STATEMENT BY BY-STANDERS SHOT IN THE AMBASSADOR HOTEL PANTRY

Four of us who were wounded during the assassination of Robert Kennedy have become convinced of the need of a new investigation of this case. Unitl now we have strongly resisted all efforts to question the obvious and official version that Kennedy's death and our wounds involved only one gunman. Former New York Congressman Allard Lowenstein and Paul Schrade (one of us) have raised serious questions about the substantial dictions and gaps in the evidence which have created grave doubts in our minds about the official version.

We can no longer resist when faced with such compelling questions. We need to know. Therefore, we support further tests and investigation by competent and reputable experts as proposed by Lowenstein and Schrade, in order to reconcile and to answer their three key questions:

1. Why does the bullet (Exhibit #47) extracted from Kennedy not match the bullet (Exhibit #54) extracted from Weisel (one of us) in any of its primary characteristics if they came from one gun?

2. Why did the prosecution's own eyewitness and its own expert witnesses so sharply and directly contradict each other on their estimates of the distance of the gun from Kennedy?

3. Why is there no reliable inventory of the number of bullets fired and their trajectories?

The tests and investigation proposed by Lowenstein and Schrade will answer these questions. If such a new investigation reconciles the gaps and contradictions in the evidence then we can have the peace of mind that we most desire and we will be sure that justice was done. If, on the other hand, the new investigation shows that more than one person was involved in the assassination then the full truth must be pursued and a greater measure of justice must be provided.

We have known the horror and pain of this experience as few others have. It has changed our lives. We as many others will always feel deeply the terrible loss of Robert Kennedy.

Therefore, we make this special plea to the authorities to re-open and continue the investigation of this case and to pursue the full truth.

Paul Schrade

William Weisel

Irwin Stroll

Ira Goldstein

Statement by Karl Uecker

"I have told the police and testified during the trial that there was a distance of at least 1½ feet between the muzzle of Sirhan's gun and Senator Kennedy's head. The revolver was directly in front of my nose. After Sirhan's second shot, I pushed his hand that held the revolver down, and pushed him onto the steam table. There is no way that the shots described in the autopsy could have come from Sirhan's gun. When I told this to the authorities, they told me that I was wrong. But I repeat now what I told them then: Sirhan never got close enough for a point blank shot, never."

Statement by Richard Lubic

"I was at Senator Kennedy's right side when Sirhan appeared. I testified at the trial about Sirhan's comment to Senator Kennedy before he began shooting. What I want to stress today is that the muzzle of Sirhan's gun was 2 to 3 feet away from Senator Kennedy's head. It is nonsense to say that he fired bullets into Senator Kennedy from a distante of 1 to 2 inches, since his gun was never anywhere that near to Senator Kennedy.

"I was kneeling at Senator Kennedy's right side after he fell to the floor. I saw a man in a guard's uniform standing a couple of feet to my left behind Senator Kennedy. He had a gun in his hand and was pointing it downward.

"I told these facts to the authorities during the investigation. Even though I testified at the trial about other matters, they showed no interest in the information that I gave them about the distance of Sirhan's gun from Senator Kennedy, or the presence of anthor gun immediately behind Senator Kennedy."

POSTMORTEM PROTOCOLS IN OFFICIAL MEDICAL-LEGAL INVESTIGATION— A STUDY IN CONTRAST

(AUTOPSY REPORTS IN THE ASSASSINATION DEATHS OF PRESIDENT JOHN F. KENNEDY AND SENATOR ROBERT F. KENNEDY)

COUNTY OF LOS ANGELES
DEPARTMENT OF CHIEF MEDICAL EXAMINER–CORON
Hall of Justice, Los Angeles, California 90012
Thomas T. Noguchi, M.D.
Chief Medical Examiner-Coroner

File 68-5

This is to certify that the autopsy on the body of Senator Robert Kennedy was performed at The Hospital of The Good Samaritan, Los Ange California, by the staff of the Department of Chief Medical Examiner-Coro on June 6, 1968.

From the anatomic findings and pertinent history, I ascribe the death

GUNSHOT WOUND OF RIGHT MASTOID, PENETRATI BRAIN.

The detailed medical findings, opinions and conclusions required Section 27491.4 of the Government Code of California are attached.

Thomas T. Noguchi, M
Chief Medical Examiner-Coro

TTN:rtl

FINAL SUMMARY

Gunshot Wound No. 1 (Fatal Gunshot Wound)

ENTRY:	Right mastoid region
COURSE:	Skin of right mastoid region, right mastoid, petrous portion of right temporal bone, right temporal lobe, and right hemisphere of cerebellum
EXIT:	None
DIRECTION:	Right to left, slightly to front, upward
BULLET RECOVERY:	Fragments (see text)

LESIONS IN DETAIL (NEUROPATHOLOGY)

A. Primary lesions—caused by the bullet and further injuries by bone and bullet fragments
   1. Bone, dura, and dural sinus
      a. Penetration of right mastoid process
      b. Fracture of right petrous ridge
      c. Severance of right petrosal sinus
      d. Metal fragments in right temporal bone
   2. Cerebrum
      a. Contusion-laceration and hemorrhage of right temporal lobe
      b. Intraventricular hemorrhage due to above
      c. Metal and bone fragments in right temporal lobe
   3. Cerebellum
      a. Hemorrhagic tract and cavity in right cerebellar hemisphere
      b. Metal and bone fragments in right cerebellar hemisphere

B. Immediate Secondary Lesions
   1. Bone Lesion
      a. Fracture of right supraorbital plate
   2. Meningeal Lesions
      a. Subdural hemorrhage
      b. Subarachnoid hemorrhage
      c. Laceration of right supraorbital dura
   3. Cerebral Lesions
      a. Contusion-laceration of right orbital gyri
      b. Contusion-laceration of right occipital lobe

      c. Contusion of contralateral (left) inferior temporal gyrus
   4. Cerebellum
      a. Hemorrhagic necrosis of cerebellar tonsils
   5. Brain Stem
      a. Hemorrhage in midbrain
      b. Hemorrhagic necrosis of left inferior olive of medulla
   6. Epidural hemorrhage of C1 and C2 vertebral level

C. Later Secondary Lesions
   1. Edema of brain and herniations
   2. Subdural hemorrhage
   3. Subarachnoid hemorrhage
   4. Intracerebral and intraventricular hemorrhage
   5. Hemorrhagic infarction of right temporal cortex
   6. Intracerebellar and intraventricular hemorrhage
   7. Petechial hemorrhages of thalami
   8. Brain stem hemorrhage and early necrosis
   9. Herniation of cerebellum through craniotomy wound
   10. Early laminar necrosis of occipital lobe

Gunshot Wound No. 2, Through-and-Through

ENTRY:	Right axillary region
COURSE:	Soft tissue of right axilla and right infraclavicular region
EXIT:	Right infraclavicular region
DIRECTION:	Right to left, back to front, upward
BULLET RECOVERY:	None

Gunshot Wound No. 3

ENTRY:	Right axillary region (just below Gunshot Wound No. 2 entry)
COURSE:	Soft tissue of right axilla, soft tissue of right upper back to the level of the 6th cervical vertebra just beneath the skin
EXIT:	None
DIRECTION:	Right to left, back to front, upward
BULLET RECOVERY:	.22 caliber bullet from the soft tissue of paracervical region at level of 6th cervical vertebra at 8:40 A.M., June 6, 1968

Evidence of Recent Surgical Procedures

1. Craniotomy, right temporal occipital
2. Other, minor surgical procedures are described elsewhere

Pathologic Findings Related to Gunshot Wound No. 1

1. Hypostatic Pneumonia

Miscellaneous Pathologic Findings not Related to Cause of Death

1. Adenoma of the left kidney (benign)
2. Retention cyst of left kidney

DESCRIPTION OF GUNSHOT WOUNDS

Gunshot Wound No. 1

The wound of entry, as designated by Maxwell M. Andler, Jr., M.D., neurosurgeon attending the autopsy, and more or less evident by inspection of the apposed craniotomy incision, is centered 5 inches (12.7 cm) from the vertex, about ¾ inch (1.9 cm) posterior to the center of the right external auditory meatus, about ¾ inch (1.9 cm) superior to the Reid line, and 2½ inches (6.4 cm) anterior to a coronal plane passing through the occipital protuberance at its scalp-covered aspect. The defect appears to have been about 3/16 inch (0.5 cm) in diameter at the skin surface. The surgical incision passing through the area of the wound of entry has been fashioned in a semilunar configuration with the concavity directed inferiorly and posteriorly. The incision has been intactly sutured by metallic and other material. The arc length is about 4 inches (10 cm).

Further detailed description of the area is given elsewhere in this report.

Varyingly moderate degrees of very recent hemorrhage are noted in the soft tissue inferior to the right mastoid region, extending medially as well. There is no hematoma in the soft tissue.

In conjunction with the wound of entry, the right external ear shows, on the posterior aspect of the helix, an irregularly fusiform zone of dark red and gray stippling about one inch (2.5 cm) in greatest dimension, along the posterior cartilaginous border and over a maximum width of about ¼ inch (0.6 cm) at the midportion of the stippled zone. This widest zone of stippling is approximately along a radius originating from the wound of entry in the right mastoid region. Moderate edema and variable ecchymosis is present in the associated portions of right external ear as well.

No evidence of powder burn, tattoo, or stippling is found in the area surrounding the wound of entry of Gunshot Wound No. 1, to include an arbitrary circular zone superimposed upon the above-described stippling on the right ear.

LESIONS IN DETAIL (NEUROPATHOLOGY)

A. Scalp and Cranium

A U-shaped recent surgical wound is present over the right temporo-occipital region of the recently shaved scalp behind the right ear. Many wire sutures are in place. About 2 cm above the tip of the mastoid process immediately behind the pinna at about the level of the external auditory meatus, the anterior portion of the skin of the incision shows a semicircular defect said to be a portion of the original bullet entrance wound (according to the surgeons who were present at the examination). After removing the wire sutures, the scalp is incised by the usual mastoid-to-mastoid incision across the vertex. The incision on the right is extended into the surgical incision mentioned above. After reflecting the scalp, dark red subcutaneous and subgaleal hemorrhages are found in the right temporo-occipital region overlying and around the wound and the surgical craniotomy over an area measuring 9.5 × 10 cm. The hemorrhage ranges up to 3 mm in thickness. The right temporal muscle shows a small amount of hemorrhage along its posterior aspect.

The bony defect of the cranium included the superior portions of the right mastoid process and the adjacent temporo-occipital bones in an irregularly oval area measuring 6 × 5 cm. Gelfoam and hemorrhagic material is removed from the craniotomy site.

A circumferential cut with three notches is made in the calvarium with a vibratory saw. The calvarium is removed from the underlying dura. There is no lesion in this portion of the cranium.

The bone surrounding the craniotomy is removed in a single piece, including the posterior half of the right external auditory canal. The bullet wound in the skull appears to be located with its anterior margin 1

cm posterior to the right external auditory meatus, 2 cm superior to the tip of the mastoid process; but the original configuration is obscured by the surgical enlargement and by the adjacent craniotomy. The surgical opening of the right temporo-occipital bone measures 6 cm anteroposteriorly and 5 cm supero-inferiorly. Burr holes, saw cuts, and rongeur cuts can be seen along the margins of the bone.

The bullet wound of the mastoid extends medially to the base of the petrous portion where there is a triangular defect with the base of the triangle corresponding to the petrous ridge and measuring 8 mm in width.

A curved fracture about 1 cm long is found in the central thinnest portion of the right supra-orbital plate with intra-orbital hemorrhage beneath it surrounding the right eye. A laceration of the dura and contusion of the right orbital gyri are located above the fracture.

B. Meninges, blood vessels, and cranial nerves

In the dorsolateral aspect of the subdural space there is a film of blood up to 3 mm thick, covering the arachnoid over both posterior frontal and parieto-occipital regions and extending downward to, and in some places below the sylvian fissure bilaterally, slightly more on the left side than on the right. Similar blood clot is also found on the left middle fossa and in both posterior fossae, again more on the left side. A small amount of blood clot, about 2 cc, is found between the cerebral hemispheres just dorsal to the midbrain.

Rather diffuse subarachnoid hemorrhage is present over the parieto-occipital regions, over the dorsal and right side of the cerebellum, and also over the ventral surface of the pons and medulla. All of this, however, is quite slight, and the blood clot does not obscure the underlying structures.

Epidural hemorrhages are found in the following three locations:

1. Adjacent to the craniotomy defect of the right temporo-occipital region. This is minimal and extends not more than 1 cm from the surgical incision and it is less than 1 mm in thickness.
2. Above the right supraorbital plate where the fracture is present as described above. This is deemed minimal and less than 1 mm in thickness covering an area 1.5 × 1 cm.
3. Epidural hemorrhage measuring 2 cm longitudinally and 1 cm transversely is found in the dorsal aspect of the epidural space at C1 and C2 vertebral levels.

The dorsal veins which empty into the superior sagittal sinus are

inspected but they reveal no evidence of the source of subdural hemorrhage.

The right superior petrosal sinus is severed for a distance of 8 mm corresponding to the defect of the petrous ridge mentioned above. The remainder of this sinus adjacent to the defect has been cauterized. The tentorium which has its attachment to the right petrous ridge is lacerated where the bony defect is present. This laceration of the dura is continued laterally and communicates with the surgical defect which measures 4.5 × 2.0 cm just anterior to the right sigmoid sinus and above the transverse sinus beneath the craniotomy opening. A second surgical defect is present on the dura posterior to the sigmoid sinus and inferior to the transverse sinus and this measures 3 × 2 cm. There are areas of brownish discoloration and a minimal amount of blood clot is scattered along the margins of these dural openings.

The lateral portion of the transverse sinus and the sigmoid sinus thus transverse the craniotomy defect horizontally through its posterior portion and vertically through its inferior portion.

The tentorium cerebelli shows no defects in its central portions.

The dura was lacerated over a small area over the right supra-orbital plate where a curved fracture was present as mentioned above.

The superior saggital sinus, left transverse sinus, left sigmoid sinus and cavernous sinuses are inspected and reveal no evidence of thrombosis or laceration. The right transverse and sigmoid sinuses do not appear to be damaged in spite of their proximity to the dural openings anterior and posterior to it, but cautery marks are on and close to these sinuses which contain dark red blood clots.

Examination of the arteries of the brain stem and cerebellum reveals a right vertebral artery that is smaller than the left. The basilar artery measures 3 mm in diameter and is slightly tortuous. The anterior inferior cerebellar arteries and the posterior inferior cerebellar arteries have a normal distribution and show no evidence of traumatic injury. The left superior cerebellar artery is intact. The right superior cerebellar artery is intact throughout its main trunk, but several of its superficial branches are involved in the cortical contusion and laceration of the cerebellum and many of its deeper branches have been damaged by the penetrating bullet and bone fragments.

All of the remaining blood vessels of the brain stem, cerebellum and cerebral hemispheres have normal distribution and show very slight atherosclerosis. There is no evidence of injury except for the areas of contusions and lacerations.

The cranial nerves are all intact

C. Cerebrum

Slight depression of the cerebral cortex is noted over both posterior frontal and parietal convexities in the areas beneath the subdural hemorrhage that is described above. The right cerebral hemisphere is slightly larger than the left with shallow tentorium grooves over both unci, slightly more prominent on the right than on the left. However, there is no evidence of herniation of the cingulate gyri beneath the falx. The gyri over both cerebral convexities are flattened.

When the brain is inspected from the ventral aspect, three areas of contusion-laceration can be seen in the cortex of the right cerebral hemisphere and a fourth area of contusion on the left. The largest one measures 4 × 3 cm. It consists of superficial and deep lacerations and contusions of the mesial half of the posterior one-third of the right inferior temporal gyrus for an anteroposterior distance of 4 cm; the middle third of the right fusiform gyrus for 3 cm and the lateral portion of the hippocampal gyrus for a distance of about 1 cm. Coronal sections show that this laceration has a subcortical hemorrhage extending 1.5 cm into the subcortical white matter to the floor of the posterior part of the temporal horn of the right lateral ventricle with rupture into this cavity. The medial portions of the temporal lesion are characteristic of laceration and contusion, while the lateral portions of this lesion are quite characteristic of hemorrhagic infarction.

The second largest contusion is in the middle part of the right orbital gyri and measures 1.5 × 1.0 cm with a 5 mm curved laceration within it. Hemorrhage extends into the subcortical white matter to a depth of 6 mm. This lesion overlies the lacerated dura and fracture of the right supraorbital plate.

The third contusion measures 14 × 7 mm with a linear 6 mm transverse laceration and is situated in the mesial portion of the inferior part of the right occipital cortex.

The fourth contusion of the cortex is a very small lesion in the middle of the left inferior temporal gyrus and measures 5 × 2 mm. There is no laceration in this area. This condition is limited to the gray matter.

D. Cerebellum

In the anterior and lateral aspects of the right hemisphere of the cerebellum, there is an irregular penetrating wound. The opening measures 2 × 2 cm with irregular margins. The margins of this wound and adjacent areas are elevated to form a ring of tissue at the bony margin, 2 mm distal to the internal bone surface. This indicates herniation of the cerebellar tissue into the bony defect. On the surface of this defect and in the bone incision, there are fragments of gelfoam and soft friable blood clots.

A partially collapsed linear tract measuring 5 cm in length extends from the cerebellar cortex and subcortical white matter of the cerebellum to the vermis. The tract begins just rostral to the tegmentum of the anterior one-third of the pons, anterior to the middle cerebellar peduncle and proceeds in a superior and posterior direction. From an imaginary transverse plane between the two mastoid bones, one would estimate that this tract proceeds about 45 degrees posteriorly and medially and 30 degrees superiorly from the mastoid perforation. The tract ends in the vermis of the cerebellum where a 1 cm transverse laceration is found in the region of the primary fissure which is approximately 3 cm posterior to the anterior cerebellar notch. At the termination of the tract, hemorrhage can be seen within the cortical laceration.

The size of the penetrating wound is difficult to determine at this time since the tract is largely filled by the swollen white matter of the cerebellum and by hemorrhage. However, probing into the tract at the entrance wound indicates that it was in the order of 2 cm in width at maximal expansion.

Upon palpation and probing in the region of the laceration in the superior vermis, a metallic fragment is found just beneath the arachnoid membrane and within an area of hemorrhage. This irregular gray metallic fragment measures 6 × 3 × 2 mm and corresponds to the largest fragment that was identified in the postoperative x-ray of a radiopaque object near the midline.

In addition to the penetrating wound and the laceration of the vermis at its terminal end, an area of contusion and hemorrhagic necrosis measuring 2.5 × 2.0 cm covers most of the superior surface of the right cerebellar hemisphere and extends 5 mm over the midline. Beneath this area of contusion and communicating with the penetrating wound, a recent hematoma is found that measuers 2.5 × 2.0 cm. The hemorrhage involves the region of the declivis, folium, and tuber. Smaller satellite contusions and hemorrhagic necrosis are scattered lateral to the large contusion of the superior surface of the cerebellum. Both cerebellar hemispheres are markedly swollen with flattened gyri and with a cerebellar pressure cone. Two small areas of hemorrhagic necrosis, each 3 mm in diameter, are present in the cortex of the herniated left cerebellar tonsil. The right cerebellar tonsil shows a single area of cortical hemorrhagic necrosis, also 3 mm in diameter.

An elliptical groove over the superior surface of the anterior lobe of the cerebellum indicates upward herniation of these structures through the incisura of the tentorium cerebelli.

Horizontal sections of the cerebellum reveal the penetrating wound and the hemorrhage described above. These lesions have destroyed much of

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the cortex and subcortical white matter of the right cerebellar hemisphere, the dentate nuclei and probably the roof nuclei.

E. Brain stem
The ventral surface of the pons and medulla is markedly flattened.

The periagueductal gray matter contains multiple petechial hemorrhages extending over an area of 8 to 9 mm in width on the left side and about 5 mm on the right side. In sections above the pons, the midbrain reveals several irregular hemorrhages within the tegmentum. The largest of these hemorrhages is slitlike, measures 5 × 1 mm in size, and is situated in the left lateral tegmentum. Numerous petechial hemorrhages are found throughout both the tegmental and ventral portions of the rostral ¾ of the pons on multiple horizontal sections. Section through the medulla shows an area of hemorrhagic necrosis 4 × 3 mm in diameter located in the left inferior olive.

F. Ventricular system
The lateral and third ventricles are moderately narrowed in size. They contain a small amount of blood clot totaling about 6 cc. The source of the intraventricular hemorrhage is due to rupture into the right inferior horn of the hemorrhage of the right temporal lobe. The fourth ventricle also contains a small amount of fresh blood clots.

G. Spinal cord and spinal canal
The foramen magnum and the upper cervical vertebrae are inspected and they show no abnormalities.

The bodies of the lower cervical, thoracic, and upper lumbar vertebrae are removed in a column. After inspecting the spinal nerve roots, the cervical, thoracic, and lumbar spinal cord is removed in toto.

A 41-cm portion of the spinal cord extending from the high cervical region into the lumbar region is examined. The leptomeninges are thin and transparent. The anterior spinal artery is thin-walled and shows no evidence of occlusion or laceration.

The posterior aspect of the spinal cord additionally reveals thin leptomeninges and normal distribution of vessels and nerve roots. There is no evidence of pathologic damage to the spinal cord. The subarachnoid space shows faint blood staining. Multiple transverse sections of the spinal cord and nerve roots show no gross lesions.

H. Pituitary gland
The diaphragma sella and pituitary stalk are normal in appearance. The pituitary gland measures 1.1 × 0.8 × 0.5 cm. Section shows a pink homogeneous anterior lobe and a reddish gray posterior lobe. The bony structures forming and surrounding the pituitary fossa are all within normal limits.

MICROSCOPIC REPORT (NEUROPATHOLOGY)

There are 31 slides divided into three groups: A, B, and C. Each group is again numbered as A-1, A-2, A-3, or B-1, B-2, B-3, B-4 and C-1, C-2, C-3, C-4, etc.

Sections confirmed all the lesions described at the gross examination.

All tissue sections show congestion and some extravasation with occasional actual petechial hemorrhages, the latter being particularly noticeable in the thalami near the ventricular walls. A few mononuclear cells are present in the perivascular spaces. The ground substance of the cerebral cortex and centrum shows fine vacuolations. In the occipital cortex, there is early status spongiosus, portions of which have a laminar distribution. Some nerve cells have pyknotic nuclei and homogenization of the cytoplasm, the latter showing definite eosinophilia. The white matter of the frontal lobe shows occasional areas of pallid staining. In the ventral pons there is early necrosis in addition to the hemorrhages.

A-1, Right Frontal Lobe:
This section shows marked congestion of the meningeal and parenchymal blood vessels. The endothelium of the blood vessels shows hypertrophy. There is no inflammatory infiltrate in the meninges. There is a diffuse rarefaction of the matrix of the cortex and white matter, but more marked in the white matter where there are actual areas of early status spongiosus. Many of the nerve cells are pyknotic. The glial and ependymal elements are swollen.

A-2, Left Frontal Lobe:
Findings are similar to A-1, except that the status spongiosus of the white matter is not obvious.

A-3, Right Temporal Lobe—Hippocampus:
Findings are similar to A-2.

A-4, Left Temporal Lobe—Hippocampus:
In addition to similar findings as in A-3, there are several small petechiae in the cortex. This section also shows slight subarachnoid hemorrhage.

A-5, Right Parietal Lobe:
The general findings of these sections are similar to A-2. However, some nerve cells are not only pyknotic but are also beginning to show eosinophilia of the contracted and homogenized cytoplasm.

A-6, Left Parietal Lobe:
This slide shows findings similar to A-2. In addition, there is subarachnoid hemorrhage.

A-7, Right Occipital Lobe:
This section shows marked congestion of all the blood vessels with extravasation of blood in the white matter. The cortex shows early status spongiosus which has a suggestive laminar pattern.

A-8, Left Occipital Lobe:
This section shows findings similar to A-7 above. Some of the nerve cells are beginning to show eosinophilia of the cytoplasm.

A-9, Right Striatum:
In general the blood vessels and nerve cells show changes of the cortex similar to those described in A-2. The subependymal blood vessels show a few mononuclear cells in the perivascular spaces. There is also some extravasation of blood from these vessels.

A-10, Left Striatum:
The findings are similar to A-9.

A-11, Right Lenticular Nucleus:
The findings are similar to A-9 except the extravasation of blood is not obvious.

A-12, Left Lenticular Nucleus:
The findings are similar to A-11.

A-13, Right Thalamus:
These sections show generalized congestion and actual petechial hemorrhages in the walls of the third ventricle. The nerve cells show pyknotic changes. Portions of the matrix show early status spongiosus.

A-14, Left Thalamus:
The findings are similar to A-13, but the petechial hemorrhages are not as marked.

A-15, -16, -17, and -18, Spinal Cord:
Sections are taken from the cervical, thoracic, and lumbosacral regions. The vascular changes in the meninges and spinal cord are minimal and certainly not as pronounced as those in the cerebrum. A few of the nerve cells in the gray matter, mostly in anterior horns, show pyknotic changes.

B-1, Right Transverse Sinus:
Sections show red blood cells between the laminae of the dura. The sinus contains antemortem thrombus along the vessel walls. This thrombus consists mainly of platelets. In the remainder of the blood clot there are numerous neutrophils.

B-2, Right Sigmoid Sinus:
Portions of the dura show coagulation necrosis with tinctorial changes toward basophilia. Antemortem thrombus is also found in the sinus, as in B-1

B-3, Right Frontal Lobe—Orbital Gyri:
Sections show hemorrhagic necrosis of the cortex.

B-4, Right Temporal Lobe—Parahippocampal and Fusiform Gyri:
This section shows most extensive hemorrhagic defects, both in the gray and white matter. The defect communicates with the external surface. The remaining portions of the specimen show changes similar to A-2.

B-5, Right Temporal Lobe:
The findings are similar to B-4.

B-6, Right Occipital Lobe, Medial Inferior Aspect:
Sections show superficial hemorrhagic defect of the cortex.

C-1, Left Inferior Temporal Lobe:
This section shows multiple hemorrhagic necrosis in the cortex.

C-2, Midbrain:
Section shows multiple hemorrhages. The cerebral aqueduct is patent.

C-3 and C-4, Pons:
Sections show multiple hemorrhage, mostly in the ventral portions, and acute necrosis. The fourth ventricle is collapsed.

C-5, Medulla:
Focal hemorrhagic necrosis is present in the left inferior olive.

C-6, Cerebellum, Dorsal Aspect:
This shows a large hemorrhagic defect with multiple petechial hemorrhages in portions of the dentate nucleus. In another portion of the dentate nucleus, where there is no hemorrhage, there is acute necrosis.

C-7, Cerebellum, Tonsil:
This shows multiple petechiae in the cortex.

Additional Microscopic Slides (Neuropathology):
The pineal gland shows a few corpora amylacea.

Sections of the temporal lobe reveal essentially the same histopathologic findings described previously.

Slide Labeled Gunshot Wound [GSW #1], (Entrance Wound):
The perpendicular section, stained with hematoxylin and eosin, through the wound track shows loss of epithelium and patchy areas of swollen dermis.

The area of margins of squamous epithelium shows perinuclear vacuolation and spindle form distortion.

The dermis is extensively involved with coagulation, also visible in special stain. The hair follicles and sebaceous glands are partly involved also.

Capillaries are dilated. There are areas of extravasation and infiltration by acute inflammatory cells. Scattered, varying-sized powder residues are found in the keratin layer and the inner surface of the wound track to a depth of 2 mm. There are also disclike powder granules embedded in the epidermis, and the powder-embedded area is surrounded by pink-staining denatured collagen. Powder residues are in an assortment of shapes and sizes, the edges showing minute crystalloid material which is also visible on the unstained sections.

Subcutaneous tissue and muscle elements are hemorrhagic and heavily infiltrated by neutrophils.

Microscopic Diagnosis:
Entry of the gunshot wound is consistent with very close range shooting.

Slide from Posterior Aspect of Helix of Right Ear, Including Grossly Described Powder Smudging and Tattooing:
The sections stained with hematoxylin and eosin show patchy areas of loss of epithelium due to thermal and blast effect. The squamous epithelium between the exposed coagulated dermis shows perinuclear vacuolation and nuclear elongation, along with fragmentation at the edges.

Dark brown to black powder residues in varying sizes are embedded through the epithelium to the dermis, which is also recognizable in unstained sections. The dermis shows extensive coagulation of the collagen tissue. Sweat glands and hair follicles, together with associated sebaceous glands, are involved, with changes consistent with heat and blast effect. Coagulation of the collagen tissue is also visible on sections stained by Masson's method.

REPORTS OF X-RAY STUDIES

Description of Preoperative X-rays

Anteroposterior and lateral portable films of the skull, exposed on June 5, 1968, at approximately 1:00 A.M., reveal a gunshot wound of the right temporal bone. The wound of entry is 2.0 cm above the temporal tip and approximately midway between the external auditory canal and the sigmoid sinus region, approximately 1.0 cm posterior to the auditory canal.

There are two bullet tracks. One extends slightly anterior to the vertical dimension (15 degrees). The second extends 30 degrees posterior to the vertical dimension, so that the two tracks diverge 45 degrees.

In the frontal projection, both tracks extend superiorly toward the vertex at an angle of 30 degrees to the horizontal.

In the tracks of the bullet wound are numerous metallic foreign bodies and

fragments of the mastoid. The largest metallic fragment is situated in the petrous ridge at about the arcuate eminence. This measures 12 mm in transverse dimension, 7 mm in vertical dimension, and approximately 12 mm in anteroposterior dimension.

Several metallic foreign bodies are present in the soft tissues lateral to the mastoid process. Twelve metallic foreign bodies, 1 mm or larger, are present in the mastoid process. In addition to the largest fragment described, at least thirty metallic fragments 1 mm or larger are present in the posterior fossa.

One fragment of bone and several metallic fragments projected through the orbit above the petrous ridge are, I believe, supratentorial, and in the mesial aspect of the temporal lobe posteriorly.

A fragment, 7 mm in transverse diameter, 4 mm in greatest anteroposterior dimension and vertical dimension, is situated superiorly slightly to the left of the midline and 4.0 cm anterior to the inner cortex of the occipital bone at or just below the tentorium.

The main fragments of the bullet are anterior to the sigmoid sinus as seen in the lateral projection, and this includes the major bony fragment as well.

Description of Postmortem Radiographs

Postmortem radiographs exposed at 2:00 A.M. to 3:00 A.M., under the direction of the Chief Medical Examiner-Coroner, on June, 6, 1968, reveal that a major portion of the petrous ridge has been removed, together with most of the metallic foreign bodies and the detached osseous fragments.

At this time, the metallic fragment most superior and posterior has shifted slightly posteriorly and to the right.

Small fragments remain in the soft tissues lateral to the temporal bone, numbering approximately eleven and very minute. Other fragments, approximately seven in number, are situated directly above the petrous apex and, I believe, supratentorial, in the temporal lobe. This represents the remains of the largest metallic fragment noted preoperatively. Other minute fragments are present in the posterior fossa, numbering approximately twenty.

All of the bony fragments have been removed.

X-rays of the skull at the conclusion of the postmortem revealed that five minute metallic foreign bodies were present in the skin, and approximately twenty minute fragments remained embedded in the remaining portion of the temporal bone in the region of the semicircular canals.

Description of Specimen Radiographs of Surgical Bony Specimen

A series of x-ray films was obtained on June 7, 1968, between 4:00 P.M. and 7:30 P.M.

The initial x-rays consisted of the fragments of temporal bone removed at surgery. These were exposed on industrial film-type M (Kodak) and reveal many more minute metallic foreign bodies than were evident on the early films. Pieces of bone identifiable as mastoid process are filled with approximately 70 individual metallic fragments. Others bearing the Rongeur marks are fragments of cortex removed at surgery from the craniotomy site. Other fragments represent petrous ridge and are also embedded with innumerable fine metallic particles.

The specimen of temporal bone removed at postmortem includes the craniotomy site and the remaining portion of the mastoid process extending posteriorly to include the lateral sinus groove and the facial canal distally. Mesially, the bone is amputated lateral to the cochlea. This contains the external auditory canal. Posterior and superior to the canal are many metallic fragments. These number at least sixty, the majority less than 1 mm in size, with ten above 1 mm.

Description of Specimen X-rays Exposed at the Good Samaritan Hospital (Friday, June 7, 1968)

X-rays of the entire brain, taken initially in the vertex-base direction, reveal small metallic foreign bodies in the cerebellum and temporal lobe. There is a considerable defect of the cerebellum on the right. A small amount of residual contrast (Hypaque) is present in the arterial tree in the left temporal area.

Following the above, the individual sections were x-rayed and labeled respectively: A for the tips of the frontal lobes and successively posteriorly at 2.0 cm intervals, B; C (which includes the anterior aspect of the temporal lobes); and D; etc. E shows one metallic foreign body in the right temporal lobe, plus a defect in the mesial aspect of the temporal lobe in the region of the uncal gyrus. Residual contrast is in the choroid plexus of the lateral ventricle on the left.

Specimen labeled F consists of slice F plus the separate specimen F-1 from the temporal lobe, which contains ten minute metallic foreign bodies in one segment and three minute ones in another area. The cerebellum is also present which reveals a large defect and twenty minute metallic foreign bodies. The specimens of the brain, G and H, extending to the occipital pole, reveal no abnormality.

Separate x-rays were performed on specimen F and F-1 and the cerebellum, plus x-rays of the meninges. The meninges are tattooed with many metallic foreign bodies surrounding the defect, which is in the region of the original wound of entry.

These number fully fifty, with all but three or four under 1 mm in diameter.

Description of Skin and Hair X-rays

X-rays of 68–5731 obtained at the Good Samaritan Hospital between 1:00 and 3:00 P.M., Saturday, June 8, 1968.

The right ear is portrayed in profile and en face. The profile shows the skin surface directed away from the identifying number. The larger side of the ear specimen is to the right in both projections.

Tattooed in the skin are many small metallic foreign bodies. Other foreign bodies are present in the ear which do not appear to be metallic.

Gunshot Wound No. 1 was examined in profile with the cutaneous surface directed toward the number. Two fragments of the wound are present. Both reveal metallic foreign bodies of varying size from barely visible to 1 mm in diameter in the subcutaneous tissue. Many minute foreign bodies are present in the skin superficially surrounding the wound of entry. These resemble in size the particles seen in the ear.

The skin of Gunshot Wound No. 2 and Gunshot Wound No. 3 also reveals the superficial dense metallic impregnation of the skin with several metallic foreign bodies in the subcutaneous tissue. These specimens are also arranged in profile with the cutaneous surface extending toward the identifying number.

The third examination is of the scalp hair obtained prior to surgery. In this area, many dustlike metallic particles are evident, varying in size but all extremely small and differing appreciably from the several artifacts noticed to the left of the label "scalp hair" on the superior aspect of the film.

Three metallic particles are noted in the hair obtained at autopsy. Two of these are extremely minute and one is approximately 0.5 mm in diameter.

Description of X-rays of Skin Wounds

X-rays were obtained of the skin wounds, which are labeled 1, 2, and 3.

Gunshot Wound No. 1:

A profile view of the skin surrounding wound of entry in the right mastoid area reveals a few metallic foreign bodies superficially and other larger foreign bodies (1 cm) in the subcutaneous tissue.

Gunshot Wounds Nos. 2 and 3:
A frontal projection of the axillary skin surrounding wounds labeled 2 and 3 reveals fine metallic foreign bodies in both these situations.

The wound of exit is placed in profile. Wound 2 reveals two minute metallic foreign bodies barely visible in the subcutaneous tissue below the wound.

HEAD AND NERVOUS SYSTEM (GENERALLY)

Also revealed by the reflection of the scalp is a fairly well demarcated area of nonrecent hemorrhagic discoloration, about 1.5 cm in greatest dimension, in the left parietal occipital region. No associated galeal hemorrhage is demonstrated.

The cerebrospinal fluid is blood tinged.

Abundant and freshly clotted, but drying blood is found at the right external auditory canal, extending outward to the lateral interstices of the external ear. No evidence of hemorrhage is found at the left ear.

The spinal cord is taken for further evaluation. At the time of removal of the cord, a small amount of cervical epidural hemorrhage is noted. There is no evidence on preliminary inspection of avulsion of roots leading to the right brachial plexus.

Those portions of peripheral nervous system exposed by the described dissection show no abnormality.

Gunshot Wound No. 2

GROSS

This is a through-and-through wound of the right axillary, medial shoulder, and anterior superior chest areas, excluding the thorax proper. The wound of entry is centered 12½ inches (31.8 cm) from the vertex, 9 inches (22.9 cm) to the right of midline, and 3¾ inches (8.3 cm) from the back (anterior to a coronal plane passing through the surface of the skin at the scapula region). There is a regularly elliptical defect 3/16 x ⅛ inch overall (about 0.5 x 0.3 cm) with thin rim of abrasion. There is no apparent charring or powder residue in the adjacent and subjacent tissue. The subcutaneous fatty tissue is hemorrhagic.

The wound path is through soft tissue, medially to the left, superiorly and somewhat anteriorly. Bony structures, major blood vessels, and the brachial plexus have been spared.

The exit wound is centered 9¾ inches (about 24.5 cm) from the vertex and about 5 inches (about 12.5 cm) to the right of midline anteriorly in the in

fraclavicular region. There is a nearly circular defect slightly less than ¼ x 3/16 inch overall (0.6 x 0.5 cm).

Orientation of the wounds of entry and exit is such that their major axes at the skin surfaces coincide with the central axis of a probe passed along the entirety of the wound path. No evidence of deflection of trajectory is found.

MICROSCOPIC EXAMINATION OF THE SLIDE LABELED GUNSHOT WOUND NO. 2 (GSW #2) ENTRANCE WOUND

The perpendicular sections of the gunshot wound show cellular degeneration of the margins of the covering epithelium. The dermis shows extensive coagulation, early cell infiltration by mostly neutrophiles, and hemolyzed and relatively intact erythrocytes. The area of coagulation necrosis includes disintegration of apparently sweat and sebaceous gland. Only remnants are visualized.

Gunpowder granules embedded into the dermis and the surface of the gunshot wound track are visible on stained and unstained sections.

The subcutaneous and adipose tissue shows extensively extravasated hemorrhage.

Gunshot Wound No. 3

GROSS

The wound of entry is centered 14 inches (35.6 cm) from the vertex and 8½ inches (21.6 cm) to the right of midline, 2 inches (5 cm) from the back anterior to a plane passing through the skin surface overlying the scapula, and ½ inch (1.2 cm) posterior to the midaxillary line. There is a nearly circular defect 3/16 inch by slightly more than ⅛ inch overall (0.5 x 0.4 cm). There is a thin marginal abrasion rim without evidence of charring or apparent residue in the adjacent skin or subjacent soft tissue. The subcutaneous fatty tissue is hemorrhagic.

The wound path is directed medially to the left, superiorly and posteriorly through soft tissue of the medial portion of the axilla and soft tissue of the upper back, terminating at a point at the level of the 6th thoracic vertebra as close as about ½ inch (1.2 cm) to the right of midline.

BULLET RECOVERY

A deformed bullet (later identified as .22 caliber) is recovered at the terminus of the wound path just described at 8:40 A.M., June 6, 1968. There is

a unilateral, transverse deformation, the contour of which is indicated on an accompanying diagram. The initials, TN, and the numbers 31 are placed on the base of the bullet for future identification. The usual evidence envelope is prepared. The bullet, so marked and so enclosed as evidence, is given to Sergeant W. Jordan, No. 7167, Rampart Detectives, Los Angeles Police Department, at 8:49 A.M. this date for further studies.

An irregularly bordered and somewhat elliptical zone of variably mottled recent ecchymosis is present in the superior-medial axillary skin on the right, in the zones of wounds of entry No. 2 and No. 3, especially the former. The ecchymosis measures 3½ x 1½ inches (9 x 3.8 cm) overall with the right upper extremity extended completely upward (longitudinally).

Triangulation of Gunshot Wounds

Angles and planes refer to the body considered in the standing position, in accordance with usual anatomic custom.

GUNSHOT WOUND NO. 1

Goniometric studies by Dr. Scanlan are described by him elsewhere in this report. Photographs of internal features of the skull are confirmatory.

GUNSHOT WOUND NO. 2

Autopsy measurements indicate an angle of 35 degrees counterclockwise from the transverse plane as viewed frontally. Triangulation measurements from photographs give an angle of 33 degrees.

Autopsy measurements indicate an angle of 59 degrees counterclockwise from the transverse plane as viewed laterally from the right. Measurements from photographs also indicate an angle of 59 degrees.

Autopsy measurements indicate an angle of 25 degrees measured clockwise from the coronal plane (anteriorly) as viewed from the vertex.

GUNSHOT WOUND NO. 3

Autopsy measurements show an angle of 30 degrees upward from the transverse plane, counterclockwise as viewed frontally. Photographic studies also show an angle of 30 degrees.

Autopsy measurements show an angle of 67 degrees clockwise from the transverse plane as viewed laterally from the right. Photographs indicate an angle of about 70 degrees.

Measurements indicate an angle of 5½ degrees counterclockwise and be[illegible]

the coronal plane as viewed from the vertex. The photographs are in agreement for this small angle.

EXAMINATION OF CLOTHING AT THE TIME OF AUTOPSY

1. There is a dark blue, fine worsted-type suit coat bearing the label "Georgetown University Shop—Georgetown, D.C." The coat has been cut and/or torn at the left yoke and left sleeve area. The right sleeve is intact. There is variable blood staining over the right shoulder region and on the right lapel. Two apparent bullet holes are identified in the right axillary region, slightly over 1 inch (2.5 cm) and slightly over 1¼ inch (3.2 cm) from the underseam area, respectively, and corresponding with wounds described on the body elsewhere in this report. Also noted at the top of the right shoulder region centered about 1¼ inches from the shoulder seam and about ⅝ inch (1.6 cm) posterior to the yoke seam superiorly is an irregular rent of the fabric, somewhat less than 1¼ inch (3.2 cm) in diameter and definitely everting superficially and upward. The three front buttons of the garment are intact. (Subsequent examination of the coat showed the presence of a superficial through-and-through bullet path through the upper right shoulder area, passing through the suit fabric proper but not the lining.)

2. There is a pair of trousers of matching material with a very dark brown leather belt with rectangular metal buckle and showing the gold-stamped label "Custom Leather, Reversible, 32." The zipper is intact. There is a minimal amount of apparent blood staining over the anterior portions of the trouser legs.

3. There is a white cotton shirt with the label "K WRAGGE, 48 West 46th Street, New York." The laundry mark initials "RFK" are present on the neck band. The left portion of the shirt has been disrupted in approximately the same manner as the suit coat and is similarly absent. The right cuff is intact and is of semi-French design. A chain connected yellow metal cufflink with plain oval design is in place. A corresponding left cufflink is not among the items submitted. Apparent bullet holes are identified as corresponding to those in the previously described area of suit coat.

4. There is a tie of apparent silk rep, navy blue with an approximately [illegible] inch (0.5 cm) gray diagonal stripe. The label is "Chase and Collier McLean, Virginia." The marker is RIVETZ.

5. There is a pair of navy blue, nearly calf-length socks of mixed cashmere and apparently nylon fiber, the fiber content stencil labeling still being nearly discernible on the foot portions.
6. There is a pair of white broadcloth boxer-type shorts with two labels: "Sunsheen Broadcloth V' Cloth—34"; and "Custom fashioned for Lewis and Thos. Saltz, Washington." There is a small amount of blood stain at the anterior crotch, along with pale straw-colored discoloration to the left of the fly. A few patches of dry blood are present on the back as well.
7. There is a trapezoidally folded cotton hankerchief showing, on what appears to be the presenting (anterior) surface, several scattered dark red and somewhat brown spots ranging from a fraction of a millimeter to about 4 mm (less than $\frac{3}{16}$ inch) in greatest dimension.
8. No shoes are submitted for examination.

The above listed items are saved for further and more detailed study by others.

GENERAL EXTERNAL EXAMINATION

The nonembalmed body, measuring 70½ inches (179 cm) in length and weighing about 165 pounds (74.5 kg), is that of a well-developed, well-nourished, and muscular Caucasian male appearing about the recorded age of 42 years. The extremities are generally symmetrical bilaterally, showing no obvious structural abnormality.

The head shows extensive bandaging, somewhat blood-stained in the posterior aspect. Dressings are also present in the right clavicular region, the right axilla, and the right ankle regions. Also present over the right inguinofemoral region are apparently elastoplast dressings. A recent tracheostomy has been performed at a comparatively low level. A clear plastic tracheostomy tube fitted with an inflatable cuff is in place. The area also shows a gauze dressing.

Lividity is well developed in the posterior aspect of the body, mainly at the upper shoulder and midback regions with approximately equal distribution bilaterally. The lividity blanches definitely on finger pressure.

Rigor mortis is not detected in the extremities or in the neck. (Rigor was noted to be developing in the arms and legs by the time of conclusion of the autopsy.)

A complete examination of the external surfaces of the body is undertaken following removal of all dressings.

The head contour is generally symmetrical, due allowance being made for the soft-tissue edema and hemorrhage in the right postauricular region in general. The hair is graying light brown and of male distribution. Portions of the right half of the scalp have been clipped and/or shaved. Hair in the inguinal and femoral regions has also been shaved in part. Hair texture is medium.

There is an irregularly bordered area of comparatively recent yet pale ecchymosis centered about 1 inch (2.5 cm) above the midportion of the right eyebrow. Marked ecchymosis with moderate edema is present in the right periorbital region but mainly of the upper eyelid. No abnormality is noted in the left periorbital tissue externally. No hemorrhage or generalized congestion is seen in the conjunctival or scleral membranes. The nose is symmetrical, showing no evidence of fracture or hemorrhage. The glabella shows no evidence of trauma.

Eye color is hazel. Pupillary diameters are equal at about 5 mm ($\frac{3}{16}$ inch).

The buccal mucosa and the tongue show no lesion.

Chest diameters are within normal limits and there is bilateral symmetry. The breasts are those of a normal adult male. The abdomen is scaphoid. No abdominal scar is identified. There is an old low medial inguinal scar on the right.

Texture and configuration of the nails are within normal limits, and no focal lesions are noted. There is no peripheral edema.

The skin in general shows a smooth texture and no additional significant focal lesion. There is abundant suntan, especially at the neck region where its contrast with the areas shaved for surgical preparation on the right can be noted.

No structural abnormality is noted on the back.

There is a diagonally disposed recent surgical incision about 3 inches (7.5 cm) in length in the right anterolateral femoral region. This incision has been intactly sutured. There is an associated plastic tubing of small diameter, centered about ½ inch (12 mm) from the infero-medial margin of the incision.

Also noted in a comparable location on the left are several hypodermic puncture marks. These just mentioned areas show the presence of red-orange dye.

There are recent cutdowns at the right ankle and the lateral right knee with thin polyethylene tubes in place. No extravasation is noted.

The external genitalia are those of a normal circumcised adult male.

CAVITIES

An incision is made as far as the two previously described surgical incisions, allowing upward reflection of skin and soft tissue to afford access for carotid angiography before the head is opened. Following completion of these roentgenographic studies, the traditional Y incision is continued. The peritoneal surfaces are smooth and glistening. No free fluid is found in the abdominal cavity. There are no adhesions. Abdominal organs are in their usual relative positions.

The pleural surfaces are smooth. There is no pleural effusion.

The pericardium is intact and encloses a small amount of transparent straw-colored liquid.

CARDIOVASCULAR SYSTEM

The heart weighs 360 g and presents smooth epicardial surfaces. There is moderate right atrial dilatation. The contour otherwise is within normal limits. Cut surfaces of myocardium show a uniform gray-red muscle fiber texture with no focal lesion. The endocardial surfaces are smooth. About 50 ml of dark red postmortem clot is present in the chambers collectively. No cardiac anomaly is demonstrated. The thickness of the left ventricular wall is up to 1.3 cm, and that of the right, 0.3 cm. Valve circumferences are: Tricuspid—13, pulmonic—8.5, mitral—10.5, and aortic—7 cm. There are no focal lesions. The coronary arterial tree arises in the usual sites and distributes normally. The coronary arteries are thin-walled and pliable, showing widely patent lumina. The aorta has a normal configuration and varies from 3.3 to 5.2 cm in circumference. The intimal surface of the aorta shows small and comparatively pale yellow atheromatous areas totaling no more than 10 percent of the area studied.

The lining of the inferior vena cava is smooth throughout. The distal end of the intravenous polyethylene catheter is noted at the level of the second lumbar vertebra and shows no evidence of thrombosis at the tip. Free flow is also demonstrated.

Other vessels studied are not remarkable, save where special descriptions are given elsewhere in this report.

RESPIRATORY SYSTEM

The right lung weighs 490 g; the left, 330 g. There is a moderate amount of wrinkling of the external surfaces, suggestive of atelectasis. Dusky discoloration is noted in the hypostatic portions bilaterally. The outer surfaces of the lungs are intrinsically smooth. Cut surfaces of the lungs disclose a few scattered areas of atelectasis, especially in the left lower lobe. There is mild edema throughout. Hypostatic congestion is noted in an estimated 30 percent of the total lung volume, approximately equally distributed bilaterally. In these hypostatic areas, there is probable patchy hemorrhage of the matrix as well. No areas of consolidation are identified. Noncongested portions of the lungs are comparatively pale tan in color. Anthracotic pigmentation is not excessive for the age of the subject. A small amount of slightly pink frothy mucoid material is present in the bronchial tree, but no exudate. There is no evidence of aspiration of gastric content.

The hilar lymph nodes show no abnormality.

NECK ORGANS

The pharyngeal and laryngeal mucosa shows no focal lesion. There are a few petechial hemorrhages of the epiglottis. Intrinsic musculature and soft tissues of the larynx show no hemorrhage or other evidence of trauma. The vocal cords do not appear edematous, nor is there evidence of generalized submucosal edema. The hyoid bone is intact.

The trachea is in midline. The plastic tracheostomy tube previously mentioned shows no obstruction of its airway and no exudates or hemorrhagic material. The mucosa lining the trachea is moderately injected at the general level of the tracheostomy, again with no obvious exudate.

The thymus is comparatively fatty but not otherwise remarkable.

HEPATOBILIARY SYSTEM

The liver weighs 1,810 g and has a smooth intact capsule. The edges are sharp. Cut surfaces of the liver show no focal lesion in the comparatively

dark brown matrix. Little blood wells up from the freshly cut surfaces. A number of normal sized portal veins present themselves. There is no evidence of fibrosis. No fatty sheen is seen on the cut surfaces.

The gallbladder has a wall of average thickness and a smooth serosal surface. The organ is distended by the presence of more than 25 ml of green-black bile of intermediate viscosity. There are no calculi. The extrahepatic biliary system is patent.

HEMIC AND LYMPHATIC SYSTEM

The 150 g spleen is moderately firm and has a smooth intact capsule. Multiple cut surfaces of the spleen show no focal lesion in the dark gray-red matrix. The capsule shows no areas of thickening. The malpighian bodies are distinct. No accessory spleen is identified.

There is no evidence of marked departure from normal blood volume. In areas where postmortem clot is found, this is of uniformly normal degree and texture. No evidence of any hemorrhagic diathesis is noted.

The abdominal lymph nodes, mainly the para-aortic, show moderate enlargement (up to three times the normal size) but no induration or focal change. Other lymph nodes studied are not remarkable.

PANCREAS

Configuration and size are within normal limits. Multiple cut surfaces show no evidence of an acute inflammatory change, fatty necrosis, scarring, or hemorrhage.

UROGENITAL SYSTEM

The right kidney weighs 180 g and has a smooth capsule which strips readily. Cut surfaces disclose normal corticomedullary ratios, with an average cortical thickness of about 6 mm, compared with 1.0 cm of the medulla. There are no focal lesions. A moderate amount of engorgement is noted.

The left kidney weighs 175 g and has a generally smooth capsule which can be stripped readily. Also present, however, is a retention cyst about 2.5

cm in greatest dimension but showing on subsequent study, a principal volume delineated by a space 2.0 × 1.8 × 1.5 cm. Thin watery liquid is enclosed. About 3.0 cm from one pole of the left kidney and 2.0 cm from the pelvis is a well-circumscribed and slightly raised subcapsular nodule having a uniform yellow matrix and measuring 1.0 × 0.9 × 0.9 cm overall. The cut surface of this yellow nodule protrudes slightly. The lesion is about 6.0 cm from the just described retention cyst. Intervening matrix of the left kidney shows no focal change. The renal pelves of both kidneys and both ureters show no induration, dilatation, or exudates. Ureteral implantation is noted to be normal in the urinary bladder. About 8 ml of faintly amber-pink cloudy urine is contained. There is no focal lesion of the urothelial lining. There are no urinary calculi.

The prostate is symmetrical with a transverse diameter of 3.5 cm. Cut surfaces show no distinct nodular areas and no focal lesion. There are scattered areas of vascular engorgement near the origin of the prostatic urethra. a slightly gritty texture is found on the cut surfaces of the prostrate. Scattered discrete calculi up to 2 mm in diameter are found.

The seminal vesicles are of normal configuration and contain a small amount of green-gray mucoid material.

Both testes are present in the scrotal sac and are of normal size and consistence. Tubular stringing is readily accomplished. No evidence of hydrocele is present.

DIGESTIVE SYSTEM

The esophagus is lined by smooth, pale gray epithelium following the usual longitudinal folds. No focal lesion is found. The stomach has a wall of average thickness and a smooth serosal surface. There is mild gaseous dilatation. No evidence of hemorrhage or ulceration is found in the gastric mucosa. Within the lumen is about 500 ml of cloudy gray watery mucoid material in which no discrete food fragments are found. The duodenum, small intestine, and colon show no gross abnormalities of mucosal or serosal elements. The appendix is not identified. The mesenteric lymph nodes are not remarkable.

ENDOCRINE ORGANS

The pituitary is intrinsically symmetrical and within the normal limits of size. As is the sella turcica.

The thyroid is symmetrical and not enlarged; cut surfaces of the brown-red colloid matrix show no focal change.

The adrenals total 13.5 g and are of normal configuration. Multiple cut surfaces show no focal lesion. The thickness of the cortex is little more than 1 mm. The medullary tissue is not remarkable.

MUSCULOSKELETAL SYSTEM

The bony framework is well developed and well retained. No evidence of a diffuse osseous lesion is found. The fracture of the right orbital plate and of other components of the base of the skull are described in detail elsewhere in this report, mainly the neuropathology section. No additional evidence of recent fracture or other focal trauma is demonstrated in the skeleton.

The clinically described and radiologically documented old fractures are not dissected.

The vertebral marrow is a uniform brown-red, showing no focal change.

Cut surfaces of muscles studied, in areas apart from the trauma, show no abnormality.

SPECIMENS STUDIED

Organs and body fluids enumerated elsewhere in this report for the purpose of toxicologic examinations.

General Toxicologic Analyses:

Nothing significant could be detected in a "General Unknown" analysis performed on blood, liver, and lung tissue.

Microscopic Studies:

Tissue sections for microscopic examination as denoted in other portions of this report.

Blood Typing:

Group A_1, Rh positive.

Radiologic Examinations:

Radiographs of the entire body were made at the time of autopsy. Subsequent radiographic studies are described elsewhere in this report.

Photographs in Custody of this Office:

At autopsy: 35mm Kodachrome transparencies and prints of dissection and study of pertinent external and internal anatomic features.

At-scene investigation: Ambassador Hotel: 35mm Kodachrome transparencies and prints.

At test firings: 35mm Kodachrome transparencies and prints.

Special studies under our direction: Infrared and panchromatic photographs by James Watson, Scientific Investigation Division, Los Angeles Police Department.

Prints of certain photographs by other jurisdictions, for corroborative studies by this office.

AUTOPSY CHRONOLOGY AND PERSONNEL

Autopsy:

Place: The Hospital of the Good Samaritan Medical Center
1212 Shatto Street
Los Angeles, California 90017

Date and Time: June 6, 1968. Shortly before 3:00 A.M., the Chief Medical Examiner arrived at the hospital and took charge of the case. Autopsy commenced at 3:00 A.M. The body was released from custody at 9:15 A.M. the same date.

County Official in Charge of Medicolegal Investigations:

Thomas T. Noguchi, M.D.
Chief Medical Examiner-Coroner
County of Los Angeles

Aide in Charge of Interagency Relations:

Herbert McRoy
Administrative Deputy Coroner

Pathologists:

Thomas T. Noguchi, M.D.
Chief Medical Examiner-Coroner

John E. Holloway, M.D.
Deputy Medical Examiner

Abraham T. Lu, M.D.
Deputy Medical Examiner (in charge of neuropathology)

Radiologist:

R. L. Scanlan, M.D., Chairman
Department of Radiology
The Hospital of The Good Samaritan Medical Center, and Deputy Medical Examiner.

Postmortem radiographs taken under the direction of the Chief Medical Examiner with assistance of Dr. Scanlan and his staff.

Members of Neurosurgical Team Present as Observers:

Henry M. Cuneo, M.D., Neurosurgeon in Charge
Nat D. Reid, M.D.
M. Andler, M.D.
James Poppen, M.D.

Pathologist from the Hospital of the Good Samaritan Present as Observer:

J. A. Kernen, M.D.

Consultants from the Armed Forces Institute of Pathology:

Pierre A. Finck
Colonel, M.C., U.S.A.
Chief, Military Environmental Pathology Division and
Chief, Wound Ballistics Division

Charles J. Stahl, III
Commander, M.C., U.S.N.
Chief, Forensic Pathology Branch and
Assistant Chief, Military Environmental Pathology Divisior.

Kenneth Earle, M.D.
Chief, Neuropathology Branch

Forensic and Medical Photographers:

John E. Holloway, M.D.
Deputy Medical Examiner

Richard Kottke
Deputy Coroner

Charles Collier
Scientific Investigation Division
Los Angeles Police Department

In Charge of Security of Autopsy Room, for the Office of the Chief Medical Examiner-Coroner:

Charles Maxwell
Chief of Investigation Division

Autopsy Assistant:

Edward Day
Senior Investigator

Others Present:

Other individuals were present from time to time during the autopsy for various purposes. Names of these authorized persons appear on rosters maintained by the department and other agencies also bearing responsibility for the security of the autopsy room.

Pathologist for General Microscopic Studies and Clinicopathologic Correlation:

Victor J. Rosen, M.D.
Deputy Medical Examiner

Advisors not Present at Autopsy:

William G. Eckert, M.D.
Pathologist to St. Francis Hospital, Wichita, Kansas

Russell S. Fisher, M.D.
Chief Medical Examiner
State of Maryland

Edward H. Johnston
Colonel, M.C., U.S.A.
Assistant Chief of Pathology
Armed Forces Institute of Pathology, Washington, D.C.

Bruce H. Smith, Jr.
Captain, M.C., U.S.N.
The Director
Armed Forces Institute of Pathology, Washington, D.C.

Cyril H. Wecht, M.D., J.D.
Chief Forensic Pathologist
Allegheny County, Pennsylvania, and
Director, Pittsburgh Institute of Legal Medicine

CHRONOLOGY OF SUBSEQUENT STUDIES

Neuropathology

Inspection of the head and removal of the brain, spinal cord, and temporo-occipital bone began at 7:40 A.M. and was completed at 9:15 P.M., June 6, 1968, in the autopsy room of The Hospital of The Good Samaritan, Los Angeles, California.

Preliminary examination of the brain and cranial wound was made by 10:00 A.M., including two horizonal sections through the midbrain and upper portion of the pons.

The specimens were then placed in 10 percent neutral formalin for fixation and transferred to the laboratories of the Chief Medical Examiner-Coroner, Hall of Justice.

At 4:00 P.M., June 6, 1968, after six hours of preliminary fixation, the brain was cut in six coronal sections and examined. Records were made on all gross findings.

At 7:00 P.M., June 7, 1968, the brain was further cut into thirteen coronal sections and reexamined. All lesions and their locations were again confirmed and descriptions checked for accuracy.

Color photographs and radiographs, including internal carotid artery angiography, were made at different stages of examination.

Radiography

Radiographs of the brain specimen were taken on June 7, 1968.

Additional Photography

Infrared and black-and-white photographs of scalp hair, gunshot wounds, and of skin from the right ear were taken on June 8, 1968.

At-Scene Investigation

At-scene investigation at the Ambassador Hotel, 3400 Wilshire Boulevard.

Los Angeles, was conducted by Dr. Noguchi and Commander Stahl on June 8, 1968.

Additional ballistic aspects were considered during a follow-up at-scene investigation with Mr. DeWayne Wolfer, Los Angeles Police Department, and Drs. Holloway and Noguchi on June 11, 1968.

Test Firings

Test firings were conducted on June 11, 1968, using a weapon and ammunition supplied by the Los Angeles Police Department as being of the most nearly identical manufacture possible to that of the fatal weapon. An area adjacent to the firing range on the Los Angeles Police Academy was utilized. Personnel consisted of Drs. Holloway and Noguchi, Mr. DeWayne Wolfer and Sgt. William J. Lee. Preliminary studies were with a target composed of a single layer of muslin over 3/8-inch (9 mm) gypsum board. The muzzle was perpendicular to the target unless otherwise noted.

A firm contact firing shows a circular defect about 3/8 inch (9 mm) in diameter, surrounded by a concentric zone of powder deposition about 7/8 inch (22 mm) in diameter and sometimes having a multilaminar configuration at the periphery. These are on the outer surface of the muslin. Also evident on the undersurface is a concentric zone of pale soot deposition about 3 inches (7.5 cm) in diameter.

At a 1/4 inch muzzle distance, there is a 5/16 × 1/4 inch (7.5 × 6 mm) defect with transverse ripping of the fabric over a zone 1½ inches (3.8 cm) in length and about evenly divided bilaterally. Also present is a concentric zone of dense, dark gray discoloration 1 inch (2.5 cm) in diameter with irregular "clouding" within a zone up to 2½ inches (6.3 cm) in diameter. Several faint radial smudges are identified as corresponding roughly with the known land-and-groove characteristics of the test weapon.

A firing at ½-inch muzzle distance is similar in configuration except for the absence of ripping of the target fabric and absence of land-and-groove "puffs." Visually detected powder residue is presented in a zone having a maximum diameter of about 6 inches (15 cm).

At 1-inch distance there is the usual central defect and dense but comparatively homogeneous smudging up to a radius of 1⅝ inches (4.2 mm).

A firing at 2-inch muzzle distance shows fairly homogeneous but comparatively lighter smudging up to a radius of 2¼ inches (5.6 cm). Discrete tattoo particles are now seen in a central zone up to 7/8 inch (2.2 cm) in radius.

The 3-inch distance firing shows pale mottling of powder residue with a

radius up to 2¼ inches (5.6 cm), as well as finely dispersed powder granules up to a radius of about 1¾ inches (4.4 cm).

At 4 inches there is a pale smudging zone up to 1¾ inches (4.4 cm) in radius. In sharp contrast, discrete powder tattoo particles are identified out to a radius as much as 2 inches (5 cm).

Target configuration was then changed as follows. A single layer of muslin was placed over several crumpled thicknesses of the same fabric. Additional firings at close contact, loose contact, 1/8 inch (3 mm), 1/4 inch (6.5 mm), all show patterns similar to those on the original target.

A series of firings was then performed using geometry simulating that of the fatal gunshot wound to the head, as determined by previous studies. The postauricular region was simulated by the padded muslin described above. The ear was simulated by an animal ear obtained from an abbatoir and with the hair removed.

With the test weapon at an angle of 15 degrees upward and 30 degrees forward (to correspond with goniometric data) and at a distance of 1 inch (2.5 cm) from the edge of the right "ear," the test pattern is most similar to the powder residue pattern noted on the right ear and on hair specimens studied. Similarity persists, on the 2-inch (5 cm) distance firing, with respect to the distribution of discrete powder granules.

DESCRIPTION OF SPECIAL PHOTOGRAPHY AND RADIOGRAPHIC STUDIES DONE JUNE 7, 1968, AT THE PHOTOGRAPHY DEPARTMENT, LOS ANGELES POLICE DEPARTMENT, AND AT THE GOOD SAMARITAN HOSPITAL

Report of supplemental examinations done on the brain and various associated bony tissue obtained both at the time of surgery and at autopsy.

2:10 P.M. on June 7, 1968

The undersigned and Colonel Pierre A. Finck took the fixed and previously partly sectioned brain specimen, along with bone fragments submitted from the Surgical Pathology Department, Good Samaritan Hospital, and a segment of skull removed at autopsy (to include the surgical margins of the wound of entry to the head and a portion of the associated trajectory zone) to the Los Angeles Police Department Crime Laboratory by prior arrangement. It was recommended by the Director of the Scientific Investigation Division of the Los Angeles Police Department, Captain Martin, that the contemplated x ray studies might be better accomplished at another facility.

There was, however, at our disposal, the services of the Photographic Department of the Los Angeles Police Department, and the following photographs were taken by James Watson, Senior Photographer, under our direction:

1. Segment of bone removed at autopsy from the right mastoid region, internal aspect, infrared at a ratio of reproduction of 1:1 on the negative.
2. The external aspect of the above specimen, infrared technique
3. External aspect of the above specimen; black and white; pan.
4. Internal aspect of the same; black and white; pan.

The foregoing photographs are all on 4 × 5 material and all bear the identification No. 68-5731, the autopsy number.

5. A 1:1 ratio photograph of various fragments of bone submitted from the Surgical Pathology Department of Good Samaritan Hospital under their number B-2411-68. Pan film; millimeter scale included in photograph.
6. An infrared study of the same material in the same orientation and at the same scale.

The above negatives, having been exposed and developed and showing adequate representation of the fractures sought, were left for printing by the Los Angeles Police Department photo lab.

We left the Los Angeles Police Department Building at 4:10 P.M. to pursue the x-ray studies at The Good Samaritan Hospital, Department of Radiology. These were done in the company of and with the kind consultation of Drs. R. L. Scanlan and J. D. Camp. The x-ray technician for these studies was Mr. G. O. Drianis. We arrived at The Good Samaritan Hospital at 4:15 P.M. for these studies.

The first studies were of the brain slices reassembled in the best approximation of their original anatomic positions and x-rayed with the cerebellum approximated in situ as well (two exposures, radiation entering at the vertex).

The thus assembled brain was then x-rayed in a similar manner, but with the cerebellum detached slightly along the midsagittal axis (four films).

The segment of skull excised at the time of autopsy and containing both the surgical defect and portions of the wound of entry to the head was then x-rayed with the specimen in as intimate contact with the film plane as possible and thus very nearly representative of a perpendicular view through the center of the surgical defect, but not the wound of entry. Two

exposures of this aspect were made. The specimen was then rotated 90 degrees so as to provide a somewhat lateral view with reference to that portion of mastoid in the specimen. The specimen was supported for this study by a balsa wood block. Two exposures were made at varyingly perpendicular planes to the foregoing. The above-mentioned four exposures are all contained on one sheet of film.

Composite films embodying visible evidence of the gunshot wound to the head were then made, including that portion of dura in which the traumatic and surgical defect was present, a portion of posterior aspect of temporal lobe nearest the wound of entry, and the two portions of cerebellum as previously sectioned by the neuropathologist. Four films of this configuration were taken to include some variety of roentgenographic technique in view of the considerable variation of geometry in the specimens studied. All of the foregoing described films bear the autopsy number 68-5731.

The next study was a series of two exposures on one sheet of film of the collection of bone fragments obtained at time of surgery (or a portion of these same). The fragments were oriented to emphasize two particular fragments, larger as it happened, which show on infrared negatives some reaction in that spectrum. The two fragments are at the upper portion of the x-ray field, the lower aspect being delineated by the number B-2411-68, surgical pathology accession number for this specimen at The Good Samaritan Hospital. Again a varying technique was used to afford a more meaningful interpretation of radio-dense areas.

Returning to the brain specimen proper, the reassembled specimen was then arranged in a serial manner commencing from anterior and proceeding posteriorly with the arbitrary assignment of alphabetical designation of the slices which had been previously chosen by the neuropathologist.

This first film includes arbitrary sections A, B and C. A letter R designates the right hand side of the array. The next film in this series includes arbitrary sections D and E. The next film includes arbitrary sections F, G and H, with the addition of a separate segment of cerebral cortex and associated hemorrhagic material known to have come from the region of the wound of entry to the head. The latter material bears the designation F-1. This series ends with section H, which represents the terminus of the occipital lobes.

The next film is a composite of arbitrary section F, its accompanying fragment F-1, and separated views of cerebellum. Alignment of these specimens on the film is such that the midsagittal plane passes perpendicular to the film, the separate fragment of cerebrum and the associated hemorrhagic material are comparably distant from the midline; and the ventral portion of the cerebellum (including the pons) are similarly aligned. The remaining

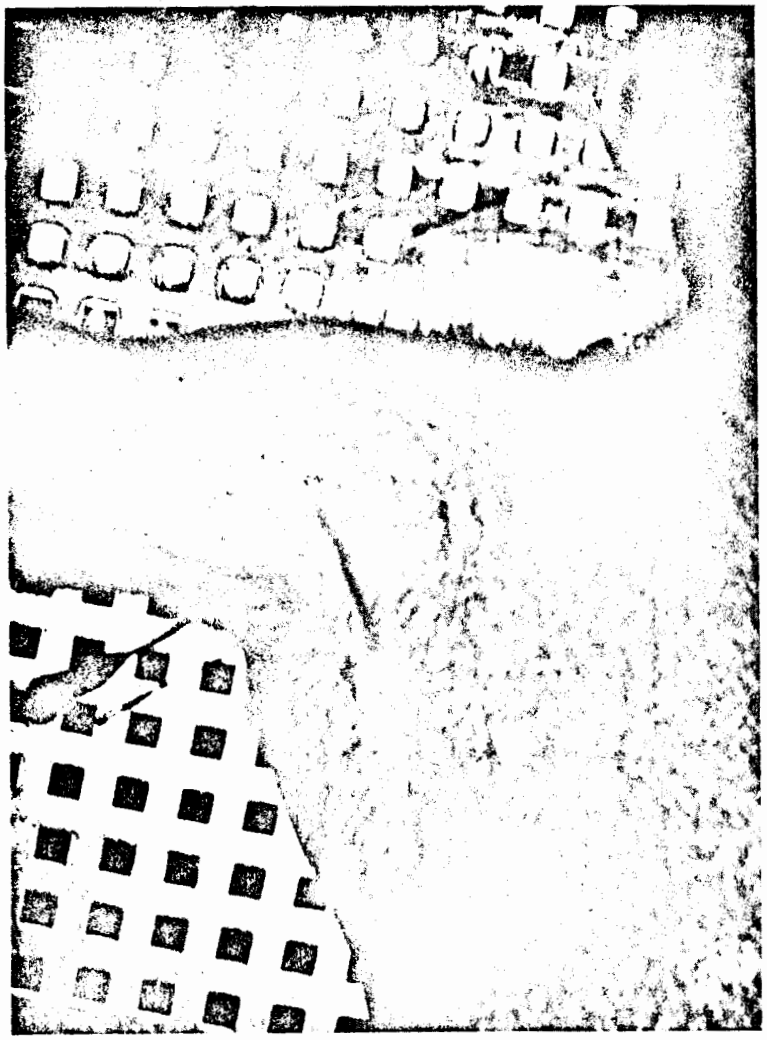

Fig. 5. Probes placed through Gunshot Wounds Nos. 1, 2 and 3 in head and right axilla, demonstrating angle of fire.

portion of cerebellum is then placed to the left of the ventral portion but along the same axis of lateral displacement.

The next film includes the foregoing configuration and adds the portion of dura which was originally fixed in formalin with the brain and which includes the traumatic and surgical defect.

The last film in this series is an array of the wounds of entry and exit. An

Fig. 6. Photomicrograph of gunshot wound of entrance (Gunshot wound No. 1.) in right mastoid area. Note powder residue. × 4,000.

"entry" column is arranged on the left of the film and the "exit" column on the right. Numbers appearing beside specimen images correspond to the assignment of gunshot wound numbers indicated in the autopsy protocol. Entry No. 1 is a view in which the superior portion of the image represents merely the integumental free surface and the remainder represents subcutaneous tissue. The specimen designated to include Entry No. 2 and Entry No. 3 is oriented on the film such that the radiation enters at the

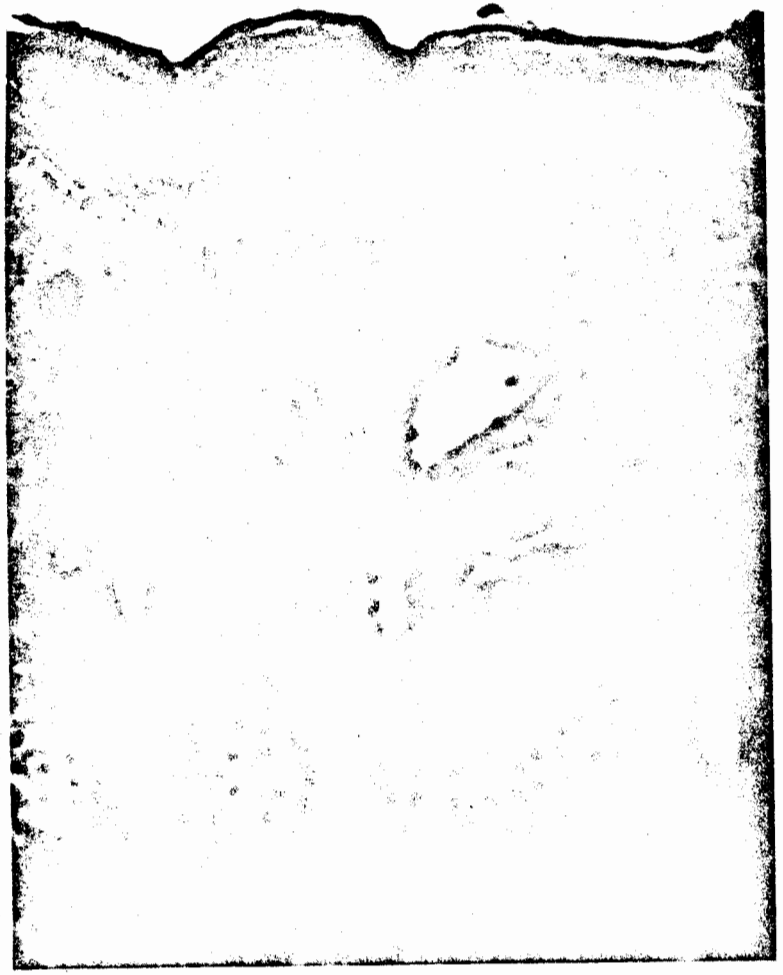

Fig. 7. Photomicrograph of wound of entrance (Gunshot wound No. 2.) in right axilla. Note powder residue. × 4,000.

free surface of the skin. Orientation of this specimen takes into account the previously placed (at time of autopsy) suture nearest Entry No. 2. A faint image of this identifying suture is seen in this radiograph. Exit No. 2 is taken wtih the same orientation as the tissue including Entries 2 and 3.

Technical data for radiographs of wounds of entry and exit: 90 KV, 100 MA and ½ second exposure. The film suggested by Drs. Scanlan and Camp and used for these studies was Eastman Industrial type, affording superior contrast and resolution.

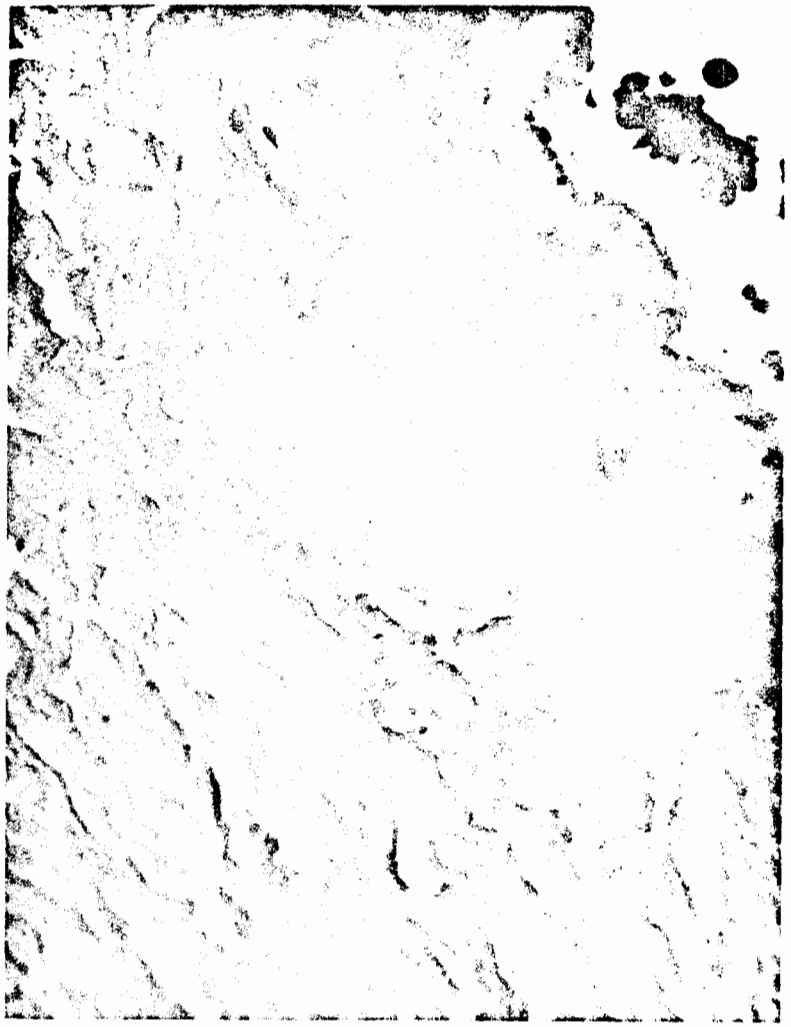

Fig. 8. Photomicrograph of wound of entrance (Gunshot wound No. 3.) in right axilla. Note powder residue. × 4,000.

The above studies having been completed and all films processed and dried, the undersigned left The Hospital of The Good Samaritan at 7:25 P.M., to take the above items to the Hall of Justice. Colonel Finck had previously left the hospital (at 7:00 P.M.) for the purpose of returning the brain and other specimens (excluding the tissues containing wounds of entry and exit) to the Office of The Chief Medical Examiner-Coroner for further evaluation by the neuropathologist. The undersigned returned the gunshot wound specimens to the office, along with the above described films.

TOXICOLOGY LABORATORY REPORT

Report of Chemical Analysis
County of Los Angeles Medical Examiner-Coroner
Toxicology Laboratory
Hall of Justice
Los Angeles, California

File No. 68-5731

Name of Deceased: Senator Robert F. Kennedy — Lab. No. 6-161

Date Submitted: June 6, 1968 — Time: 8 A.M.

Autopsy Surgeon: T. T. Noguchi, M.D.

Material Submitted:

Blood	X	Liver	X	Stomach	
Brain		Lung	X	Lavage	
Femur		Spleen		Urine	
Kidney		Sternum		Gall bladder	
Drugs		Chemicals			

Test Desired: General Toxicological Analysis

Laboratory Findings:

A general toxicological analysis was performed on blood, liver, and lungs. Nothing significant could be detected.

Examined By: R. C. Gupta, Ph.D. Head Toxicologist. Date: June 14, 1968

REPORT OF BLOOD TYPING

Report of Microbiological Analysis
Chief Medical Examiner-Coroner's Office
Bacteriology Laboratory
Hall of Justice
Los Angeles, California

File No. 68-5731

Name of Deceased: Robert F. Kennedy

Date Submitted: June 6, 1968

Autopsy Surgeon: Thomas T. Noguchi, M.D.

Material Submitted: Blood for ABO and Rh Typing.

Laboratory Findings: BLOOD: Group A1 Rh positive.

Examined By: Roderick I. Luke Date: June 12, 1968

GENERAL MICROSCOPIC DESCRIPTION

Cardiovascular System

HEART (Sections 72-12 A, B, and C; 72-13 A, B, and C; 72-14 A, B, and C; 72-15 A, B, and C; 72-16 A, B, and C; 72-17 A, B, and C; 72-18 A, B, and C; 72-19 A, B, and C; 72-23 A, B, and C.)

Epicardial surfaces show flat sparse mesothelium. The epicardial fat is of normal amount. In a few areas there is the usual degree of insinuation of epicardial fat cells in the outermost myocardium extending between isolated fibers and bundles of fibers. All sections show regular myocardial fibers with central nuclei which are of consistent and regular size. Tinctorial characteristics are uniform with the usual degree of eosinophilia. Within the myocardial interstitium is a minimal amount of edema, usually located adjacent to small vascular channels. No myocardial necrosis, fiber fragmentation, or inflammatory infiltrate is observed. No microscopic intramyocardial hemorrhage can be identified. The endocardial surfaces show an intact endothelium. The usual complement of fibrous connective tissue is present subjacent to the endothelium. Small tributaries of the coronary arterial tree included in the sections of heart show no intrinsic disease. No thrombi or emboli are identified.

AORTA (Sections 72-28 A, B, and C)

The section is that of a complete circumferential segment of aorta. It includes intima, media, and a generous portion of adventitia. The endothelial surface is intact. In a few random areas, minimally increased amounts of fibrous tissue can be noted beneath the endothelium. A few minute pools of mucopolysaccharide material are seen in the deep intima and innermost media. Only rare isolated foam cells can be seen immediately subjacent to the endothelium. The pattern of the elastic plates of the media is normally preserved. The adventitia consists of the usual loose collagenous connective tissue. The vasa vasorum extending from the adventitia into aortic wall are of normal caliber. No inflammatory infiltrate is identified in any layer of the aortic wall.

INFERIOR VENA CAVA (Sections 72-29 A, B, and C)

The structure of the full thickness of vein wall is preserved. The endothelial surface is intact. The usual complement of subendothelial fibrous

tissue is present which appears to be loosely arrayed bundles of collagen. The media of the vein shows the usual bundles of smooth muscle separated by collagen bundles. The smooth muscle gradually thins out as it approaches the adventitia, which is composed of loose areolar connective tissue. A few small nerve trunks and blood vessels in the adventitia are unremarkable.

CORONARY ARTERIES (Sections 72-23 A, B, and C; 72-24 A, B, and C; 72-25 A, B, and C represent gross sections of branches of the coronary tree. Sections 72-26 A, B, and C; 72-27 A, B, and C represent longitudinal sections of coronary arteries.)

Cross-sectioned vessels show intact endothelial surfaces. No cross-sectioned branches show significant luminal compromise. There is a slight increase in fibrous tissue deposition immediately subjacent to the intima, blending with the muscular media. Rare isolated foam cells can be identified. No sharply defined plaques are observed. In a few areas, loose fibrillar appearing pink-staining material is noted in the subintimal connective tissue adjacent to the muscular media and is surrounded by small aggregates of fibroblasts, foam cells, and rare lymphocytes.

The longitudinally sectioned arterial branches show no additional alterations beyond those previously described in the cross-sectioned segments.

Respiratory System

TRACHEA (Sections 72-4 A, B, and C; 72-5 A, B, and C; 72-6 A, B, and C)

Sections of trachea include epithelium, cartilagenous rings, and peritracheal connective tissue. There is focal denudation of the surface epithelium. In other areas the normal columnar epithelium is intact. Some evidence of early regeneration of denuded epithelium is noted. The tracheal basement membrane is irregularly thickened and eosinophilic. Immediately subjacent to it are aggregates of lymphocytes in a slightly edematous subepithelial stroma. Most of the tracheal mucous glands appear intact. A few of their ducts contain inspissated secretions. In one block (72-6 A, B, and C) neutrophilic leukocytes are noted aggregating beneath the basement membrane. There is stromal hemorrhage adjacent to the neutrophils. In another section (72-5 A, B, and C) necrosis of the epithelial and subepithelial tissue down to the level of perichondrium is noted. The areas of necrosis are manifested by loss of nuclei with persistent nuclear dust, smudging of blood vessels, and some extravasation of blood. The necrosis also involves mucous glands. At the junction of the vital and necrotic tracheal mucosa, neutrophilic leukocytes are gathered. The tracheal cartilagenous rings are

visible. In all sections, some central cartilagenous calcification is noted. Some extravasation of blood into the peritracheal connective tissue is seen.

LUNGS (Sections 72-7 A, B, and C; 72-8 A, B, and C; 72-9 A, B, and C; 72-10 A, B, and C; 72-11 A, B, and C)

Sections of pulmonary parenchyma are essentially similar to one another. All show moderate engorgement of the arterial bed with red blood cells as well as congestion of the alveolar capillary bed. In addition, precipitated proteinaceous edema fluid can be seen in many microscopic fields, located within alveolar spaces as well as within the perivascular and peribronchial interstitial tissue. Anthracotic pigment aggregates are sparse and collected in subpleural foci associated with slight fibrous tissue proliferation and lymphocytic aggregates. Other small aggregates of anthracotic pigment can be seen in perivascular and peribronchial location. Terminal bronchioles, respiratory bronchioles, and many alveolar ducts contain neutrophilic exudate. In some small respiratory passageways plugging by neutrophilic cells can be seen, while in other areas the aggregation is loose. In the areas of intraalveolar neutrophilic exudation diapedesis of neutrophils through alveolar capillaries can be observed. In areas of the neutrophilic collections, fibrin meshworks are noted. In a few alveolar spaces, fibrinous material appears compressed against the lining, but hyaline membrane formation is not a prominent feature in any of the sections examined. Larger bronchi, small bronchi, and bronchioles of various caliber show prominent folding of their mucosal surfaces and some postmortem denudation of epithelium. In the areas of pulmonary parenchyma not involved with the pneumonitic process, slight hyperexpansion of alveolar ducts and alveolar spaces is noted. Several small pulmonary arterial branches contain thrombo-embolic material filling the lumen. No organization is observed. Search of vessels in the described sections reveals no obvious embolic central nervous system tissue.

LUNGS (Sections L20-1 A, B, and C; L20-2 A, B, and C; L20-3 A, B, and C; L 20-4 A, B, and C; L20-5 A, B, and C; L20-6 A, B, and C; L20-7 A, B, and C; L20-8 A, B, and C; L20-9 A, B, and C; L20-10 A, B, and C; L20-11 A, B, and C; L20-12 A, B, and C; L20-13 A, B, and C; L20-14 A, B, and C; L20-15 A, B, and C; L20-16 A, B, and C; L20-17 A, B, and C; L20-18 A, B, and C; L20-19 A, B, and C; L20-20 A, B, and C)

Multiple sections of pulmonary parenchyma reveal varying amounts of red-cell congestion of the capillary bed, exudation of neutrophilic leukocytes, and proteinaceous material into scattered alveolar spaces, and precipitated edema fluid in other alveolar spaces. The changes are patchy. In some sections, there is collapse of individual pulmonary lobules. In other sections, small bronchi and bronchioles show postmortem autolytic sloughing of the

epithelium. Neutrophilic leukocytic aggregates are also seen in some bronchioles. In other fields, randomly scattered in the sections examined, hyperinflation of alveolar spaces can be recognized. In section L20-2 A, B, and C, two small vascular channels contain aggregates of fibrillar to spongy, palé pink-staining material in which ghosted nuclear structure can be identified. This material suggests embolic autolyzed central nervous system tissue. Special stains for myelin will be prepared.

Hemic and Lymphatic System

LYMPH NODES (Sections 72-35 A, B, and C; 72-36 A, B, and C)

Two lymph nodes are represented in these sections. Slides 72-35 A, B, and C show a node structure embedded in considerable fibro-adipose tissue. Within the fibro-adipose tissue are several myelineated nerve structures. The lymph node itself shows a well-formed capsule. The subcapsular sinusoids are open. The lymph node cortex shows small reactive follicles. In the medullary portion of the node are aggregates of macrophages obscured by black pigment. The lymph channels in the medullary portions of the nodes are unremarkable. The lymph node represented on section 72-36 A, B, and C demonstrates an intact capsule with small amounts of adjacent areolar tissue and a few tags of smooth muscle. In this node the subcapsular sinusoids are also open and lined by normal littoral cells. The node cortex has small, rather symmetrically distributed lymphoid follicles with visible reactive centers. Within the medullary portion of the node is a large amount of black pigment consistent with carbon incorporated into macrophages. The medullary lymphoid sinusoids are unremarkable. The reticuloendothelial cells lining the sinusoids are not unduly prominent.

SPLEEN (Sections 72-30 A, B, and C)

The splenic capsule is intact and of normal thickness. The trabecular framework of the splenic parenchyma is unchanged from normal. Malpighian follicles are normally arrayed along the central arterioles. No significant reactive centers are identified. Some of the central arterioles show a mild to moderate degree of hyalinosis. Throughout the splenic section, red pulp sinusoids are engorged with red cells. The cell population of the red pulp is normal. No evidence of extramedullary hematopoiesis is seen. There is no acute splenitis.

BONE MARROW (Sections 72-31 A, B, and C)

Section of marrow includes the enclosing cortical compact and medullary cancellous bone. The adjacent periosteum is of the usual thickness and composed of dense bundles of collagen and small numbers of fibroblasts. The bony cortex shows the usual lamellar pattern. The cancellous bone trabeculae are of the usual configuration. The marrow within the medullary space is cellular and is approximately 20 percent fat. The cellular maturation of all lines is orderly. Megakaryocytes are present. The myeloid to erythroid ratio is approximately 2.5 to 1, suggesting an early hyperplasia of the erythroid line. There is prominent activity of the normoblastic series in the marrow.

THYMUS (Sections 72-57 A, B, and C; 72-58 A, B, and C)

All sections show residual thymic elements embedded in lobulated fat containing several small blood vessels. The thymic lobules show nodular peripheral aggregates of mature lymphoid thymic cells. The medullary portions of the thymus are looser but are composed of lymphoid cells in a delicate reticular stroma. Hassell's corpuscles are prominent in all sections. Many show prominent cystic change, and the cystic areas are filled with flakes of keratinlike material and epithelial cells with occasional formation of epithelial pearls. Amorphous flocculent pink-staining material surrounds the recognizible ghosted areas. There is no evidence of reactive lymphoid follicular activity within the thymus.

Gastrointestinal System

ESOPHAGUS (Sections 72-37 A, B, and C)

The section is that of a complete cross-sectional representation of esophagus. Outer adventitial fibro-adipose tissue tags are present. The circular and longitudinal muscles, bundles, and associated nerve filaments and ganglia are normally distributed. The submucosa consists of rather loose areolar connective tissue. The muscularis mucosae is prominent but not abnormally thickened. The submucosa contains small clusters of lymphocytic cells near blood vessels. The esophageal squamous epithelium is intact and shows normal maturation from basal layer to the lumen. The section appears to represent midesophagus, as no outer skeletal muscle attachments or submucosal gland structures are identified.

TONGUE (Sections 72-1 A, B, and C)

This section includes a generous strip of lingual mucosa, subepithelial tissue, and a prominent mass of lingual skeletal muscle. The epithelial surface shows numerous filiform papillations. The tips of the papillae are covered with slightly hypercornified squamous epithelium. The epithelial maturation appears orderly. Numerous bacterial colonies are present in

the exfoliating squamous cellular debris. Colonies appear to be predominantly coccal. The lingual musculature is entirely within normal limits. There is no evidence of inflammation.

STOMACH (Sections 72-38 A, B, and C; 72-39 A, B, and C; 72-40 A, B, and C)

All sections reveal similar features. The gastric serosa and muscularis are unremarkable. The gastric mucosal folds are prominent. The epithelium is moderately well preserved. Some superficial autolytic loss of the columnar surface epithelium adjacent to the gastric pits is noted. Between some mucosal folds are aggregates of entrapped mucus, containing exfoliated surface cells. The capillary bed of the mucosa appears engorged. Surrounding the necks of the gastric glands are rather prominent aggregates of plasma cells and occasional lymphocytes. In a few areas these cellular aggregates extend through the full thickness of mucosa and form small mononuclear aggregates at the junction of mucosa and muscularis mucosae. A distinctive feature observed in all sections is prominence of the parietal cell population of the gastric glands, with relative reduction in the zymogen cell population. The muscularis mucosae is of normal thickness. Submucosal tissues are of loose areolar type and contain engorged thin-walled blood vessels.

PANCREAS (Sections 72-41 A, B, and C)

The sections are similar to one another. All show well-preserved lobular pancreatic tissue. The vascular bed is mildly to moderately congested. Occasional fat cells are present within the lobules themselves, but there is no fat in the interstitial tissue. Several interlobular ducts and some intralobular ductal elements contain inspissated proteinaceous pink-staining material. The epithelium within most ducts is well preserved. Only rare pancreatic acini show ectasia. There is no interstitial inflammatory reaction identified. The islets of Langerhans appear normally distributed through the lobular parenchyma and show no evidence of hyalinization. There is no evidence of arteriolar sclerosis.

LIVER (Sections 72-42 A, B, and C)

All sections are similar. The liver lobular architecture is well preserved. The portal triads contain no inflammatory cell infiltrate. The portal vein tributaries, hepatic artery tributaries, and bile ducts are unremarkable. The central veins show mild to moderate engorgement by red blood cells. Some congestive changes in the innermost pericentral sinusoids are also observed. The liver cells are arranged in plates of single cell thickness. There is minimal edema of the spaces of Disse. The Kupffer cells are normally [illegible]

tributed. There is no evidence of cholestasis. The pericentral liver ce contain the usual complement of lipochrome pigments.

GALLBLADDER (Sections 72-43 A, B, and C)

A section of gallbladder shows extensive autolytic changes involving t mucosa, with all the cells apparently ghosted and anucleated. The ga bladder muscular coat is unremarkable. The liver bed of the gallbladder included in the section and shows unremarkable liver cells at their juncti with the pericholecystic connective tissue.

Urogenital System

KIDNEYS (Sections 72-44 A, B, and C; 72-45 A, B, and C; 72-46 A, B, a C; 72-47 A, B, and C; 72-48 A, B, and C; 72-49 A, B, and C; 72-50 A, and C; 72-51 A, B, and C)

Sections of kidney show moderately well preserved tubular elements a intact glomeruli. Most of the interstitial renal vascular bed is engorg with red blood cells. The glomerular capillary bed shows red blood c engorgement. There is no evidence of renal tubular necrosis. In some s tions, proximal tubular epithelium shows a slightly vacuolated to groun glass appearance suggestive of a minimal osmotic nephropathy. Only ra glomeruli in multiple sections examined show ischemic obsolescence. general, small arteries of arcuate to interlobar size show slight intim fibrous thickening. No significant arteriolar hyalinization is found.

Sections taken from blocks 72-44 and 72-45 include an adenomatous nodu within the outer cortex. This nodule appears well encapsulated by den hyalinized fibrous tissue. A few central fibrous trabeculae course across t nodule. The nodule is composed of sheets, cords and tubules of sm cuboidal to columnar cells, occasionally arranged as papillary fronds. T cells have sparse pale pink vacuolated to finely granular cytoplasm a large oval to rounded basophilic nuclei.

No mitotic activity is recognized within the nodule. No insinuation in blood vessels or the surrounding renal parenchyma is observed. There scarring with associated tubular atrophy and some glomerular distortic and compression in the cortex immediately adjacent to the nodule.

Sections from blocks 72-46, 72-47, and 72-48 include the grossly describe renal cyst. The cyst wall is composed of hyalinized fibrous connective tissu The lining consists of sparse cuboidal cells. The renal parenchyma in immediately adjacent to the cyst wall shows a generous rim of atrophic cortic

and medullary tubules, compressed and distorted glomeruli, clusters of hyalinized glomeruli, and a minimal lymphocytic infiltration. These changes are consistent with pressure atrophy. Some small blood vessels in this area immediately adjacent to the cyst show prominent fibrosis.

Sections of the kidney, including the papillae as they enter the calyces, show normal endothelial lining the calyces and a normal fibrous and muscular calyceal wall. The tip of a papilla is covered with unremarkable cuboidal epithelium. The collecting tubules appear unremarkable except for a rare focus of calcium salt deposition in their basement membranes.

BLADDER NECK–PROSTATE (Sections 72-52 A, B, and C; 72-53 A, B, and C; 72-54 A, B, and C)

Sections examined from block 72-52 of the urinary bladder include the bladder neck and prostatic junction. The bladder wall musculature is unremarkable. The blood vessels immediately subjacent to the bladder epithelium are markedly congested with red cells. There is some loss of the transitional epithelium. In its place neutrophilic leukocytes and occasional mononuclear cells are clustered. The subepithelial tissue extending into the muscularis shows moderate edema and associated chronic inflammation. In the prostatic uretheral portion of the specimen, there is also subepithelial edema and mild inflammation. The prostatic glands at the junction of bladder neck and prostate show normal papillary epithelium of columnar type, with basally located nuclei. No atypical features are identified. Sections from blocks 72-53 and 72-54 show only prostatic elements. The fibromuscular stroma is unremarkable. The glands are arranged in their normal manner. The epithelium is intact. A few small ductules contain neutrophilic leukocytes and proteinaceous debris and are surrounded by mononuclear cells and rare neutrophils. Other glandular elements contain inspissated proteinaceous material, rare corpora amylacea, and a few small calcific spherules.

TESTES (Sections 72-55 A, B, and C)

Sections are essentially similar to one another. The tunica albuginea is thick and composed of laminated collagen bundles. A few minute ductular epithelial rests lined by cuboidal columnar cells and containing inspissated pink-staining material are seen within the tunica albuginea. The testicular parenchyma shows the usual tubular pattern. There is mild interstitial edema. Interstitial cells are arranged in small and large clusters. Many show golden pigment within their eosinophilic cytoplasm and a few contain crystalloids of Reinecke. The parenchymal tubules show mild basement membrane thickening. Most tubules show orderly spermatogenesis extending through spermatozoa formation. Only rare tubules appear to show absence of spermatozoa formation and in these, spermatids can be identified.

Endocrine System

THYROID (Section 72-56 A, B, and C)

The thyroid follicles show mild to moderate variation in size. Most contain rather abundant colloid. There is peripheral scalloping of colloid in a few follicles. The thyroid epithelium is generally low and cuboidal. A rare thyroid follicle shows squamous metaplasia. There is no evidence of interstitial inflammation, edema, or fibrosis. Intrathyroid blood vessels are unremarkable.

PITUITARY (Sections 72-59 A, B, and C; 72-60 A, B, and C; 72-61 A, B, and C; 72-62 A, B, and C; 72-63 A, B, and C; 72-64 A, B, and C)

Multiple sections of the pituitary include anterior, intermediate, and posterior portions. The connective tissue capsule around the pituitary shows focal extravasation of blood. There is no hemorrhage within the substance of the pituitary, however. The anterior lobe contains the usual complement of cells of eosinophilic, basophilic, and chromophobic types. The eosinophils show the usual nodular aggregation along the anterior pole. There is no evidence of necrosis of pituitary cells. Within the pars intermedia a few colloid filled cystic structures lined by attenuated cuboidal epithelium are seen. The posterior lobe has the typical neural appearance and is unremarkable.

ADRENALS (Sections 72-65 A, B, and C; 72-66 A, B, and C; 72-67 A, B, and C; 72-68 A, B, and C)

All sections of adrenal are essentially similar. All show a connective tissue capsule composed of dense hyalinized fibrous tissue containing fibroblasts. This capsule has a sharp junction with the surrounding periadrenal fat. Some of the periadrenal fat is of the fetal type such as is frequently seen in this region. A few small arterioles in the adrenal capsule and perirenal fat show minimal hyalinization of their walls. No extracapsular cortical nodules are identified. A few intracapsular microscopic aggregates of adrenal cortical cells are seen. The adrenal cortex shows well-demarcated zonation. The glomerulosa is well formed and easily demarcated from the fasciculata. There is no significant nodularity identified within the cortex. The cells of the fasciculata have pale pink cytoplasm which is granular to finely vacuolated. The vascular bed appears mildly congested in the reticularis;

in some sections it is moderately to markedly congested as it approaches the medulla. The reticularis shows cells having rather dense eosinophilic cytoplasm. There is the usual interdigitation of reticularis with the adrenal medulla. The medullary cellular elements are well preserved. The usual thick-walled venous channels are seen within the medulla.

Peripheral Nervous System

PERIPHERAL NERVE (Sections 72-72 A, B, and C)

Peripheral mylineated nerve including its epineural connective tissue shows well-formed axonal structures with the usual complement of Schwann cell nuclei distributed in a normal manner. No diagnostic changes are recognized.

Miscellaneous

Slides labeled 72-2 and 72-3 A, B, and C are sections of pieces of gelfoam covered peripherally with blood clot and showing early migration of neutrophilic leukocytes into the more peripheral interstices.

Slides labeled 72-32, 72-33, and 72-34 A, B, and C and 72-22 A, B, and C are all pieces of blood clot; no lamination or organization is present and the material appears to be of either agonal or postmortem origin.

Slides labeled 72-21 A, B, and C and 72-20 A, B, and C show pieces of gelfoam infiltrated with red cells, neutrophils, and lymphocytes. Fibrin and red cells are at the periphery.

Surgical Pathology Slides for Review

Microscopic review of surgical tissue sections from The Hospital of The Good Samaritan, received in this office on June 7, 1968. Sections are labeled B2411-68 and consist of three slides.

One section shows skin and subcutaneous fat. Only a small area of surface epithelium is present. Several pilosebaceous structures and scattered sweat glands are noted. Collagen of the dermis shows fragmentation and coagulation, and some coagulation of epidermis is also present. Extravasation of blood into the dermis is widespread, and early neutrophilic migration out of capillaries into dermis and subcutaneous fat is recognized. Scattered fragments of bone dust are spread through the disrupted dermis. Aggregates of fine brown granular material can be observed near and in the most [illegible]

[illegible] dermal tissue. These are consistent with grains of gunpowder.

Another tissue section reveals small pieces of disrupted edematous cerebellar cortex without reaction or hemorrhage. Purkinje cells show variable degrees of distortion and nuclear pyknosis. Small pieces of bone are also present on the slide as are irregular pieces of blood clot and fibrin mesh with entrapped leukocytes.

The third slide is a section of a piece of gelfoam to which are adherent a piece of blood clot, a few bony spicules, and sparse pieces of brain tissue. Some minute strips of tissue consistent with leptomeninges are also noted.

CLINICOPATHOLOGIC CORRELATION OF SYSTEMIC AUTOPSY FINDINGS

Introductory Comment:

The gross and microscopic findings obtained from the postmortem examination of the decedent have been correlated with information available from the clinical records of The Hospital of The Good Samaritan. Each organ system is reviewed, noting all changes and how these changes were manifested clinically. In addition, effects of therapy and the effects of the agonal events upon the gross and histopathologic findings are described.

Cardiovascular System:

The structure of the cardiovascular system appears to be within normal limits for the age of the decedent. There is no morphologic evidence of sustained hypertension, as the heart weight is normal and the myocardial thickness is also within the range of normal. No valvular deformities or abnormal intracardiac shunts are found to account for the systolic murmur reported in the clinical notes. No vegetations or antemortem marantic thrombi are seen grossly or microscopically. No myocardial necrosis of the type occasionally noted following the treatment of shock with vasopressors is identified in multiple sections. The coronary arteries reveal no evidence of significant luminal compromise by atherosclerosis. The minimal amount of interstitial edema within the myocardium is considered to be of agonal origin. The aorta and the venae cavae are within normal limits. No antemortem thrombus is recognized in the inferior vena cava in the region of the central venous catheter. The splenic vascular bed shows an amount of arteriolar hyalinosis normally seen in individuals of the stated age. Minimal [illegible] thickening of the intima of intermediate sized renal arteries is also

consistent with the age of the individual. The slight amount of hyalinosis of occasional periadrenal arterioles is also considered to be within normal limits.

Respiratory System:

The gross and microscopic changes described in the trachea are those usually found in comatose individuals in whom tracheostomy has been performed. The patchy denudation and regeneration of surface epithelium frequently accompanies measures utilized to keep the airway open. They are described in the microscopic notes as showing mucosal necrosis, and acute inflammation is typical for the site of a tracheostomy tube. Such a lesion can show complete regeneration of epithelium following removal of the tracheostomy tube. The degree of calcification of tracheal cartilage rings is usual for the age of the decedent.

The pulmonary alterations are those usually encountered in the comatose individual. Mild intraalveolar and interstitial edema frequently appears during the agonal period of life. Some pooling of secretions in the dependent portions of the lungs and the accumulation of the edema fluid in the hypostatic areas have given rise to a mild bronchopneumonic process. No evidence of abscess formation is noted microscopically, and the bronchopneumonic process appears to be early, showing no evidence of organization. No microscopic evidence of oxygen toxicity is noted. The pulmonary septal cells are unremarkable. The thromboemboli described microscopically are small and infrequent in these sections. These thromboemboli appear to be of recent origin and are not associated with infarction. Material suggestive of necrotic central nervous system tissue is identified in two arterial branches. Such pulmonary embolization of central nervous system tissue is not infrequent in craniocerebral trauma in which large vascular channels have become disrupted.

Hemolymphatic System

The lymph nodes examined microscopically are within normal limits. The spleen demonstrates red pulp congestion such as is usually seen as an agonal event. There is no manifestation of systemic sepsis. The bone marrow reveals a slight erythroid hyperplasia, this change reflecting an early response to a major blood loss. The thymus demonstrates the usual residual atrophic lobules. Many small cystic structures derived from Hassall's corpuscles are found throughout the medullary portion. Such cystic changes are not clinically significant.

Gastrointestinal System

The bacterial colonies identified in the hypercornified lingual epithelium are frequently seen on the tongue of an unconscious individual where there is no mechanical effect of chewing or swallowing to cleanse the surface of the tongue. No inflammatory changes are identified in the tongue.

The esophagus shows no evidence of mucosal erosion or ulceration, and there is no evidence of esophagitis.

The stomach shows no evidence of mucosal erosion or ulceration frequently associated with central nervous system disorders. The minimal amount of superficial autolysis of the epithelium is consistent with the postmortem interval from pronouncement of death until autopsy. Of interest is the prominence of parietal cells in the gastric glands. The plasmacytic and lymphocytic aggregates within the lamina propria suggest a slight chronic gastritis.

No specific lesions are identified in the entire gastrointestinal tract.

Pancreas

The pancreas shows no gross or microscopic alteration of any significance.

The central venous congestion observed within sections of liver is a usual agonal event. No liver cell necrosis is observed and the liver is devoid of inflammatory disease. There is no demonstrable evidence of toxicity of any therapeutic agent in the material examined.

Urogenital System

The left kidney contains a solitary renal cortical adenoma and a renal cortical cyst. The adenoma is well circumscribed, small, and composed of benign renal tubular epithelial cells. Lesions of this type are extremely common findings in postmortem examination and are of no clinical significance. The solitary renal cortical cyst is of no clinical significance. The slight amount of compression atrophy of renal parenchyma adjacent to both the adenoma and the cyst is so minimal as to not compromise renal function.

There is no evidence of renal tubular necrosis morphologically demonstrable in right or left kidney. The minimal vacuolar change described in

some of the proximal tubular epithelium is a frequent finding associated with mannitol infusion. Such changes are reversible. There is no evidence of infection involving the renal pelves or calyces or parenchyma. The vascular congestion described is considered of agonal origin.

The slight amount of calcification around basement membrane around collecting tubules identified in the renal papillae is of obscure origin. Such calcification can be seen in individuals who ingest large amounts of milk, alkali, or vitamin D. It is of no clinical significance.

The mild edema, congestion, and slight acute and chronic inflammation of the bladder neck is consistent with the presence of an indwelling catheter. The changes are mild. No ulceration of bladder mucosa is recognized. The small collections of acute inflammatory cells within the prostatic periurethral glands are also consistent with the presence of an indwelling catheter. There is no evidence of hyperplasia of the prostatic gland. The small calcific spherules and corpora amylacea within the prostate are frequent normal findings.

The testicular tissue is completely within normal limits.

Endocrine System

The thyroid and pituitary glands show no gross or microscopic alteration.

The adrenal glands are small but within normal limits. The cortices are thin, have normal zonation, and show decreased lipid. The adrenals frequently show this pattern in healthy individuals dying acutely due to various causes. The Decadron therapy was of too short a course to have caused significant suppression and atrophy of the adrenal cortex.

NOTE: In the preparation of these opinions and conclusions, a number of diagrams, x-rays, and photographs, together with their descriptive notes, were utilized as work documents consistent with generally accepted medicolegal practice. In each instance, these items support the findings and conclusions contained herein. They are, however, not included as part of this report, pursuant to the provisions of Section 129 of the California Code of Civil Procedure.

SIGNATURES

(Signed)
Thomas T. Noguchi, M.D.
Chief Medical Examiner-Coroner

(Signed)
John E. Holloway, M.D.
Deputy Medical Examiner

(Signed)
Abraham T. Lu, M.D.
Deputy Medical Examiner

(Signed)
Victor J. Rosen, M.D.
Deputy Medical Examiner

(Signed)
Robert L. Scanlan, M.D.
Deputy Medical Examiner

AUTOPSY REPORT AND SUPPLEMENTAL REPORT

Date and Hour Died: 22 November 1963 1300 (CST).
Date and Hour Autopsy Performed: 22 November 1963 2000 (EST).
Prosector: (497831) Cdr. J. J. Humes, MC, USN; Assistant: (489878) Cdr. "J" Thornton Boswell, MC, USN; LCol. Pierre A. Finck, MC, USA (04 043 322).
Clinical Diagnoses (*Including operations*): Ht.—72½ inches; Wt.—170 pounds; Eyes—blue; Hair—Reddish brown.
Pathological Diagnoses: *CAUSE OF DEATH:* Gunshot wound, head.
Approved—Signature: J. J. Humes, Cdr. MC, USN.
Military Organization: President, United States.
Age: 46; Sex: Male; Race: Cauc.; Autopsy No.: A63-272.
Patient's Identification: Kennedy, John F.; Naval Medical School.

CLINICAL SUMMARY: According to available information the deceased, President John F. Kennedy, was riding in an open car in a motorcade during an official visit to Dallas, Texas, on 22 November 1963. The President was sitting in the right rear seat with Mrs. Kennedy seated on the same seat to his left. Sitting directly in front of the President was Governor John B. Connally of Texas and directly in front of Mrs. Kennedy sat Mrs. Connally. The vehicle was moving at a slow rate of speed down an incline into an underpass that leads to a freeway route to the Dallas Trade Mart where the President was to deliver an address.

Three shots were heard and the President fell forward bleeding from the head. (Governor Connally was seriously wounded by the same gunfire.) Ac-

cording to newspaper reports (*Washington Post*, November 23, 1963) Bob Jackson, a Dallas *Times Herald* Photographer, said he looked around as he heard the shots and saw a rifle barrel disappearing into a window on an upper floor of the nearby Texas School Book Depository Building.

Shortly following the wounding of the two men the car was driven to Parkland Hospital in Dallas. In the emergency room of that hospital the President was attended by Dr. Malcolm Perry. Telephone communication with Dr. Perry on November 23, 1963, develops the following information relative to the observations made by Dr. Perry and procedures performed there prior to death.

Dr. Perry noted the massive wound of the head and a second much smaller wound of the low anterior neck in approximately the midline. A tracheostomy was performed by extending the latter wound. At this point bloody air was noted bubbling from the wound and injury to the right lateral wall of the trachea was observed. Incisions were made in the upper anterior chest wall bilaterally to combat possible subcutaneous emphysema. Intravenous infusions of blood and saline were begun and oxygen was administered. Despite these measures cardiac arrest occurred and closed chest cardiac massage failed to reestablish cardiac action. The President was pronounced dead approximately thirty to forty minutes after receiving his wounds.

The remains were transported via the presidential plane to Washington, D.C., and subsequently to the Naval Medical School, National Naval Medical Center, Bethesda, Maryland for postmortem examination.

GENERAL DESCRIPTION OF BODY: The body is that of a muscular, well-developed and well-nourished adult Caucasian male measuring 72½ inches and weighing approximately 170 pounds. There is beginning rigor mortis, minimal dependent liver mortis of the dorsum, and early algor mortis. The hair is reddish brown and abundant, the eyes are blue, the right pupil measuring 8 mm in diameter, the left 4 mm. There is edema and ecchymosis of the inner canthus region of the left eyelid measuring approximately 1.5 cm in greatest diameter. There is edema and ecchymosis diffusely over the right supra-orbital ridge with abnormal mobility of the underlying bone. (The remainder of the scalp will be described with the skull.) There is clotted blood on the external ears but otherwise the ears, nares, and mouth are essentially unremarkable. The teeth are in excellent repair and there is some pallor of the oral mucous membrane.

Situated on the upper right posterior thorax just above the upper border of the scapula there is a 7 × 4 mm oval wound. This wound is measured to be 14 cm from the tip of the right acromion process and 14 cm below the tip of the right mastoid process.

Situated in the low anterior neck at approximately the level of the third and fourth tracheal rings is a 6.5 cm long transverse wound with widely gaping irregular edges. (The depth and character of these wounds will be further described below.)

Situated on the anterior chest wall in the nipple line are bilateral 2 cm long recent transverse surgical incisions into the subcutaneous tissue. The one on the left is situated 11 cm cephalad to the nipple and the one on the right 8 cm cephalad to the nipple. There is no hemorrhage or ecchymosis associated with these wounds. A similar clear wound measuring 2 cm in length is situated on the anterolateral aspect of the left midarm. Situated on the anterolateral aspect of each ankle is a recent 2 cm transverse incision into the subcutaneous tissue.

There is an old well-healed 8 cm McBurney abdominal incision. Over the lumbar spine in the midline is an old, well-healed 15 cm scar. Situated on the upper anterolateral aspect of the right thigh is an old, well-healed 8 cm scar.

MISSILE WOUNDS: 1. There is a large irregular defect of the scalp and skull on the right involving chiefly the parietal bone but extending somewhat into the temporal and occipital regions. In this region there is an actual absence of scalp and bone producing a defect which measures approximately 13 cm in greatest diameter.

From the irregular margins of the above scalp defect tears extend in stellate fashion into the more or less intact scalp as follows:

a. From the right inferior temporo-parietal margin anterior to the right ear to a point slightly above the tragus.

b. From the anterior parietal margin anteriorly on the forehead to approximately 4 cm above the right orbital ridge.

c. From the left margin of the main defect across the midlane anterolaterally for a distance of approximately 8 cm.

d. From the same starting point as c. 10 cm posterolaterally.

Situated in the posterior scalp approximately 2.5 cm laterally to the right and slightly above the external occipital protuberance is a lacerated wound measuring 15 x 6 mm. In the underlying bone is a corresponding wound through the skull which exhibits beveling of the margins of the bone when viewed from the inner aspect of the skull.

Clearly visible in the above described large skull defect and exuding from it is lacerated brain tissue which on close inspection proves to represent the major portion of the right cerebral hemisphere. At this point it is noted that the falx cerebri is extensively lacerated with disruption of the superior saggital sinus.

Upon reflecting the scalp multiple complete fracture lines are seen to radiate from both the large defect at the vertex and the smaller wound at the occiput. These vary greatly in length and direction, the longest measuring approximately 19 cm. These result in the production of numerous fragments which vary in size from a few millimeters to 10 cm in greatest diameter.

The complexity of these fractures and the fragments thus produced tax satisfactory verbal description and are better appreciated in photographs and roentgenograms which are prepared.

The brain is removed and preserved for further study following formalin fixation.

Received as separate specimens from Dallas, Texas are three fragments of skull bone which in aggregate roughly approximate the dimensions of the large defect described above. At one angle of the largest of these fragments is a portion of the perimeter of a roughly circular wound presumably of exit

which exhibits beveling of the outer aspect of the bone and is estimated to measure approximately 2.5 to 3.0 cm in diameter. Roentgenograms of this fragment reveal minute particles of metal in the bone at this margin. Roentgenograms of the skull reveal multiple minute metallic fragments along a line corresponding with a line joining the above described small occipital wound and the right supraorbital ridge. From the surface of the disrupted right cerebral cortex two small irregularly shaped fragments of metal are recovered. These measure 7 × 2 mm and 3 × 1 mm. These are placed in the custody of Agents Francis X. O'Neill, Jr., and James W. Sibert, of the Federal Bureau of Investigation, who executed a receipt therefor (attached).

2. The second wound presumably of entry is that described above in the upper right posterior thorax. Beneath the skin there is ecchymosis of subcutaneous tissue and musculature. The missile path through the fascia and musculature cannot be easily probed. The wound presumably of exit was that described by Dr. Malcolm Perry of Dallas in the low anterior cervical region. When observed by Dr. Perry the wound measured "a few millimeters in diameter"; however it was extended as a tracheostomy incision and thus its character is distorted at the time of autopsy. However, there is considerable ecchymosis of the strap muscles of the right side of the neck and of the fascia about the trachea adjacent to the line of the tracheostomy wound. The third point of reference in connecting these two wounds is in the apex (supraclavicular portion) of the right pleural cavity. In this region there is contusion of the parietal pleura and of the extreme apical portion of the right upper lobe of the lung. In both instances the diameter of contusion and ecchymosis at the point of maximal involvement measures 5 cm. Both the visceral and parietal pleura are intact overlying these areas of trauma.

INCISIONS: The scalp wounds are extended in the coronal plane to examine the cranial content and the customary (Y) shaped incision is used to examine the body cavities.

THORACIC CAVITY: The bony cage is unremarkable. The thoracic organs are in their normal positions and relationships and there is no increase in free pleural fluid. The above described area of contusion in the apical portion of the right pleural cavity is noted.

LUNGS: The lungs are of essentially similar appearance, the right weighing 320 g, the left 290 g. The lungs are well aerated with smooth glistening pleural surfaces and gray-pink color. A 5 cm-diameter area of purplish red discoloration and increased firmness to palpation is situated in the apical portion of the right upper lobe. This corresponds to the similar area described in the overlying parietal pleura. Incision in this region reveals recent hemorrhage into pulmonary parenchyma.

HEART: The pericardial cavity is smooth walled and contains approximately 10 cc of straw-colored fluid. The heart is of essentially normal external contour and weighs 350 g. The pulmonary artery is opened in situ and no abnormalities are noted. The cardiac chambers contain moderate amounts of postmortem clotted blood. There are no gross abnormalities of the leaflets of any of the cardiac valves. The following are the circumferences of the cardiac valves: aortic 7.5 cm, pulmonic 7 cm, tricuspid 12 cm, mitral 11 cm.

The myocardium is firm and reddish brown. The left ventricular myocardium averages 1.2 cm in thickness, the right ventricular myocardium 0.4 cm. The coronary arteries are dissected and are of normal distribution and smooth walled and elastic throughout.

ABDOMINAL CAVITY: The abdominal organs are in their normal positions and relationships and there is no increase in free peritoneal fluid. The vermiform appendix is surgically absent and there are a few adhesions joining the region of the cecum to the ventral abdominal wall at the above described old abdominal incisional scar.

SKELETAL SYSTEM: Aside from the above described skull wounds there are no significant gross skeletal abnormalities.

PHOTOGRAPHY: Black-and-white and color photographs depicting significant findings are exposed but not developed. These photographs were placed in the custody of Agent Roy H. Kellerman of the U.S. Secret Service, who executed a receipt therefor (attached).

ROENTGENOGRAMS: Roentgenograms are made of the entire body and of the separately submitted three fragments of skull bone. These are developed and were placed in the custody of Agent Roy H. Kellerman of the U.S. Secret Service, who executed a receipt therefor (attached).

SUMMARY: Based on the above observations it is our opinion that the deceased died as a result of two perforating gunshot wounds inflicted by high velocity projectiles fired by a person or persons unknown. The projectiles were fired from a point behind and somewhat above the level of the deceased. The observations and available information do not permit a satisfactory estimate as to the sequence of the two wounds.

The fatal missile entered the skull above and to the right of the external occipital protuberance. A portion of the projectile traversed the cranial cavity in a posterior-anterior direction (see lateral skull roentgenograms), depositing minute particles along its path. A portion of the projectile made its exit through the parietal bone on the right carrying with it portions of cerebrum, skull and scalp. The two wounds of the skull combined with the force of the missile produced extensive fragmentation of the skull, lacerations of the superior saggital sinus, and of the right cerebral hemisphere.

The other missile entered the right superior posterior thorax above the scapula and traversed the soft tissues of the supra-scapular and the supraclavicular portions of the base of the right side of the neck. This missile produced contusions of the right apical parietal pleura and of the apical portion of the right upper lobe of the lung. The missile contused the strap muscles of the right side of the neck, damaged the trachea, and made its exit through the anterior surface of the neck. As far as can be ascertained this missile struck no bony structures in its path through the body.

In addition, it is our opinion that the wound of the skull produced such extensive damage to the brain as to preclude the possibility of the deceased surviving this injury.

A supplementary report will be submitted following more detailed exam-

ination of the brain and of microscopic sections. However, it is not anticipated that these examinations will materially alter the findings.

(Signed)

J. J. HUMES	"J" THORNTON BOSWELL	PIERRE A. FINCK
CDR, MC, USN (497831)	CDR, MC, USN (489878)	LT COL, MC, USA (04-043-322)

SUPPLEMENTARY REPORT OF AUTOPSY NUMBER A63-272
PRESIDENT JOHN F. KENNEDY

GROSS DESCRIPTION OF BRAIN: Following formalin fixation the brain weighs 1,500 g. The right cerebral hemisphere is found to be markedly disrupted. There is a longitudinal laceration of the right hemisphere which is para-sagittal in position approximately 2.5 cm to the right of the midline which extends from the tip of the occipital lobe posteriorly to the tip of the frontal lobe anteriorly. The base of the laceration is situated approximately 4.5 cm below the vertex in the white matter. There is considerable loss of cortical substance above the base of the laceration, particularly in the parietal lobe. The margins of this laceration are at all points jagged and irregular, with additional lacerations extending in varying directions and for varying distances from the main laceration. In addition, there is a laceration of the corpus callosum extending from the genu to the tail. Exposed in this latter laceration are the interiors of the right lateral and third ventricles.

When viewed from the vertex the left cerebral hemisphere is intact. There is marked engorgement of meningeal blood vessels of the left temporal and frontal regions with considerable associated subarachnoid hemorrhage. The gyri and sulci over the left hemisphere are of essentially normal size and distribution. Those on the right are too fragmented and distorted for satisfactory description.

When viewed from the basilar aspect the disruption of the right cortex is again obvious. There is a longitudinal laceration of the mid-brain through the floor of the third ventricle just behind the optic chiasm and the mammillary bodies. This laceration partially communicates with an oblique 1.5 cm-tear through the left cerebral peduncle. There are irregular superficial lacerations over the basilar aspects of the left temporal and frontal lobes.

In the interest of preserving the specimen coronal sections are not made. The following sections are taken for microscopic examination:

a. From the margin of the laceration in the right parietal lobe.
b. From the margin of the laceration in the corpus callosum.
c. From the anterior portion of the laceration in the right frontal lobe.
d. From the contused left fronto-parietal cortex.
e. From the line of transection of the spinal cord.
f. From the right cerebellar cortex.
g. From the superficial laceration of the basilar aspect of the left temporal lobe.

During the course of this examination seven (7) black-and-white and six (6) color 4 x 5-inch negatives are exposed but not developed (the cameras containing these negatives have been delivered by hand to Rear Admiral George W. Burkley, MC, USN, White House Physician).

MICROSCOPIC EXAMINATION:

BRAIN: Multiple sections from representative areas as noted above are examined. All sections are essentially similar and show extensive disruption of brain tissue with associated hemorrhage. In none of the sections examined are there significant abnormalities other than those directly related to the recent trauma.

HEART: Sections show a moderate amount of subepicardial fat. The coronary arteries, myocardial fibers, and endocardium are unremarkable.

LUNGS: Sections through the grossly described area of contusion in the right upper lobe exhibit disruption of alveolar walls and recent hemorrhage into alveoli. Sections are otherwise essentially unremarkable.

LIVER: Sections show the normal hepatic architecture to be well preserved. The parenchymal cells exhibit markedly granular cytoplasm indicating high glycogen content which is characteristic of the "liver biopsy pattern" of sudden death.

SPLEEN: Sections show no significant abnormalities.

KIDNEYS: Sections show no significant abnormalities aside from dilatation and engorgement of blood vessels of all calibers.

SKIN WOUNDS: Sections through the wounds in the occipital and upper right posterior thoracic regions are essentially similar. In each there is loss of continuity of the epidermis with coagulation necrosis of the tissues at the wound margins. The scalp wound exhibits several small fragments of bone at its margins in the subcutaneous tissue.

FINAL SUMMARY: This supplementary report covers in more detail the extensive degree of cerebral trauma in this case. However, neither this portion of the examination nor the microscopic examination alter the previously submitted report or add significant details to the cause of death.

J. J. HUMES
CDR, MC, USN, 497831
6 December 1963

From: Commanding Officer, U.S. Naval Medical School
To: The White House Physician
Via: Commanding Officer, National Naval Medical Center
Subj: Supplementary report of Naval Medical School autopsy No. A63-272, John F. Kennedy; forwarding of
1. All copies of the above subject final supplementary report are forwarded herewith.

J. H. STOVER, JR.

• • • • •

6 December 1963

FIRST ENDORSEMENT
From: Commanding Officer, National Naval Medical Center
To: The White House Physician

C. B. GALLOWAY