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Freshwater Mussels and Their Fish Hosts; Physiological Aspects

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Isom and Hudson (1982, Nautilus **96:** 147–151; 1983, Official Gazette, U.S. Def. Pub. **T102:** 602) have developed and demonstrated the use of an artificial medium which, in combination with fish blood plasma, allows in vitro transformation of freshwater mussel glochidia to juveniles. Most of the over 1,000 species of freshwater mussels are thought to be obligate parasites of fish during their glochidial life stage.

The literature includes many mussel species thought to have more than one fish host. Fuller (1974. *In* Pollution ecology of freshwater invertebrates, C. W. Hart and S. L. H. Fuller (eds.). Academic Press, Inc., New York, New York, pp. 215–273) has summarized the North American literature on this subject. Confusion in the literature results because, even though many mussel species have been reported with multiple fish hosts, there is an assumption that freshwater mussels are specific for one host species. An ex-

ceptional report which supports the concept of multiple fish hosts is presented by Lefevre and Curtis (1912, Bull. Bur. Fisheries **30:** 105–201). It is important to remember that the laboratory infection of fish with glochidia may not represent the natural fish host specificity because there is no consideration of ecological and behavioral features.

In developing an in vitro culture medium and process for transforming glochidia of freshwater mussels to juveniles, bypassing the fish host(s), Isom and Hudson (1982, loc. cit.) found evidence indicating that there is nonspecificity of fish host blood requirements. For example, successful transformation of *Ligumia recta* (Lamarck) glochidia was demonstrated in artificial medium with plasma from channel catfish (*Ictalurus punctatus* (Raf.)) and smallmouth buffalo (*Ictiobus bubalus* (Raf.)). In addition, *Pleurobema cordatum* (Raf.) glochidia were transformed in plasma from the above fish and also in plasma from the flathead catfish (*Pylodictis olivaris* (Raf.)) and common carp (*Cyprinus carpio* (Linn.)). Furthermore, species not reported (Fuller, 1974, loc. cit.) to have the channel catfish (*Ictalurus punctatus* (Raf.)) as a fish host (e.g., *Fusconaia ebena* (Lea), *Anodonta imbecilis* (Say), and *Lampsilis ovata* (Say)) transformed into juveniles using medium containing plasma from *Ictalurus punctatus* (Raf.).

Results of these experiments indicate that the "essential" component in fish blood necessary for initiation of glochidial transformation is contained in the blood of all fish tested. There is an "essential" component, because transformation will not occur when the medium is used without fish plasma. Transformation also did not occur when the fish plasma was substituted with bovine or fetal bovine serum, or 100% fish plasma was used.

These findings indicate that even though fish plasma seems essential for the initiation of transformation, there is no specificity for one host's blood by a given mussel species. This implies that there is no physiological plasma basis, other than possible immune response, for mussel host specificity.

These findings represent a significant breakthrough for the potential conservation of freshwater mussels worldwide, many of which are threatened or endangered.