Molluscs often play major roles in processing phytoplankton-synthesized dimethylsulfoniopropionate (DMSP) in local ecosystems. We find that some mollusc species retain tissue DMSP exceptionally tightly and exhibit unusually great and statistically nonnormal interindividual variation in DMSP accumulation and retention. Individual mussels (*Mytilus, Geukensia*) living within a single clump, for example, range 6- to 11-fold in tissue [DMSP] and are often nonnormal in statistical distribution. These properties cannot be explained by the elevation of the substrate on which the mussels are living or by mussel position in a clump. When mussels (*M. edulis*) are deprived of DMSP for up to 5 weeks in depuration experiments, some individuals retain high tissue [DMSP], whereas others exhibit reduced [DMSP]. Such interindividual divergence helps explain nonnormal distributions of tissue [DMSP] after depuration. We re-analyze published data from which the half-time for tissue DMSP loss during depuration can be calculated. In the only mollusc so studied (*Haliotis*), the half-time is 13-25 times longer than in similar-size fish. Besides posing a challenge for DMSP mass balance studies, retention and interindividual variation may point to as yet unknown properties of molluscs: Tight retention suggests functional roles for DMSP, and nonnormal statistical distributions suggest discontinuities among individuals in DMSP metabolism.