MIRVing. Let N_i represent the number of missiles in the ith launch regardless of the side responsible. Let M_i be the MIRV factor associated with the ith launch, that is, the number of reentry bodies per missile, and let P be the single-kill probability of a reentry body. (I assume it is the same for all launches.) Then a policy of launching only threatened missiles for all launches after the first can be stated as

$$N_{i+1} = M_i N_i P \qquad (1)$$

I have made three simplifying assumptions by ignoring that: (i) The number of missiles launched is limited by the number remaining to the side in question. (ii) After the first two launches and if missiles cannot be retargeted, some reentry bodies will be aimed at empty silos and hence will not evoke a subsequent launch. (iii) Multiple reentry bodies may be targeted for the same silo on a single launch.

The corresponding effects of these assumptions on the model and the results relating to escalation are: (i) No effect. (ii) Overstates the rate of escalation for larger values of i. (iii) Understates the rate of escalation for large values of N_i. Since escalation implies that N_i gets larger as i increases, the effects of the assumptions will partially cancel.

Equation 1 also assumes perfect information. To restate Eq. 1 for imperfect information, let Q_i be the perceived quality of information regarding the ith launch ($0 \leq Q_i \leq 1$). Then,

$$N_{i+1} = \frac{1}{Q_i} M_i N_i P \qquad (1')$$

Escalation is simply the condition that

$$N_{i+1} > N_i \text{ for all } i \qquad (2)$$

From Eqs. 1′ and 2, it can be concluded that escalation will occur if

$$1 < \frac{1}{Q_i} M_i P$$

$$P > \frac{Q_i}{M_i} \qquad (3)$$

I have no knowledge of actual values of P, but Gustavson suggests that values are fairly high and uses .8 in his example. In any case, as long as $P > .5$ escalation will occur in any MIRV system because $M_i \geq 2$ for all i. Since the perceived quality of information is likely to decrease during a battle, it is more likely for Eq. 3 to hold for larger values of i.

It is disturbing that the MIRV factors, M_i, have an inverse effect on the escalation threshold (Eq. 3). Only in a non-MIRV system ($M_i = 1$) is it theoretically possible to increase the threshold to 1 (thereby eliminating the possibility of escalation) by increasing the perceived quality of information, Q_i.

ROB GERRITSEN

Department of Decision Sciences, Wharton School, University of Pennsylvania, Philadelphia 19174

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5 December 1975; revised 24 May 1976

Gerritsen's conclusions (*1*) are founded on my "extreme example," which was intentionally and carefully provided with the warning: "This illustration is meant to be heuristic only. It assumes an extreme and simplified situation which is much less complex than that likely to occur."

Gerritsen also has introduced an assumption that entirely changes the character of this extreme example. In my article, having examined a case in which A strikes and B simply suffers attrition, I postulated a special innovation in giving B, the side attacked, the capability to discern which of its missiles was threatened and also the ability to launch these missiles quickly enough to avoid their destruction. The example served to illustrate the potentially profound impact of one side having introduced such an innovation in its posture. Gerritsen changes this example in a very significant way by attributing this same innovation in capability to side A. However, if both sides have such a capability and particularly if both sides also realize this in advance, then A's use of one-quarter of its forces in a countermissile, disarming strike is quite unreasonable. Analysis readily demonstrates that such a decision would, in fact, be far from A's optimum strategy for what is now a minimax type situation.

Finally, my heuristic example included, for the sake of simplicity, only a very few of the innovations suggested in the article. All or many of these innovations may be implemented at the same time and at varying performance levels in future force postures. A fully adequate analytic procedure would accommodate quantitative measures of performance for all of the suggested innovations. Such a comprehensive treatment would provide a foundation on which predictions could be more confidently based.

I feel that, as Gerritsen suggests, the perceived quality of information will play an important role. It would, in fact, be desirable if one were able to include explicitly all of the aspects of the "information war" identified by Rona (*2*). Precisely defining the components out of which this quality of information function is composited and incorporating this function into a comprehensive analytic scheme would be a major achievement. It is one of the numerous outstanding challenges facing the technologist in coping with the evolution of strategic arms.

M. R. GUSTAVSON

Lawrence Livermore Laboratory, University of California, Livermore 94550

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27 July 1976

Breast Lobules

Jensen *et al.* (*1*) report a continuum of atypical lobules through carcinoma in human breasts in patients with associated malignant disease of ipsilateral or contralateral breast. Unfortunately, their report provides no evidence to substantiate their claims. The histologic pictures labeled figure 4 and figure 5 represent papillary intraductal carcinoma and not atypia. This is a well-known neoplasm which, according to McDivitt *et al.* (*2*, p. 46), "is least frequently recognized by those sending us slides in consultation."

Furthermore, the terminology of Jensen *et al.* serves to confuse a relatively recently clarified concept. Lobular carcinoma of the breast is a well-defined entity and differs considerably, both in appearance and prognostic implications, from intraductal carcinoma. Whether or not so-called intraductal carcinoma originates from breast lobules appears to be irrelevant. Finally, papillary hyperplasia with cytologic atypia is a term that was once used to describe what we now recognize as papillary carcinoma; thus it is not at all surprising that this lesion is "more frequent in cancerous breasts."

R. PETER ROSIER

Post Office Box 1625, Fort Myers, Florida 33902

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22 January 1976

In our report a severely atypical lesion, bordering on ductal carcinoma in situ (*1*, figures 4 and 5), demonstrated lobular microarchitecture when viewed in its three-dimensional entirety (figure 3). This lesion was selected to illustrate that lesions precancerous to ductal carcinoma arise in the lobule and not in bigger ducts, as commonly believed. No doubt many pathologists would diagnose the illustrated lesion as ductal carcinoma in situ; however, when myoepithelial cells persist, we call the lesion severely atypical.

Only 154 of the 2612 atypical lesions reported (*1*, figure 1) showed the severe atypia depicted in the illustrations. About 95 percent of the statistical data we presented refer to lesions displaying mild and moderate atypia; these lesions have been described and classified, and they were given the names, atypical lobules, type A, grade 1, 2, and 3 (*2*). Therefore, our report cannot be construed as being confined to lesions that are carcinoma in situ as suggested by Rosier (*3*).

We do not intend to challenge facts allowing pathologists to differentiate between lobular and ductal carcinoma by their microscopic characteristics. These two entities of breast disease obtained their names from the way they look in the light microscope in the fully evolved in situ stages in which lobular carcinoma looks "lobular" and ductal carcinoma looks "ductal." However, ductal carcinoma looks ductal because the lobule in which it arose unfolded and became a sphere as the cancer grew. Such a sphere when cut and studied under the light microscope looks like a bigger duct.

The site of origin of ductal carcinoma is important since its precancerous stages undoubtedly would have a similar location. Identification and isolation of potentially precancerous lesions to ductal carcinoma make it possible to study their biological behavior as transplants in animal hosts (*4*). Elucidation of factors that can induce regression of precancerous lesions would appear extremely important especially if they had clinical application. Thus detection of precancer in the living woman and nonsurgical reversion of the disease at a precancerous stage associated with little morbidity would be an ultimate goal.

In summary, our purpose is not to challenge currently useful terminology or concepts of the surgical pathologist, but to broaden our knowledge of the precancerous stage of ductal carcinoma of the human breast.

H. M. JENSEN
Department of Pathology,
School of Medicine,
University of California, Davis 95616
J. D. RICE
Department of Biomedical Engineering,
Sutter Memorial Hospital,
Sacramento, California 95819
S. R. WELLINGS
Department of Pathology,
School of Medicine,
University of California, Davis 95616

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1 June 1976; revised 3 August 1976

Erythrocyte Sedimentation Rates and Malignancy: Role of Age and Erythrocyte Aggregation

Riley's suggestion (*1*) that "ESR [erythrocyte sedimentation rate] enhancement occurs in association with malignancy but not in analogous benign conditions" fails to recognize the effect of age variations on the observed data. Gilbertsen (*2*) reported increasing ESR with age in a group of more than 4000 patients at the University of Minnesota Cancer Detection Center. Ninety percent of ESR values in females 45 to 49 years old were under 39 mm/hour, while the 90 percent range extended to 53 mm/hour in women 70 to 79 years old.

The incidence of breast cancer rises dramatically with age, as observed in the Third National Cancer Survey (*3*). Figures for the Minneapolis–St. Paul metropolitan area (*3*) show average annualized rates per 100,000 females of all races of 75.2 in women 35 to 44 years old, 233 in those 55 to 64 years old, and 380 in those 75 to 84 years old.

Data from my laboratory (*4*) on 660 consecutive breast biopsies showed malignancy rates of 6 percent in women less than 40 years old, 22 percent in women between 40 and 59 years old, and 45 percent in those more than 60 years old. The reciprocal figures represent percentage of benign lesions decreasing with age.

The bimodal distribution of ESR observed by Riley in the breast cancer patients may, as he suggested, correlate with age (before or after menopause). Such bimodal distributions of breast cancer with age have been observed in the Netherlands (*5*).

W. A. FOLEY
Abbott-Northwestern Hospital Corporation,
Minneapolis, Minnesota 55403

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29 January 1976

Riley (*1*) concludes that clues for rational approaches to cancer therapy and diagnosis might be identified if the relationship of enhanced erythrocyte sedimentation rate (ESR) to neoplasia can be clarified. We believe that literature dealing with erythrocyte and particle aggregation may contribute to the clarification in that it points out that rapid settling rates reflect a close-packed system of cells or particles (*2*, *3*).

Riley's observation that neither viscosity nor rouleaux effects will account for increased ESR among patients with malignant disease is confirmed by our research. Further, our study of 565 samples of blood drawn from male patients undergoing routine physical examination disclosed an essentially trimodal as opposed to bimodal distribution of ESR's. This study raised the question of the desirability of measuring ESR's both on the basis of 24-hour and 1 hour observations (*2*).

In suspension systems, sedimentation of suspended particles, be they red cells, platelets, or nonbiological particles, can be accounted for by the state of their dispersion or aggregation present at the time the sedimentation rate is measured (*2*). On the matter of dispersion and aggregation, the International Union of Pure and Applied Chemistry (*4*) recognizes the following states: (i) dispersed, in which each cell or particle settles as an independent unit; (ii) coagulated, an aggregated state in which the cells or particles are in surface contact with each other and settle as compact units; and (iii) flocculated, in which cells settle as part of a network-aggregated system consisting of particles linked by bridging molecules.

Our observations of the settling properties of suspensions in these states indicate that coagulated aggregates sediment most rapidly, flocculated systems