amination of the fetal tissues was raised. It was obviously impossible to get permission from the fetus. Furthermore, the samples were to be obtained from a department of pathology, to which they had been delivered as surgical specimens. (For hospital accreditation all surgical specimens must be sent to the pathology department for examination.) Because the operation permission form specifically asks patients for permission to dispose of any tissue removed in whatever fashion deemed appropriate by the staff, it was felt that appropriate permission had been granted. Since patient consent is not sought for other types of examination on surgical specimens—that is, what fixatives, kinds of microtomes, or types of stains are to be used—we saw no reason to ask specific questions about the details of our examination of the surgical specimens.

Fifth ethical question: Response to legal intervention. In contrast to the first four questions, the fifth did not arise from the experiment itself, but from a public accusation of unethical conduct in performing research (*2*). An investigation had been stimulated by the first of two articles (*3, 4*) in which we reported the results of the drug study. We and the pathologist who supplied the tissues were charged under an 1814 Massachusetts law entitled Violation of Sepulture (*5*), which was designed to prevent the robbing of graves to obtain cadavers for use in anatomy. After almost 4 years, the charge was eventually dismissed.

The ethical problems that arose from this legal action were serious: to what extent we should communicate with the press, who would provide financial support for the legal costs, how we should deal with the legislatures that were responding to pressures to limit fetal research.

The major question involved the investment of time and effort to try to prevent the near elimination of fetal research in the United States. What obligations do investigators have to speak out against such restrictive measures? We have not solved this ethical problem. One of us (A.P.) continued her investigations of antibiotic pharmacology during pregnancy, but in Sweden. The others elected to continue most of their scientific and medical work as it had been done before the case. But the question of how the scientific community should respond to investigations of this sort still remains. When we attempted to gain support for our case, the president of one of the largest clinical research organizations in the United States replied that people in medical research should not speak out too often lest they lose their credibility. Although a number of serious, accomplished senior investigators in science came forth to express their interest and to offer and lend their support, many of them either were friends or were very much involved in virology or problems directly related to the fetus and the newborn. Many other investigators, some of international reputation, were eager not to become involved. The apparent fear expressed by some who were approached was reminiscent of that during the McCarthy era.

It was postulated that the forces promoting the "investigation of possible crime related to fetal research" were related to the antiabortion movement. Although fetal research has little to do with the abortion issue, they became (in our case) intertwined. Investigations of the use of drugs in pregnancy and the implications of such research for fetal welfare are vital. Studies utilizing the pluripotentiality of fetal tissue can add much to medical knowledge and capabilities.

But such investigations cannot be performed without certain assurances. We consider that there are four major requirements for successful medical research: (i) the idea, or formulation of the research project; (ii) the technical expertise, effort, and persistence to follow through the details of the experiment; (iii) the administrative ability to gather the resources (for example, money, laboratory space, workers, and equipment); and (iv) the ability to present the results (sell or package the findings) (*6*). Under our current laws, item (iii) can be limited by restrictive legislation or utilization of legal and institutional pressures to prevent an unwanted line of investigation.

Summary and conclusion. To ethically use drugs during pregnancy, knowledge of their efficacy in that setting is required. A casual observation by A.P. led to the project in which these ethical problems were encountered. She was eventually able to study the problem of ampicillin pharmacology in 26 pregnant women and found that their peak serum levels were significantly lowered ($P < .001$) during pregnancy (*7*). Five specific components of this larger ethical problem have been discussed. Relatively easy, practical, rational solutions were found for the first four. A fifth ethical consideration arose—to what extent investigators "are their brothers' keepers." There is some obligation for scientists to communicate with the nonprofessional component of society; how it is to be done remains a problem. Part of the solution was perhaps summed up by the 18th-century German philosopher Immanuel Kant, who stated, in *The Fundamental Principle of the Metaphysic of Ethic*, that man should not be used as a means to an end but rather as an end in himself. Thus, in each of these ethical considerations it is clearly essential to consider that the subjects of such investigations, as well as the rest of society, must be considered as the end. To protect that end more knowledge is needed; it will never be gained by preventing its acquisition.

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5. The law stated: "Whoever, not being lawfully authorized by the proper authorities, willfully digs up, disinters, removes or conveys away a human body, or the remains thereof, or knowingly aids in such disinterment, removal or carrying away, and whoever is accessory thereto either before or after the fact, shall be punished by imprisonment in the state prison for not more than three years or in jail for not more than two and one-half years or by a fine of not more than two thousand dollars."
6. The concept of item (iv) was suggested by M. Laverdiere in 1977.
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17 April 1978; revised 26 July 1978

Cementum Annuli in Mammal Teeth from Archeological Sites

Bourque *et al.* describe a method for examining mammal teeth from archeological sites to determine seasonality (*1*). This method elaborates upon techniques used by wildlife biologists, in which teeth are sectioned and their cementum is examined for incremental layers. Bourque *et al.* claim that "recently Spiess reported a new technique for determining the season of death from archeological faunal remains" (*1*), and they describe the study of cementum annuli in archeological sites as "Spiess's method." As the method was in use by archeologists some years prior to Spiess's paper (*2*), this is clearly an er-

0036-8075/78/1103-0541$00.50/0

ror. Gustafson (*3*) described the application of tooth sectioning to an archeological fur-seal sample from Washington but was unable to give detailed results. Christensen (*4*) used the technique to determine seasonality in bison molars from archeological sites in Banff National Park, Alberta. In this case, the teeth "were mounted in liquid casting resin and sectioned longitudinally," as in the "new" technique of Bourque *et al.* Further development of the technique was interrupted by Christensen's untimely death. Although Christensen is an obscure reference, understandably missed, it is difficult to understand how Bourque *et al.* could have overlooked a detailed article by Kay (*5*) describing the study of cementum annuli in an archeological deer sample from Missouri. Kay thin-sectioned teeth after immersion in Buehler thin-section epoxide, a standard technique used by geologists for fragile rock samples. Bourque *et al.* reject thin-sectioning but only on the basis of the inapplicability of the wildlife biology technique, which involves prior decalcification. Kay showed that impregnation of teeth with epoxide makes possible rapid preparation of sections of excellent quality, with good contrast between layers. With this procedure it is possible to distinguish between split and false annuli, a difficult feat if one uses the ground surfaces of lower contrast produced in the method advocated by Bourque *et al.*, unless one has a great deal of experience.

Frison *et al.* (*6*) and Gilbert (*7*) have also called attention to the study of cementum annuli in archeological samples. In the former case, the attempt was abandoned because chemical alteration had disrupted the structure of the 6500-year-old bison tooth cementum, reducing the reliability of observations.

The epoxy encapsulation technique described by Bourque *et al.* has been widely used for some years by paleontologists in serial-sectioning studies of fossils, from horse teeth to brachipods. The impregnation technique described by Kay allows easy production of thin sections and is therefore more useful to archeologists. Thin sections of impregnated tooth cementum have an added advantage beyond the improvement in contrast for visual scanning. Thin sections can be used as "negatives" and can be mounted directly in photographic enlargers for the production of direct prints. Although the result is a negative instead of a positive image, it allows one to sidestep the use of elaborate photomicrography systems for comparable print quality. Light transmission through the section can also serve a valuable function in quantitative microdensitometric scanning, allowing added flexibility in the collection and portrayal of data.

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17 April 1978; revised 14 June 1978

We are aware that a small number of archeologists have experimented with tooth sectioning. However, this approach clearly has not been exploited by a large majority of archeological faunal analysts despite its great potential to that field and its routine use by wildlife biologists during the past two decades. We believe that the failure to use this technique derives from two factors. First, as the references cited by Wilson (*1*) indicate, the available archeological literature stresses the use of this technique to determine age among only a few species. Few sources indicate significant results, and fewer still consider the important seasonal implications of tooth sectioning. The notable exception to this pattern is Kay's work with deer (*2*), and we acknowledge our omission of this important reference.

Second, and perhaps more important, sectioning techniques commonly used by wildlife biologists are either too destructive of archeological specimens or lie beyond the technical reach of many faunal analysts. Our aim was to point out the utility of tooth sectioning to those interested in seasonality and to describe a conservative, low-technology sectioning technique feasible for most archeological laboratories. We do not, as Wilson states, "reject thin sectioning." On the contrary, we advocate both decalcified and solid thin-sectioning where appropriate, and we so stated in (*3*). However, we certainly disagree with Wilson's unqualified statement that solid thin sections are "more useful to archeologists." Preparation of such sections, according to Kay, requires vacuum ovens, lapidary saws, and motorized polishers. Yet, in many cases, simple polished sections provide equivalent data at a fraction of the cost. Furthermore, polished sections conserve roughly 50 percent of the specimen, permitting several repolishings or even thin-sectioning where initial results are equivocal. This is an important advantage where samples are small, as is often the case in temperate regions. Finally, most microscopes can easily be fitted with camera-mounting attachments, greatly facilitating photographic documentation.

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