*E. coli* could not recognize the pili of any of the non-O1 *V. cholerae* suggests that there is no immunologic cross-reactivity between the pili of enterotoxigenic *E. coli* and those of *V. cholerae* non-O1.

This report clearly demonstrated the production of pili that were immunologically different from the pili (CFAs) of enterotoxigenic *E. coli* by some non-O1 strains of *V. cholerae*. Because pili of enterotoxigenic *E. coli* serve as colonization factors, by analogy we postulate that the pili of non-O1 *V. cholerae* may also play a role as colonization factors. This interesting possibility requires further study. It is also important to analyze the relationship between the pili of *V. cholerae* O1 reported by others [5, 9, 10] and those of *V. cholerae* non-O1 reported here.

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**References**

1. Morris JG Jr, Black RE. Cholera and other vibrioses in the United States. N Engl J Med 1985;**312**:343-50
2. Yamamoto K, Takeda Y, Miwatani T, Craig JP. Evidence that a non-O1 *Vibrio cholerae* produces enterotoxin that is similar but not identical to cholera enterotoxin. Infect Immun 1983;**41**:896-901
3. Honda T, Arita M, Takeda T, Yoh M, Miwatani T. Non-O1 *Vibrio cholerae* produces two newly identified toxins related to *Vibrio parahaemolyticus* haemolysin and *Escherichia coli* heat-stable enterotoxin. Lancet 1985;**2**:163-4
4. Gaastra W, de Graaf FK. Host-specific fimbrial adhesins of noninvasive enterotoxigenic *Escherichia coli* strains. Microbiol Rev 1982;**46**:129-61
5. Faris A, Lindahl M, Wadstrom T. High surface hydrophobicity of hemagglutinating *Vibrio cholerae* and other vibrios. Current Microbiology 1982;**7**:357-62
6. Honda T, Arita M, Miwatani T. Characterization of new hydrophobic pili of human enterotoxigenic *Escherichia coli*: a possible new colonization factor. Infect Immun 1984;**43**:959-65
7. Honda T, Khan MMA, Takeda Y, Miwatani T. Grouping of enterotoxigenic *Escherichia coli* by hydrophobicity and its relation to hemagglutination and enterotoxin productions. FEMS Microbiol Lett 1983;**17**:273-6
8. Miwatani T, Honda T. Colonization factors of human enterotoxigenic *Escherichia coli*. Bifidobacteria Microflora 1986;**5**:57-65
9. Ehara M, Ishibashi M, Watanabe S, Iwanaga M, Shimodori S, Naito T. Fimbriae of *Vibrio cholerae* O1: observation of fimbriae on the organisms adherent to the intestinal epithelium and development of a new medium to enhance fimbriae production. Tropical Medicine 1986;**28**:21-33
10. Tweedy JM, Park RWA, Hodgkiss W. Evidence for the presence of fimbriae (pili) on *Vibrio* species. J Gen Microbiol 1968;**51**:235-44



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## Immunoperoxidase Slide Test For Detecting Antibodies to *Borrelia burgdorferi*

COLLEAGUES—*Borrelia burgdorferi* has recently been established as the causative agent of Lyme disease [1, 2]. Determining circulating antibodies to *B. burgdorferi* followed by demonstrating the agent by culture or by histology has given evidence for the etiology of some dermatoses that were clinically defined long ago (erythema chronicum migrans, lymphadenosis benigna cutis, acrodermatitis chronica atrophicans). A causative role for *B. burgdorferi* is discussed for other disease entities [3]. So far, circulating antibodies to *B. burgdorferi* have been determined by immunofluorescence tests (IFT) and ELISA. Both methods require special technical equipment (fluorescence microscope, photometer) and experience in evaluating the results.

We developed an immunoperoxidase slide test (IPT) that is easily performed and read with a simple light microscope. The binding of specific IgG antibodies to smears of *B. burgdorferi* (strain B31) fixed on slides by acetone is visualized by subsequent incubation with peroxidase-conjugated antibody to human IgG followed by incubation with a chromogenic substrate. This method was com-

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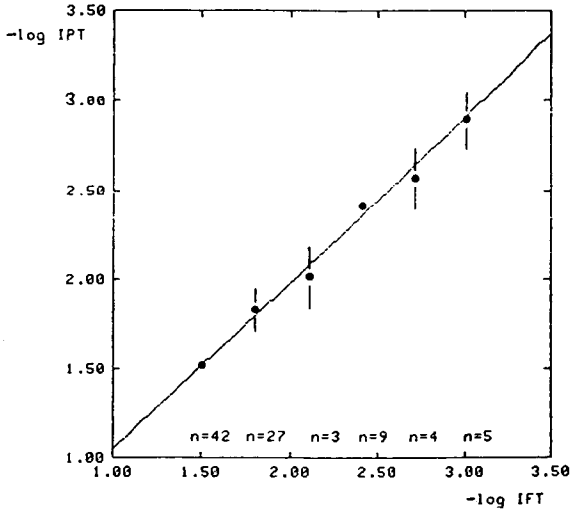


**Figure 1.** Correlation of titers of IgG antibody to *B. burgdorferi* in IPT and IFT. ●, − log of the mean titer for the no. of determinations indicated on figure; *Bars* represent ± 2 SD ($n$ = 90, $r$ = .9805, $P < .001$; 1.51 = −log 1:32, 1.81 = −log 1:64, 2.11 = −log 1:128, 2.41 = −log 1:256, 2.71 = −log 1:512, 3.01 = −log 1:1024).

pared with IFT by using both methods to test sera from 90 patients. Antibody titers obtained by using the two tests showed excellent correspondence (figure 1), with a correlation index ($r$) of .9805 ($P < .001$). In view of these almost identical results, the IPT looks promising as a simple screening assay suitable for every serological laboratory.

We have recently compared the titers of IgG and IgM antibodies to *B. burgdorferi* obtained by using IPT with those obtained by using ELISA and IFT [4].

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**References**

1. Burgdorfer W, Barbour AG, Hayes SF, Benach JL, Grunwaldt E, Davis JP. Lyme disease—a tick-borne spirochetosis? Science 1982;**216**: 1317–9
2. Barbour AG, Burgdorfer W, Grunwaldt E, Steere AC. Antibodies of patients with Lyme disease to components of the *Ixodes dammini* spirochete. J Clin Invest 1983;**72**:504–15
3. Rufli T, Lehner S, Aeschlimann A, Chamot E, Gigon F, Jeanneret J-P. Zum erweiterten spektrum zeckenübertragener spirochätosen. Hautarzt 1986;**37**:597–602
4. Schmidli J, Gerber H, Hunziker T, Aeschlimann A, Gern Lise, Kundi M, Stanek G. Immunoperoxidase slide test for the detection of antibodies against *Borrelia burgdorferi* in comparison to immunofluorescence test and ELISA. Zentralbl Bakteriol Mikrobiol Hyg [A] 1987 (in press)