dience. In this open public hearing, the tactics of infighting that are so effective in closed professional groups did not work very well. The old guard came off rather badly.

This was also a clash between scientists who had found evidence of serious hazards in their studies of humans exposed to nuclear or diagnostic radiation and scientists who denied these hazards on the basis of traditional theoretical calculations, animal studies, and the usual "put-downs" of human data. However, at this meeting the scientists who deal directly with human data and human problems were in no mood to give physical scientists pride of place. They argued that in public health issues it was human data that mattered. The concerned citizens in the audience clearly accepted this argument and rejected the claim of the old guard that it spoke "in the name of science." This seminar may well be the beginning of an increasingly bitter schism in the sciences.

In the past, the old guard has controlled the organizational machinery of science. They have often used this clout to block publication, honors, grants, and other benefits for public-interest scientists who have spoken out against radiation or other technologies pushed by Big Science. The struggle is no longer so one-sided because the public is fed up with being the guinea pigs for Big Science technologies. The scientists who have long opposed the abuses of technology are beginning to get the political clout to retaliate in kind. An all-out battle between the old guard and the new breed could bring back the good old days of the 1930's, when there was very little federal support for any science.

None of the house organs of Big Science have reported this important seminar, but any reader who would like to read the handwriting on the wall can get a transcript by writing to the House Environmental Study Conference, House Annex Building No. 2, Washington, D.C., Attention: Sarah Glazer. The moral is clear: If science does not support the public, the public will not support science.

IRWIN D. J. BROSS
109 Maynard Drive,
Eggertsville, New York 14226

Mass Vaccination: Probability of Three Sudden Deaths

Recent events dramatize how hard it is to gauge the risks and benefits of a large-scale vaccination program for a disease which may or may not become epidemic. Evidence of increased risk to Guillain-Barré syndrome has curbed the swine flu vaccination program. I shall focus on the other major event which discouraged early public acceptance of the program, namely, the three sudden deaths following swine flu inoculations in Pittsburgh.

Philip M. Boffey's article (News and Comment, 5 Nov. 1976, p. 590) gives many interesting medical details pertinent to deciding whether the three deaths following swine flu vaccination in Pittsburgh were coincidental. Probabilistic arguments show that, although the chances of three or more deaths in any one clinic on a single day are minute, the chance that some clinic would experience three or more deaths on some day during the first week of the inoculation program is appreciable and could easily be as high as 10 percent, even if the vaccine is perfectly safe. This line of reasoning is pertinent, since if any clinic experienced three or more deaths on some day early in the vaccination program, it is likely that this event would come to public attention and adversely affect public acceptance of the program.

Suppose n_{ij} patients with the average death rate α_{ij} visit clinic i on day j of the program. Then the expected number of deaths for that clinic and day is $\lambda_{ij} = n_{ij}\alpha_{ij}$, and the probability of two or fewer deaths, p_{ij}, is, from the Poisson probability law

$$p_{ij} = (1 + \lambda_{ij} + \lambda^2_{ij}/2)\exp(-\lambda_{ij})$$

assuming that each individual has a small, statistically independent chance of dying each day. The probability that all clinics experience two or fewer deaths on all seven days of the initial week of inoculations is the product

$$\prod_{j=1}^{7} \prod_{i=1}^{m} p_{ij}$$

where m is the total numbers of clinics, and the probability that some clinic experiences three or more deaths on some day during this week is 1 minus this product.

To use these formulas we must know the numbers of people who visit each clinic each day and their average death rate. Suppose $m = 100$ clinics each care for $n_{ij} = 1000$ people each day, and that the average death rate is $\alpha_{ij} = 10$ deaths per 100,000 patients per day. This is approximately the death rate for all U.S. people aged 65 to 75 (*1*). The probability of fewer than three deaths in one such clinic is

$$(1 + 0.1 + 0.005)\exp(-0.1) = 0.99985 = p_{ij}$$

and the probability of three or more deaths in one such clinic on a given day is only $1 - p_{ij} = 0.00015$. However, the probability of three or more deaths on some day in some clinic during the first week is

$$1 - \prod_{j=1}^{7} \prod_{i=1}^{100} p_{ij} = 1 - (0.99985)^{700} = 0.103$$

Thus, the chance of three or more deaths in a single clinic on a single day are remote (about 1 in 10,000). Therefore, each such episode should be carefully investigated to rule out avoidable accidents. On the other hand, these calculations show that the probability that some clinic would have three or more deaths on some day during the first week could easily approach 10 percent, even if vaccination has no effect on mortality. If some of the victims saw others collapse, as is suggested in Boffey's article, the chances of having three or more deaths in some clinic are probably enhanced.

Of course the preceding calculations are hypothetical, as the numbers of patients seen at each clinic and corresponding average death rates were not used. The main uncertainty in estimating average death rates is that those who go to clinics for vaccination may be appreciably healthier than the general U.S. population, since very ill patients are unlikely to be vaccinated. However, because the vaccination program enlisted sick and elderly patients, one can only speculate what average death rate is appropriate. The following table gives the probability of three or more deaths in some clinic on some day during the first week assuming $n_{ij} = 1000$ and various numbers of clinics and average death rates, α_{ij} (deaths per 10^5 people per day).

		Clinics (m) 50	100	300
α_{ij}	15	.16	.30	.65
	10	.05	.10	.28
	5	.01	.01	.04
	2	.00	.00	.00

Clearly the death rate is a dominant variable. For this reason it seems worthwhile to conduct special studies during several vaccination programs to determine age-specific death rates for those who actually come to clinics for vaccinations. In this way one could obtain more reliable estimates of the expected numbers of deaths and the probability of observing three or more deaths in some clinic, assuming vaccination is entirely safe.

MITCHELL GAIL
Biometry Branch, National Cancer Institute, Bethesda, Maryland 20014

References

1. *U.S. Life Tables: 1969–71* [Department of Health, Education, and Welfare Publ. No. (HRA) 75-1150, National Center for Health Statistics, Rockville, Md., 1975)], vol. 1, No. 1, p. 7.

Alleviating Confusion

In the recent Research News article "Sexual dimorphism and mating systems: How did they evolve?" (28 Jan., p. 382), some work on sexual dimorphism in bats is described. This research is wrongly credited to Philip Meyers at the University of Michigan; his interest in sexual dimorphism is limited to *Homo sapiens*. The person to whom credit belongs is Philip Myers of the University of Michigan. We hope this letter alleviates confusion.

PHILIP A. MEYERS
Department of Atmospheric and Oceanic Science, Universty of Michigan, Ann Arbor 48109
PHILIP MYERS
Museum of Zoology, University of Michigan