Commentary and update: Serological tests for diagnosis of systemic lupus erythematosus (SLE)"
on each patient. Sensitivities and specificities are shown in the Table.

Results

Predictive values\textsuperscript{12} for positive and negative results of each of the four tests are shown in Figures 1 and 2, respectively. The predictive value of a positive test is the prevalence of SLE among all patients with a positive test result; the tests with the highest positive predictive values were anti-nDNA and anti-Sm. The predictive value of a negative test result is the prevalence of non-SLE among all patients with a negative test result; the test with the highest negative predictive value was ANA.

Test efficiency\textsuperscript{12} is defined as the prevalence of true-positive and true-negative results among all the tests performed. It measures the correlation of test results with clinical situation (sum of SLE patients with positive test and non-SLE patients with negative test divided by total number of tests done). Efficiency for tests examined is shown in Figure 3; the most efficient test was the LE cell preparation.

Quantitative correlations were drawn for ANA titer and degree of positivity of LE preparation with prevalence of SLE as well as with certain other non-SLE diagnoses (Figs. 4 and 5, respectively). In both tests the prevalence of SLE increased as degree of test positivity increased, although this relationship was clearer for LE cell preparation.

Discussion

We examined the results of four tests (LE cell preparation, ANA, anti-nDNA, and anti-Sm) in 675 patients, 102 of whom were selected because they were diagnosed on clinical grounds as having SLE; the remainder were selected from laboratory records of the four tests. The results permit calculation of sensitivity and specificity figures (Table), of predictive values of positive and negative results (Figs. 1 and 2), and of test efficiency (Fig. 3) for each test. These figures show how strongly a positive or negative test result standing alone, without other data, indicates a diagnosis of SLE. The specificity figures in the Table are probably conservative (underestimate specificity) since the results are biased by the fact that the test was ordered in the first place; non-SLE patients on whom ANA was or-

<table>
<thead>
<tr>
<th>Test</th>
<th>Sensitivity</th>
<th>Specificity</th>
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<tbody>
<tr>
<td>LE Prep</td>
<td>.704</td>
<td>.946</td>
</tr>
<tr>
<td>ANA</td>
<td>.990</td>
<td>.690</td>
</tr>
<tr>
<td>Anti-nDNA</td>
<td>.569</td>
<td>.993</td>
</tr>
<tr>
<td>Anti-Sm</td>
<td>.220</td>
<td>.999</td>
</tr>
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ANA = antinuclear antibodies.
high. The LE cell prep was intermediate in specificity and sensitivity, but as a single test had the greatest efficiency.

It is clear, however, that these test results are never considered in a vacuum. The tests are ordered because of suspicion based on clinical grounds that they may be positive, and the result obtained exerts either a positive or negative effect on the clinician’s estimation of the likelihood that the patient has lupus. This clinical estimation of likelihood can be quantitated with a scoring system based on the American Rheumatism Association (ARA) criteria for the classification of SLE, according to the sensitivity and specificity of the criteria for diagnosis of SLE as we have previously reported. This allows establishment of pretest probability of SLE in a given patient. If this probability is low, a positive outcome of a test with a high positive predictive value (e.g., anti-nDNA, anti-Sm) would have the most profound effect on the diagnostic likelihood. On the other hand, for a patient with a high pretest probability of SLE, the greatest effect on probability would be exerted by a negative outcome of a test with a high negative predictive value (e.g., ANA). Because of its nonspecificity, a positive ANA exerts little effect on the likelihood of SLE, and, because of relatively low sensitivity, negative anti-DNA and anti-Sm results do not greatly influence the likelihood of SLE. Thus, as often happens in mild or inactive SLE, the combination of positive ANA, negative anti-nDNA, and negative anti-Sm is not especially helpful. If this
combination of results occurs in an individual for whom the pretest probability of SLE is low (e.g., a patient with fibrositis), the clinician is simply faced with the unpleasant task of explaining a positive ANA to someone in whom SLE was not strongly suspected initially. This realization might affect the decision to order ANA in this setting.

However, anti-nDNA and possibly anti-Sm have values in addition to their importance in diagnosis. Anti-nDNA levels correlate well with activity of SLE and, indeed, anti-nDNA is thought to be an important pathogenic antibody in SLE, particularly with glomerulonephritis. Furthermore, the combination of positive anti-nDNA and positive anti-Sm has in our experience been associated with a more severe form of lupus in which diffuse, proliferative glomerulonephritis is common (occurring in 73% of such patients) as opposed to patients in whom these antibodies are not found together, where severe renal disease is considerably less common (23%, p < 0.001). Thus, adequate monitoring of disease activity requires serial determinations of anti-nDNA along with certain other tests (complement, creatinine, urinalysis, blood count), and determinations of anti-nDNA and anti-Sm may be helpful in estimating prognosis.

References