Molting occurs when the crab begins to shed its old shell, either because it's damaged or too small, grows an underlying new and soft shell, enlarges it after the old shell has been discarded, and then gradually hardens it to complete the process. Conveniently for the purposes of research, molting can be initiated artificially in the laboratory.

Hence, molting is an important phase of growth. In fact, in the case of crabs, molting is the only time in which growth occurs. This enables investigators to compare genetic activities in growing and nongrowing periods, and draw important lessons from the differences.

Molting is an important focus of research for other reasons. It is biologically similar to the skin shedding processes of insects as they grow from larvae into adults in a process known as metamorphosis. Thus, it is a major focus of agricultural and environmental research aimed at controlling pests and understanding the effects of pollutants on life cycles and reproduction.

Also, the switching on and off of rapid tissue growth is of great importance to cancer researchers. One hypothesis for the cause of cancer is that a gene, vital to the beginning of life during the rapid growth phase of the embryo but normally dormant thereafter, is switched on again by cancer causing agents. A better understanding of the mechanisms that regulate rapid tissue growth might lead to a means for turning off such growth when it is not desired. This would be a direct and powerful cure for cancer, much more so then the less specific means of chemotherapy and radiation in use today.

In 1985 Seed Money researchers accomplished an important step along the way toward a better understanding of animal growth and growth-regulating functions. They culminated a decade of painstaking research by successfully identifying several proteins specifically associated with the crab's molting process.

This step is important because once the protein has been identified and isolated, researchers can use a number of standard laboratory techniques, working backward, to create an exact duplicate of the original DNA which gave rise to the protein in the first place. Once this DNA is in hand, it can be analyzed to reveal the sequence of the coded elements of the gene. Attached to this gene, researchers hope to find the switch that turns on the rapid tissue growth associated with shell replacement. This latter effort is now the subject of further research funded by others.

When decoded, the DNA sequences can be entered into a massive computerized library and compared to all other known DNA sequences. In this way, the keys to the regulatory functions in other species of animals may be revealed by association.

While the identification of the proteins is a major success, none of this line of research would have been possible had it not been for earlier work. In 1982, for example, Seed Money researchers used more classical biological techniques to isolate certain chemicals in the crab, called growth-regulating hormones, the fluctuating quantities of which were found to be closely correlated with the crab's molting stages. This success provided an important clue as to when and where to start looking for the proteins and set the stage for 3 years of non-Seed Money research. This subsequent research ultimately pointed the way toward the new and successful avenue of investigation pursued by the Seed Money researchers in their 1985 work.

The 1982 research, in turn, was made possible by earlier successes. Working on simpler segments of crab DNA, Seed Money researchers in 1975 were among the first anywhere to decipher correctly a segment of genetic code from higher order animals. In 1979 they established successfully at the Laboratory the methods and procedures for DNA cloning, or amplifying, a segment of a DNA molecule into more abundant and chemically useful quantities. It was these Seed Money projects that first brought together at the Laboratory the skills, equipment, and resources necessary to carry out sophisticated research in molecular biology and established the foundation on which the present work is based.

While the ultimate goal of this line of research has yet to be fully realized, and while the successes described here are not particularly unique in the burgeoning list of accomplishments in the field, these four projects collectively are representative of both the larger body of work and the process by which fundamental knowledge in this field is advanced.

Ten years of painstaking and meticulous research were required to establish the capabilities, perform the underlying research, and bring the resulting products to fruition. Each additional effort built on the successes of its predecessors.

These projects also serve as an example of how the benefits of basic research often come into clearer focus retrospectively than was possible at the outset. In 1975 it was not entirely clear to what practical end the Seed Money investment in DNA sequencing would lead.

Funds from the Seed Money program were used judiciously as a means of pursuing a new line of work and incorporating the latest scientific developments and techniques into an established organization more familiar with classical approaches. A few periodic and relatively minor Seed Money investments provided essential and nurturing support at crucial times to help establish a new avenue of research. With newly established credentials, each success led to subsequent grants from outside funding organizations. As a result, biological research at the Laboratory is now well positioned within the midst of a broad scientific revolution.