that such evaluations can be made with absolute certainty, forensic pathologists can rarely state unequivocally that a given situation is explainable by one and only one hypothesis.

(462) More commonly the forensic pathologist makes a conclusion