anatomic dimensions were being indexed. Peters *et al.* had subjects sitting, and a slight degree of pressure may have been placed on the feet. Yanowitz *et al.* do not specify whether subjects were lying down, sitting, or standing.

In our study, except for the few subjects with extreme asymmetries between feet, detected when they were seated, foot size was measured with subjects standing. With full body weight placed on the feet, there could be differential flattening and lengthening of the two feet, either due to varying flexibilities of the feet or to a biased posture that placed more weight on one foot than the other. Although we attempted to have subjects stand with equal weight on the two feet, this could only have been assured by direct measurement of muscle tension in the two legs. It is conceivable, in other words, that our measurements, and to some extent those of Peters *et al.*, were picking up dynamic aspects of foot flexibility, postural biases, or both. If so, our observations would imply that among right-handers, the left foot of women and the right foot of men flattens and lengthens more when supporting body weight, either because of biased posture or because of asymmetries of reaction to weight.

Only 16 of our 150 subjects were assessed in the seated position, and 12 of these were right-handed females, of whom 11 had larger left feet. This subgroup of 12, however, had asymmetries of a half shoe size or more and, thus, are not representative of the population.

Clearly, more research will be needed to resolve the discrepancies among studies and to gain an understanding of the relationships between static anatomical dimensions and dynamic dimensions of foot asymmetry reflecting either different reactions of the two feet to weight or postural biases in subjects. Experienced shoe salesmen generally test fit of shoes with customers standing, and it would be of interest to determine whether standard anthropometric measurements of the feet conform or not to the subjective impressions of shoe salesmen and their customers of relative tightness of shoes on the left and right feet. Peters *et al.* report that differences in foot length for individual subjects were often close to or less than 1.5 mm, a difference so small that it seems a priori unlikely that a person would notice any difference in tightness of fit of shoes, yet in the experience of J.M.L., a substantial number of customers spontaneously report that although a shoe is comfortable on one foot, it is too tight on the other. Perhaps the standing and walking feet are different organs, having different asymmetries, from the static lumps of tissue attached to the ends of the legs.

JERRE LEVY
Department of Behavioral Sciences, University of Chicago, Chicago, Illinois 60637

JEROME M. LEVY
301 South Main Avenue, Demopolis, Alabama 36732

Reference

1. J. Levy and J. M. Levy, *Science* **200**, 1291 (1978).

27 April 1981

Identification of Living and Fossil Bivalve Larvae

In an earlier report (*1*), we documented the existence of exceptionally well-preserved larval bivalve shells in Late Cretaceous (Maestrichtian) sediments. Using criteria established by various workers (*2*, *3*) for the larvae of Recent bivalve species, we identified specimens to the familial level on the basis of gross shell morphology and hinge structures. Having conducted extensive studies on living bivalve larvae over the past 3 years, we would like to comment here on some of the identification criteria of earlier workers and qualify a few of the statements made in (*1*).

In his classic monograph, Rees (*2*) discussed the usefulness of larval hinge structures in identification studies for superfamilial separation. He recognized five major categories of larval hinges and found the hinge of every larva investigated to agree with one of 18 basic types. We used Rees' criteria to assign the Cretaceous specimen depicted in figure 1D of (*1*) to the family Mytilidae. According to Rees (*2*, p. 83), the lateral thickening of the mytilacean provinculum is "quite unlike anything to be found in the usual lateral hinge system." The micro- and ultrastructural details of the mytilid hinge have been described by several workers (*4*). Figure 1 depicts the hinge region of a larvae of *Arca noae*, the type species of the genus (family Arcidae), which has been cultured under laboratory conditions from positively identified adult organisms. The provinculum of this specimen is clearly different from the arcacean (*Glycymeris*) hinge depicted by Rees (*2*). Careful comparison of the specimen shown in Fig. 1 with that shown in figure 1D of (*1*) reveals a striking similarity. Detailed examination of gross shell morphology, hinge structures, and orientation of the ligament pit strongly suggests that the Cretaceous specimen we "unambiguously identified" (*1*, p. 439) as a mytilid belongs in the family Arcidae. This and other discrepant conclusions arising from observations we have made over the past few years on the larvae of numerous Recent bivalves largely reflect the lack of adequate data accumulated by workers in the field. Until larval hinge structures have been documented for a considerably larger number of species, considerable caution should be exercised in utilizing such structures for the identification of larval specimens from past and present marine environments.

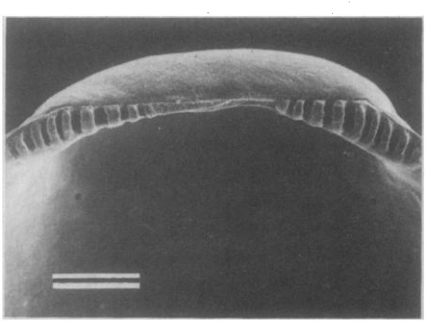

Fig. 1. Scanning electron micrograph of the hinge apparatus (provinculum) of a disarticulated shell valve of a larval *Arca noae* (family Arcidae). Compare with figure 1D of (*1*). Scale bar, 25 μm.

RICHARD A. LUTZ
Department of Oyster Culture, New Jersey Agricultural Experimental Station, Cook College, Rutgers University, New Brunswick 08903

DAVID JABLONSKI
Department of Paleontology, University of California, Berkeley 94720

References and Notes

1. R. A. Lutz and D. Jablonski, *Science* **199**, 439 (1978).
2. C. B. Rees, *Hull Bull. Mar. Ecol.* **3** (No. 19), 73 (1950).
3. P. E. Chanley, *Chesapeake Sci.* **6**, 162 (1965); R. D. Turner and A. C. Johnson, *Annu. Rep. Am. Malac. Union Inc.* **1969**, 9 (1969); E. Pascual, *Invest. Pesq.* **35**, 549 (1971); *ibid.* **36**, 297 (1972); R. S. Scheltema, *Mar. Biol.* **11**, 5 (1971); M. Le Pennec, *Cah. Biol. Mar.* **15**, 475 (1974); M. LaBarbera, *Malacologia* **15**, 64 (1975); J. L. Culliney and R. D. Turner, *Ophelia* **15**, 149 (1976); P. Dinamani, *J. Moll. Stud.* **42**, 95 (1976).
4. M. Le Pennec and M. Masson, *Cah. Biol. Mar.* **16**, 113 (1976); S. E. Siddall, *Proc. Natl. Shellfish. Assoc.* **68**, 86 (1978); R. A. Lutz and H. Hidu, *J. Mar. Biol. Assoc. U.K.* **59**, 111 (1979); M. Le Pennec, *ibid.* **60**, 601 (1980).
5. We thank S. Chapman and H. Hidu for providing larval specimens of *Arca noae*, A. S. Pooley for technical assistance with the scanning electron microscopy, and S. E. Hulburt for changing her name. Paper No. 5338 of the Journal Series, New Jersey Agricultural Experiment Station, Cook College, Rutgers University, New Brunswick, N.J. This work was performed as part of project number 32401 supported by various NOAA sea grants, NSF grant EAR 78-15536, and the New Jersey Agricultural Experiment Station.

7 January 1981

0036-8075/81/0619-1419$00.50/0