

Letters to the Editor

Certification of Criminalists

Dear Sir:

On February 17, 1993, 64 forensic scientists evidencing a pioneering spirit sat for the first offering of the American Board of Criminalistics Examination in General Criminalistics. The exam was given at the 45th Annual Meeting of the American Academy of Forensic Sciences in Boston. One laboratory in the Northeast was represented by 65% of the staff (11 of 17), including the director. The laboratory director used the examination as a training opportunity to broaden his staff's forensic expertise. He involved staff members in preparing others for the exam by having them give mini-lectures from readings in the study guide. By the time this letter is published additional sittings will have taken place. The second offering is planned for the Spring meeting of the Southern Association of Forensic Scientists in Savannah, Georgia. Approximately 50 forensic scientists are expected for this sitting. Plans are being made to offer the examination for forensic laboratory systems in the near future. The third offering will take place at the Northeastern Association of Forensic Scientists meeting during October.

The process of exam development has been ongoing for three years. As a first step the five regional associations lending support to the certification effort established peer groups in five specialty areas. The five regional associations are the California Association of Criminalists, the Mid-Atlantic Association of Forensic Scientists, the Midwestern Association of Forensic Scientists, the Northeastern Association of Forensic Scientists, and the Southern Association of Forensic Scientists. The AAFS Criminalistics Section joined the process in February 1992. The five specialty areas chosen initially were drugs, serology, hairs and fibers, paints and polymers, and fire debris. The first task of the peer groups was to develop job descriptions for each area. These job descriptions were compiled and then sent to each of the peer groups for rating. Those that received high ratings were then used as the basis for developing subcategories known collectively as KSAs, an acronym derived from knowledge, skill, and abilities. The KSAs from each of the regions were also compiled and sent back to the regions for rating. Those receiving high ratings were retained as the basis for developing questions.

In addition to giving the general examination at several sites in 1993, the ABC Board, the Examination Committee, and Peer Group Chairs from the five active regional associations have been active in the specialty exam development process. This work is being supported in part by a grant from the National Institute of Justice. It is expected that the first offerings of specialty examinations will take place at the AAFS meeting in San Antonio in February of 1994. To this end the Educational Testing Service (ETS) conducted a training meeting dealing with test development and question writing in Forsyth Georgia in March.

Anyone wanting more information should write to:

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Identifying "Does" with Help of Dentures

Dear Sir:

Since 1983 the State of California has had a section in the Business and Professions Code (#1706) that reads that every complete upper and lower denture fabricated under the direction of a dentist shall be marked with the patient's name or social security number unless patient objects. We just recently had a case where this helped in identification.

A male who appeared to be in his mid sixties collapsed while seated in a restaurant. He was not seen to be choking. Though he was a frequent patron at the restaurant, no one knew his name. He was taken to a local hospital and pronounced dead.

Autopsy exam showed the decedent died of arteriosclerotic heart disease. Tattoos were present on both upper arms and the right forearm, and he had undergone an amputation of the distal phalanx of the left index finger. Full upper and lower dentures were present.

Mr. J. T. reminded us of the law and Dr. B. F. had the upper denture transilluminated revealing a name which had been marked in the denture. Using this name fingerprint comparisons were made with positive results in the FBI file.

The above case clearly demonstrates that denture marking is useful in identification and will be especially important with an aging population and increasing denture use.

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Invasive *Hemophilus Influenzae* Type B Disease

Dear Sir:

It was with great interest that I read the article by Tepper et al. in the January issue of the Journal of Forensic Sciences [1]. We recently performed an autopsy on a 53-year-old previously healthy white female who presented with a history of acute lower back pain of a few hours duration. Physical examination revealed decreased mental status with confusion and a petechial rash of the extremities. Nuchal rigidity was absent. Laboratory studies were remarkable for a platelet count of 64,000, prothrombin time of 18.4 s and a partial thromboplastin time of 48 s. Over the next 12 h the patient pursued a rapidly worsening course and died. Antemortem blood cultures subsequently grow B-lactamase of *H. influenzae* in 4/4 bottles.

Autopsy confirmed the presence of numerous petechiae on the extremities and trunk as well as the mucosal surfaces of the respiratory and gastrointestinal tract. Bilateral adrenal hemorrhages were present. No primary focus of infection was identified, although the autopsy was limited to chest and abdominal cavities.

The fulminant clinical course and postmortem findings are consistent with the Waterhouse-Friderichsen Syndrome (WFS). Scattered reports of WFS secondary to *H. influenzae* exist [2-4], however, the association is thought to be rare in both adults [3] and children [2]. The suggestion of latex agglutination testing for capsular wall antigens of *H. influenzae* seems to offer a simple method for diagnosis, however, unencapsulated

strains represent a significant proportion of adult disease [5] and may limit the usefulness of latex agglutination.

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The Distribution of Ethanol in Postmortem Blood Samples

Dear Sir:

The recent article by Briglia et al. [1] on the distribution of ethanol in postmortem blood specimens was a comprehensive and detailed study and the authors are to be commended for undertaking such a task. One of their observations (the concentration of salt (sodium fluoride) of the blood sample had no effect on the blood ethanol concentration) merits additional comment. Their method of analysis was direct injection gas chromatography (GC), which is not susceptible to salting out effects. On the other hand, Prouty and Anderson [2], found significant changes in blood ethanol concentration as a result of salt concentration, using a headspace GC method. Headspace GC is susceptible to changes in the ethanol concentration in the headspace due to the salt concentration of the blood unless specialized techniques are employed (for example, saturation of the blood sample with excess sodium chloride) [3-6].

I would add another caution to those expressed by Briglia et al. regarding the analysis and interpretation of ethanol concentration in postmortem blood. N-propanol is not the ideal internal standard for postmortem samples as it is a common putrefaction product in blood samples [7-14]. In fact, some authors suggest that n-propanol be used as a "marker" for postmortem production of ethanol and that the increase in postmortem ethanol concentration can be calculated from the n-propanol concentration [15,16]. Another internal standard such as t-butanol is preferable when analyzing a putrefied blood sample. The use of n-propanol in this study however would probably not affect the results as only samples without "significant compositional change" were chosen [1].

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Authors' Reply

Dear Sir:

The authors thank Mr. Wigmore for his important observations. These questions probably should have been addressed more clearly in the text of the article.

The experiment regarding the possible effects of salt(s) on blood alcohol concentrations (BAC) was performed only to demonstrate that, unlike headspace analyses, direct estimations of BAC are not altered measurably by variable amounts of salt(s) in the specimen.

We apologize to any reader who may infer that n-propanol is suggested as a preferred internal standard for BAC assays. It was used in this study simply as a matter of con-

venience and is not recommended for routine application because of the very problems described by Mr. Wigmore. It should be noted that any case that revealed even a minimal indication of decomposition and/or putrefaction was eliminated from inclusion into this study.

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Police and Their Sidearms

Dear Sir:

As a Forensic Scientist that specializes in firearms examination and as a Firearms Trainer, the importance of shot placement cannot be overstated. However, I must take issue with Dr. Wilber's comments on the kinetic energy deposit criteria he postulates on casualty production [1]. Quite simply put, the amount of kinetic energy that is "transferred" to the body is of little importance in the production of an incapacitating wound and the overall reaction of the person shot. What is of importance is the placement of the bullet and the specific deep body organs that are hit. Unless the CNS system is disrupted, the police officer has to count on correct bullet placement with a bullet that has sufficient penetration to reach those organs. This does not even begin to take into account the unpredictable psychological reaction to being shot.

It is the sectional density of the missile that is of importance, not the kinetic energy that it possesses. To select police ammunition solely on the basis of "Impact energy" shows a serious lack of understanding of wound ballistics. Proper bullet/caliber selection comes from an understanding of bullet design and the sectional density requirements that are needed to give an 12 to 14 inch penetration in human tissue with a sufficiently sized permanent cavity to promote blood flow. This bullet is then coupled with a reliable firearm and the proper training to give the officer the ability to use his/her weapon effectively.

Why the American soldier is incapacitated with only 58 ft./lbs. and the Soviet counterpart needs 175 ft./lbs. to produce the same casualty production, should illustrate the unimportance of energy transfer as a mechanism of wound production. Are we to believe that the Russian soldier is some three times as tough as the American? I think we should be more concerned with *where* and *what* the bullets hit and the psychological reaction to that wound, rather than a derivation of a speed/mass computation.

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Reference

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Police and Their Sidearms

Dear Sir:

Dr. Wilber's point regarding the importance of shot placement is well taken [1]. Dr. Wilber, however, in this letter, displays a lack of understanding of wound ballistics, modern police firearms training and the realities of armed confrontation.

The kinetic energy deposit criteria he presents is a misconceived measure of wounding capacity [2]. Selection of ammunition based simply on "Impact Energy" tables would certainly be easy but could result in death or injury to police officers.

As an active police reserve officer assigned to patrol duties (six years), it is my personal experience that an overwhelming majority, if not all, of today's police officers and firearms training units, at least in the Southern California area, are fully aware of the importance of shot placement and other tactical considerations and in fact devote considerable time to these issues in training and "in-service" schools. Dr. Wilber's implication that "the alleged criminal shows superior shot placement as against that of the police officer" is also misleading. If the data he has reviewed to reach this conclusion is factual, then I suggest a little more analysis may be necessary. Officers who are the target of gunfire are generally on the defense with the element of surprise on the side of the attacker (an issue also addressed by modern firearms training), and are generally disadvantaged by that fact. Number-crunching in a university laboratory may result in an inaccurate assessment of these shooting situations.

Firearms training in shot placement, as important as it is, is only part of the equation. The FBI, as well as many other police agencies, are rightfully in constant search of optimal equipment for their agents/officers based on sound testing and evaluations. To suggest that virtually any firearm-ammunition combination will suffice does a disservice to the law enforcement community.

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Police and Their Sidearms

Dear Sir:

While I agree with many of Dr. Wilber's conclusions on police fire fights, especially the need to increase shot placement skills, I believe his basic premise is incorrect [1]. Simple comparison of impact energy is insufficient to be the sole parameter for determining if police are out-gunned or not.

The term "under-gunned" has not been defined and has several possible and significant meanings. Are we discussing the number of rounds discharged before reloading, the rate at which they are discharged or the percentage of "one-shot stops" recorded for that caliber and bullet type? Bullet type is another factor ignored by the kinetic energy comparisons.

Marshall and Sanow [2] suggest that actual performance data as recovered from post

mortems should be used as the criteria. While this method has its drawbacks, actual data is more meaningful than bench calculations.

This is not a simple subject. Police armament is a constant source of discussion and debate. You can start a long conversation with just about any police officer, target shooter, or firearm collector by asking them what they think of this subject. I suspect that the best judge of this question is the officer who needs to carry the weapon.

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Author's Reply

Dear Sir:

The comments on my recent letter are appreciated [1]. The information about police killed by criminal fire came from FBI sources. There was no intent to denigrate the police. The point was that actual police "fire fights" in many instances happen unexpectedly, at close quarters, and under less than optimal firing-range conditions. Firearms training should emphasize close encounter, surprise, bad environmental conditions, shackle effect of gear, and the like. The formal NRA police firearms training program is valuable but must be supplemented by the "realistic" drill about which we all seem to agree. Routine requalification should include the "realistic" scenario challenge as well as simple target shooting.

Incapacitation Index

Wolberg's calling into question the incapacitation index of 58 ft-lbs used by the American military and others seems to neglect the idea that as a comparative value it has proven to be useful. The fact that the Soviets published 175 ft/lbs as their casualty criterion has no relevance to the validity of the American value. The Soviet inflated value is merely one more sign of the pathetic state of the biomedical sciences in general under the Communist rule.

Bellamy and co-workers [2] have published a trustworthy analysis of various methods for judging casualty generation measures, including the "Computer Man." Incapacitation can be brought about by different combinations of bullet mass and velocity; some values suggest that incapacitation (depending on its definition) under some conditions may require as high an impact energy as 117 ft-lbs. But they conclude that "the historical value of 58 foot-pounds for incapacitation may not be all that dubious" [2].

Kinetic Energy

I am at a loss as how to answer Wolberg's assertion: ". . . the amount of kinetic energy that is 'transferred' to the body is of little importance in the production of an incapacitating wound and the overall reaction of the person shot." Wounds are the result of work done on the body of the victim. Work requires the expenditure of energy, which is in our

American system conveniently expressed as foot-pounds. [1 ft-lb force = 0.1383 m-kg force.] Energy is simply defined as the capacity to do work. If less energy is released into a target body or organ, less work (wounding) can be done. The *rate* at which the energy is released per unit of bullet path may well modify the wounding. Rapid energy release over a short path will be more destructive than a slower release over the same path. Thus it is found that bullets which deform readily have a greater wounding capacity because of the rapid dumping of energy over a short bullet path.

Experimental Data

The United States National Institute of Justice sponsored rather exhaustive tests on the incapacitation effects of police handgun ammunition. (Nat. Inst. Just. 1983) One conclusion was clear from the data "In the range of calibers studied [.380 auto - .45 Long Colt] the most important property of a moving handgun bullet affecting its performance in the target medium is its striking velocity." The volume of the maximal temporary cavity (MTC) in the target depends on the total energy available.

In addition to impact velocity, the size and shape of the MTC and the effect of the MTC on the living body influences the overall incapacitation effect of a given cartridge. In the NIJ study, the comparative effectiveness of various handgun rounds was graded in terms of a factor, the Relative Incapacitation Index (RII).

A wide spectrum of bullet types was evaluated (lead hollow-point, LHP; semi-wadcutter, SWC; jacketed hollow-point, JHP; wadcutter, WC; jacketed soft point, JSP; lead round-nose, LRN; full metal jacket, FMJ). For all bullet types the RII increased as the velocity of the bullet increased.

The over-all conclusion of these tests was: "... for handguns in the 9 mm/38 caliber to 45 caliber range, a deforming projectile, driven at a velocity above minimum deformation velocity, and an RII between 10 and 30 is a reasonable goal for handgun ammunition for use against normally clad assailants in an urban environment." Table 1 summarizes what reported tests show for the effect of bullet velocity on RII.

Hundreds of rounds were fired to ascertain the facts of shooting error. The data indicate that accuracy of commercial ammunition "far exceeds shooter accuracy."

TABLE 1—Table showing the RII of several bullets as a function of velocity.

	Low	Higher
	S & W, 90 grains, JSP, 9 mm.	
Velocity, fps	800	1600
mps	250	455
RII	5	30
	Speer, 146 grain, JSP, 38 caliber.	
Velocity, fps	600	1300
mps	155	400
RII	5	48
	Hornady, 240 grain, JHP, 44 caliber.	
Velocity, fps	600	1200
mps	175	375
RII	5	50
	Speer, 250 grain, SWC, 45 caliber.	
Velocity, fps	600	1300
mps	175	400
RII	5	65

Velocity and Cavitation

Test data in our files support the view that the maximal diameter of the temporary cavity formed in a flesh simulant by a traversing bullet has a linear relationship with the velocity:

$$D = 0.013V - 0.7$$

where D is the maximal cavity diameter, V the bullet velocity in m/s, $r = 0.99$, r squared + 0.98.

Similar relationships have been reported years ago by Sellier [3]. The volume of the temporary cavity has been shown proportional to the energy delivered to tissues by the moving bullet:

$$V = K \times E_{ab}$$

The constant K for the temporary cavity is 0.8 milliliter/Joule [3].

The classic symposium on Wound Ballistics [4] is well worth reading in connection with these matters.

Further Tests

Among the tests that we have run in our laboratory to assist police departments in selecting .38 special cartridges for side-arms are those involving ammunition from Speer, Remington, Superval (reestablished), and Glaser Safety Slug. Our criterion for acceptance was volume of cavity formed by the test bullet fired into a flesh simulant. The Glaser slug produced cavities averaging 30 ml out to 8 feet range. Non-ballistic considerations made the round not acceptable. The second round of choice was the Speer 125 grain+P JSP. The average cavity size was 23 milliliters. Impact energy was 369 foot-pounds [5,6].

Sectional Density

Wolberg maintains that "it is the sectional density of the missile that is of importance, not the kinetic energy that it possesses." I suggest that the contention may be unfounded. The following text table may be informative:

Cartridge	Sectional Density and Bullet Potency		
	Sectional Density	MV fps	ME ft-lbs
.45 auto	.130-.168	855	405
.444 Marlin	.139	2400	3069
.223 Remington	.114-.128	3185	1239

(Based on data from Sierra Bullets) [7]

One would agree that the lower 2 cartridges are significantly more potent than is the .45 auto. The crucial difference is the impact energies of the respective missiles.

It is obvious to most persons familiar with firearms that "knockdown" or "incapacitation" effect is not the result of a push that physically moves the target body to any consequential extent. The factor responsible for stopping a belligerent is the outcome of the "expenditure of the bullet's kinetic energy on the functioning of the living body" [8]. Lesce, in a popular but dependable article for hand gunners maintains: "The traditional value of 50 ft/pounds for an incapacitating injury still stands, but in practice, all police handgun bullets develop several times this value [9].

Karl's letter recognizes that incapacitation by firearms is a complex question. Cartridges that deliver side arm bullets having the impact energies shown in my original letter will

TABLE 2—Performance of selected commercial handgun ammunition.

Caliber	Wt. grains	Type	Brand	Velocity	RII	
380	85	JHP	Winch.	986 fps	300 mps	13
9 mm	115	JHP	Remin.	1192	363	28
.357 mag	140	JHP	Speer	1221	372	42
.38 sp.	95	JHP + P	Rem.	1187	361	29
.38 sp.	110	JHP	SuperV	1159	353	25
.41 mag	210	JSP	Rem.	1260	384	52
.44 mag	200	JHP	Speer	1277	389	67
.45 auto	185	JHP	Winch.	989	301	26

be potent [1,2,5,6,9]. Bullet characteristics will obviously have an effect [2]. Other concerns such as revolver or self-loader, magazine or cylinder capacity, and the like are not directly related to ballistic considerations; they are part of the over-all orientation and training for the user officers.

Interpretation of post mortem observations of gunshot wounds must be performed with caution. Surgically treated gunshot wounds must be interpreted on the basis of the surgeon's clinical judgment. By the same token it is precarious to attempt to extrapolate backward (or conclude) from the clinically observed gunshot wound to the cartridge that caused it.

Summation

It is reasonable to conclude from the overall contemporary research in wound ballistics that:

- The more a bullet deforms or fragments in a body tissue, the more destructive the biological sequelae.
- Bullets moving at greater velocity inflict greater damage to body tissues than do matching bullets with lesser velocity (Table 2).
- Bullets that are more unstable in passing through body tissue are more destructive of tissues and organs.
- With our presently available basic information it is hazardous to speculate what distinct missile caused a wound in the human body, on the basis of depiction of the wound alone.

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