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STEM Research Area:

While many of the video selections exposed me to intriguing fields of research, I was drawn to Dr. Sandra Chapman's illustration of undersea medicine and more specifically, diver performance optimization. Her deep passion was inspiring and I appreciated how she wanted to truly transform her field at a foundational level. I found her discussion on how to enhance scuba gear very enlightening since it demonstrates both the Navy and Dr. Chapman's ingenuity and commitment to their endeavors. Instead of simply modifying the current system, she is attempting to completely remake the traditional methods for supplying oxygen to divers. By using a rudimentary concept like electrolysis (something most high schoolers learn in general chemistry), she is elevating a simple topic and adding on numerous layers of complexity. Plus, her research has the potential to shape current and future naval operations.

Furthermore, as I continued to watch, I was struck by how many similarities this niche concentration shared with space medicine. From a cursory glance, the deep sea and deep space seem to be largely unrelated. However, upon further examination, it is evident that these two foreign environments share many commonalities and possibilities.

At its crux, undersea medicine seeks to innovate the methods and techniques for mitigating the physiological risks associated with maritime operations. Whether this is understanding the etiology of decompression illness and hyperbaric oxygen toxicity or designing the next generation of subaqueous combat technology, this field strives to innovate. Likewise, the emerging field of space medicine aims to accomplish comparable objectives. Though its domicile is different, space medicine focuses on optimizing astronaut performances of complex tasks. Plus it studies conditions affecting overall health such as (also) decompression illness and other musculoskeletal deficiencies associated with microgravity.

Again, it might be difficult to see the current relevance of space to undersea medicine, but it is notable to mention how space-related fields have informed national and even global naval operations throughout the last half-century. In particular, the Navy is perhaps the most reliant on space technology out of all the armed forces for navigation, surveillance, communication, and nautical support. For instance, work done by physicists and optical engineers on charge-coupled devices (CCDs) for astronomical instrumentation (CCDs are the detectors of choice to observe visible, ultraviolet, and x-ray wavelengths of light) has largely informed naval optoelectronics research.

Throughout the years, the Navy and Space Program have developed a complementary relationship and it is only natural to assume that this can extend to space and maritime medicine. As the refinement of both fields progresses, it could be in the best interest of the Navy to note any prominent developments in space medicine since it could lead to some potentially notable discoveries in undersea medicine. Effective dissemination of information and communication between two bodies can be conducive to making discoveries.

People:

While I found Dr. Chapman's story impressive, I found myself resonating more with Dr. Richard Ordoñez's background. He didn't know from a young age that he wanted to pursue research in nanotechnology (which is understandable since most children never heard of the field), and I like how his career did not necessarily follow a linear progression.

Many people seem to know from an early age exactly what they want to do. I have never experienced this realization. Since middle school, I thought that I wanted to be a doctor but since then my horizons have broadened and now I am unsure of what I want to study. In the past few years, I have found a fondness for astronomy but did not know what direction this would take me. Hearing of Dr. Ordoñez's initial affinity in cosmology piqued my interest instantaneously. I felt that I had a potential model to emulate plus it was reassuring to know that sometimes opportunities can appear unexpectedly. His passion for nanomaterials and microelectronics grew while at the Naval Research Enterprise Internship Program, not prior. Seeing how this internship changed the course of his life has reminded me to stay open to unpredictable opportunities since you never know where they may lead. This contest itself is a prime exemplification of this idea. Quite frankly, I have never remotely considered a career with the Navy as I always assumed I would just find a job in the private sector. When I envisioned the words "Navy" and "job" together, my initial thoughts produced various images of the Navy SEALs. As a skinny, short, female who is unable to do a single pull-up, I figured this was not my most viable career option. I now realize that even though the SEALs and other combat divisions are essential to naval operations, the support systems behind them are equally (if not more) important. Naval Horizons has opened my eyes to the diverse possibilities that the Navy and other branches have to offer. The Navy is a collective composed of many unique facets. Right now, I do not know if I will have the opportunity to join this group. However, in the meantime, I will keep my options open and consider the unexpected possibilities. I still do not know exactly what my future profession (or even desired profession) will be, but I will stay particularly attentive to any opportunities the Navy presents.

Future:

Humans have always possessed an intrinsic drive to explore. Whether it be tangible, geographical exploration, or a more metaphysical desire to expand the boundaries of knowledge, this primordial characteristic is evident throughout history. Since society has entered the Anthropocene epoch (meaning humans are the predominant influence on Earth), we are reaching new technological capabilities and expanding our perceptions of the physical frontier. Though this reference is ubiquitous in popular culture (ex. Star Trek V), space truly is the final frontier and the natural destination for future exploration/technological advancement.

From the SpaceX Starship to the announcement of NASA's Artemis, space exploration and colonization are at the focus of next-generation science and engineering efforts. Even Elon Musk announced

tentative plans for commercial tourism to Mars by 2040. While the feasibility of Musk's idea is unknown, it is clear that in the next decades space technology will revolutionize our daily lives considerably.

Moreover, in the upcoming years as science places an increasing emphasis on space, it is imperative that the Navy adapts accordingly. The U.S. military recognized the need for a presence in space when they established the Space Force back in 2019. Even though it is still in its incipient stages, the Space Force will eventually operate 13 of the Navy's satellites. This is a move that may seem minor but in actuality has considerable implications. Thus, as mentioned earlier in the discussion of undersea and space medicine, it could benefit the Navy to continue its efforts in space-related matters.

Unbeknownst to many, the Navy has played a historic role in space systems development. Even before the establishment of NASA, the Office of Naval Research and Naval Research Laboratory have been essential to all facets of the American space exploration program. From aviators to Underwater Demolition Team Frogmen to engineers of the now-disbanded Naval Space Command, Navy personnel have been critical to the success of the current space enterprise. For instance, Alan Shepard, the first American in orbit, was an alumnus of the US Naval Academy and Rear Admiral in the Navy. Even Neil Armstrong was a naval aviator and flew 78 combat missions during the Korean War. Ostensibly, the Navy and Space Program share a rich history so it is only apparent to continue this relationship in the upcoming years.

As aforementioned, maritime and space operating environments share many similarities. For instance, the hydrothermal systems of underwater volcanoes have potentially analogous conditions to extraterrestrial planets thought to harbor life. NASA recognized this connection and in 2019 launched the SUBSEA mission (Systematic Underwater Biogeochemical Science and Exploration Analog) which uses the sea to assess methods for optimizing future remote space exploration. They are preparing for the next generation of missions under the realistic conditions (and proximity) of Earth. Essentially, they are only continuing the natural synergy of space and maritime operations. This illustration proves that marine scientific fieldwork has applications to space. Likewise, the technology developed by NASA (called spinoffs) has immeasurably impacted all sectors of society from civilian to military. For example, in the 1990s when trying to track radio signals from quasars, NASA's Jet Propulsion Laboratory sought to overcome the limitations of their previous navigation system. As a result, the Global Positioning System (GPS) was created and it is at the forefront of Naval reconnaissance and marine navigation. Hence, it is evident that both the Navy and Space Programs benefit from each other thus in the upcoming years it is imperative to encourage full collaboration between them.

In summation, in the future, the Navy and Space Program have an invaluable opportunity to leverage one another and increase their efficacy in carrying out missions. Both have similar strategic level objectives and some sort of integration or joint operations between them could yield an unseen number of benefits.