"How might our knowledge of other creatures affect our own sense of humanness?
What does it mean to be human?"
Dr. Larry Spencer

I recently finished reading a book by Raymond Naylor entitled *The Mountain in the Sea.* Now, I realize that all of you might not be as excited as I am about reading the book as the topic is AI (artificial intelligence) and the genre is science fiction. Yet, at the same time since the focus is on octopuses and the book group just finished reading *The Soul of an Octopus,* many of you might find the thoughts of this book of interest.

First, a quick synopsis of the first part of the book. A cautionary note, I will not detail the last part of the book as I don't want to give away the ending. The book takes place a bit in the future. The location is an archipelago near Vietnam. The location at one time was a small village with a small resort hotel. The archipelago has been purchased by a large company specializing in AI and all the local residents have been bought out and moved to other locations. The resort hotel is in a somewhat state of disrepair. The only occupants of the island now are two groups, a group of Buddhist automonks (meaning not real folk, but robots) and three individuals hired by DIANIMA, the AI company. One of the three is a PhD animal behaviorist, another is a robot who exemplifies the epitome of investing AI in a robot, and the third person is never fully defined, but who is given the abilities to protect the archipelago from invaders. The automonks primarily are involved with rescue and growing sea turtles. They also have under their control extremely powerful drones. Drones have become an important tool for many different groups. Realtors use them to take photos of properties they wish to sell, biologists use them to track animals and they are used in other types of aerial studies of landforms. The other three individuals have been brought to the resort island to study a population of octopuses that occupy a sunken ship located near the hotel. The owner of DIANIMA seems to think that knowing more about the octopuses will allow her corporation to develop better AI, or at least that's what Dr. Ha, the PhD biologist thinks at first. They too, have very complex drones and the protector individual uses them to destroy anyone that tries to invade the archipelago.

So much about the book, now let's spend some time examining octopuses. They are without a doubt the most intelligent of any invertebrate group, which if you remember your high school biology are animals not having a backbone. You might ask what evolutionary pressures have caused them to be so intelligent. For the most part, they are bottom dwellers, and their food items are other creatures found on the bottom of the ocean, primarily small crabs. They are active predators and as a rule of thumb, active predators are usually intelligent. To detect and obtain these crabs for food requires a complicated skill set which involves smell, sight, and touch. At the same time, they are not protected by a shell and therefore if caught in the open are a juicy morsel of protein. The only hard part to their body are their beaks made out of chitin, the same material that forms the exoskeleton of insects and crustaceans. Therefore, in order to not be preyed upon, they have to outsmart their predators (mainly sharks and fish). This involves figuring out how and where to hide when not seeking their own food or to be camouflaged while finding their own food.

So let's talk about their sensory and integrative abilities. As the name implies octopuses have eight arms, each of which are covered by small suction cups. All the suckers are endowed by a network of tactile sensors. The arms are also endowed with chemical sensing cells. At the base of each arm is a ganglion (brain) that can integrate the sensory information detected by the arm sensors. Another major input of sensory information comes from their highly developed eyes. Their eyes function as well as ours but have a very different structure than our eyes. Connected

to each eye is a very large optic ganglion (brain). Lastly, surrounding one region of their esophagus are two ganglia, the supra and sub-esophageal ganglia (brains). If you've been counting, your tally should be twelve major ganglia or brains. What is of interest is that their system is a distributed processing system, as decisions can be made separately in each of the twelve brains to control a particular behavioral response. All of the brains are interconnected by nerve fibers so as to coordinate activities. Let me quickly give one example of octopod behavior that illustrates the functioning of the octopus. One can train an arm to recognize different kinds of surface structure (rough, smooth, with vertical or horizontal lines, etc.). If one does this to one arm, the rest of the arms will be able to recognize the same features of the object. But, if one slices the nerves that run from one arm ganglion to the other, one will have to train each arm individually, as there is no central processing of the information in the two main brains associated with the esophageal region.

How are they able to use their integument for camouflage? Their skin is endowed with two types of structures, chromatophores and iridophores. The first are cells containing dark materials that can be expanded or contracted by a series of muscles attached to the periphery of the cell. When expanded the animal turns dark, when contracted the animal turns light. The iridophores reflect light and can break up white light into its component colors. This color change is neuronally controlled, thus allowing the animal to quickly change its color to whatever color the substrate might be.

Now let us quickly look at our own nervous system. We too have peripheral sensors that are able to detect different sensory modalities. This information is then conducted via nerves to our central nervous system, which consists of the spinal cord and brain. Rate of travel along the nerves coming from the sensory structures to the CNS is extremely rapid, so detection of a pin stuck into our big toe will in a matter of milliseconds be conducted to the brain and a motor response to pull away our toe will take place immediately. When Eve was offered the apple by the serpent in the Garden of Eden, she saw it, felt it and then tasted it. It was her brain that made the decision to consume it, not her hand. In contrast to octopuses, our system is a central processing type of system. We also have another nervous system associated with our internal organs that is also associated with our endocrine system that uses chemical modalities to provide change. Everyone is knowledgeable about our fight or flight system associated with the secretion of adrenaline to our heart to make it beat more rapidly and enable us to either fight like hell or run like hell to get out of a possibly damaging system.

At this point one might want to ask, "What makes us human?", as all organisms where invertebrates like the octopods or vertebrates like us have either distributed or central processing systems and therefore can make many different kinds of responses to sensory inputs from our environments. It can't be learned behavior; most organisms show some sort of learning. It can't be consciousness; many different organisms show some sort of consciousness. When I look into the mirror in the morning, I see myself and wonder what will happen during the coming day. Other organisms, monkeys, porpoises, and perhaps even your cat or dog recognize themselves in the mirror. What about planning for the future? Humans do that, although unfortunately not always consistently. We know that when Jesus was tempted by the devil, it was aware of his future life. Other organisms do plan for the future. Consider the hiding of acorns by some species of woodpeckers, or the storing of hay by high altitude pikas, all of which implies that the organism is preparing for the long winter. What about tool use? It's not just a human ability. Octopuses often use shells and chimps use twigs to get at termites. One might say language, but we know that whales communicate with other members of their species by low frequency sounds that can travel thousands of miles. The one thing that we have that no

other species seems to have invented is a written language and through that written language we can pass our culture on from one generation to the next. This means that we are no longer dependent upon evolution/natural selection to pass traits from one generation to the next.

So, let's get back to our octopuses occupying the sunken ship in Vietnam. One of the paradoxes of biology is the intelligence of the creatures. As intelligent as octopods may be, they only live long enough to reproduce and then they die. They are not really social. I guess one could say they mate for life, but that relationship is extremely short. Nor do they really take care of their young. Fertilized eggs are attached to hidden surfaces and no octopus mother protects these locations. But, as Dr. Ha and her two colleagues begin to explore the sunken ship, they find not only adults are present, but also many young. In one room they discover that some octopuses have even set up homes in barrels and decorated those barrels with different shells and other colorful items. Ha soon realizes that one of the octopuses seems to be attempting to communicate with her via symbols not only appearing on their bodies, but also with physical indications on these symbols on the floor of their environment. In a way the creature is using its skin in the same manner as many of the outdoor signs in Times Square do. As Ha and her friends use the drones to further investigate the sunken ship, they find a room which seemingly has an altar made out of human skulls and other artifacts.

If you remember, we indicated that one other member of the corporation's party was an AI robot. Is this robot a human? If you remember, Alan Turing came up with the idea of asking a question of a person/robot and if the answer that comes back seems like it came from a human, then it's not a robot, but a human. When folks began to examine Artificial Intelligence, when a question was asked, the computer simply reshuffled the question to make it seem like an answer. For example, if I asked the computer "How was it feeling?" the computer would have answered "What makes you want to know about how I am feeling?" Today with programs such as ChatGPT, ask the same question and the answer you get will indicate a knowledge based on facts gathered from hundreds of sources and represent a very intelligent response. Is the robot of the book just the most intelligent of robots in the world or has he/she made the transition from being a robot to a human.

So, the big question we can ask at this moment in the sermon, how should we humans treat other species, particularly when that species seems to have reached a level of development equivalent to ourselves. Jesus was tested by the devil, and he could have turned stones into bread or had the whole world in his hands. If our humanness is to have the ability to transmit our culture to future generations by means of the written word, are we tempted by our humanness to have power over all the world, should we like Jesus reject that temptation and assume our humanness says to treat all creatures on the Earth as our peers. We have the power to do good in this world if we recognize our humanness. Let it be so.