 About nautilus and king nautilus By 1986, Saunders and I had collected tissue from nautiluses around Fiji, Samoa, Australia, New Guinea, the Philippines, Palau, and New Caledonia. Two independent sequencings of their genes yielded the same remarkable result there are only two distinct groups of nautiluses. One is composed of the king nautilus, which appears to have descended from the chambered nautilus about 15 million years ago. the other group is composed of all the other so-called nautilus species. If the genetic evidence is accepted, it means that the long-agreed classification of the living species has crumbled. The king nautilus represents a different genus altogether, while the differences in shell morphology of the other "species" seem to be useless in telling them apart. We had gone from 11 living species belonging to one genus--Nautilus--to two genera, Nautilus and our newly recognized genus, with only two or three species between them. We gave the king nautilus a new scientific name, Allonautilus, which is Latin for "other nautilus." These surprising results made us wonder if nautiloid fossils might also have some secrets to reveal. Unable to study extinct nautiloid DNA, we had to figure out a new way to classify these animals based on their shells alone. Previous studies of nautiloids had classified them on relatively few features, and we hoped that we might find more to examine. Luckily for us, just such a trove of distinctive new characters had been uncovered by

Neil Landman of the American Museum of Natural History in New York. The chambered nautilus hatches at a very large size: it emerges from its egg with seven fully formed chambers and a shell diameter of more than an inch, making it the largest invertebrate at hatching in the world. (Indeed, it may have been this trait that allowed it to survive the great Cretaceous mass extinction, for the nautilus appears to lay its eggs in very deep water, where they take a year to hatch. Juveniles or unhatched eggs might have survived in a deep refuge when the great comet ending the age of dinosaurs, 65 million years ago, turned all the shallower oceanic regions into a toxic, heated cauldron of extinction.) When a living chambered nautilus emerges from its egg, it stops growing temporarily, and this pause leaves a distinct groove in its shell. Since the shell wraps around itself as it grows, these earliest stages are always preserved in the middle. Landman began dissecting fossils to see if similar marks were found in extinct species as well. He discovered that not only did these marks occur, but many other features also. Saunders and I combined Landmans new characters with the classical ones and then began to study their occurrence in living and extinct nautiloids. Both of us had been taught that present-day nautiluses are the most recently evolved of the 10,000 nautiloids that have swum through the oceans over the past 500 million years. Thus we expected them to have a lot of features that had evolved relatively recently. To our surprise, we found that todays chambered nautilus appears to be extremely primitive--rather than being a descendant of some fairly recently evolved nautiloid, the chambered nautilus evolved much earlier. It

may even be the ancestor of most of the nautiloids present on our planet for the last 75 to 100 million years. 