Lesson 4 Creative Ideas for a Better World

Science for All

Microscopes have been an essential tool for science for over 400 years. If microscopes had not been invented, we might not have discovered bacteria or the microscopic structures of living organisms. In certain areas of the world, however, even basic light microscopes are not accessible due to their cost. It was the Foldscope that Manu Prakash and Jim Cybulski presented as a solution to the problem. The Foldscope, a paper microscope they invented, achieved powerful magnification, and cost less than a dollar in parts. "The idea has been to make science accessible to everybody," said Prakash.

While researching methods for identifying infectious diseases in Thailand in 2011, Prakash came across an expensive microscope that was meant for malaria testing but was unused. Malaria takes over half a million lives annually, so early diagnosis is crucial in preventing its spread. But then, why was the microscope sitting unused?

Prakash found that there were multiple reasons. The microscope was bulky and awkward to transport, required training to operate, and was difficult to maintain. As it was a delicate and expensive instrument, even trained lab workers felt nervous about using it. Prakash began wondering. A cheap, strong microscope could save thousands of lives. After he returned to Stanford University, where he was a professor, he started to reflect on the idea.

It was not until he met Jim Cybulski that his idea of an affordable and accessible microscope began to take shape. A graduate student at Stanford, Cybulski was looking for ways to apply his engineering background to make a difference in the real world. After hearing Prakash's vision, Cybulski quickly recognized its potential and was eager to contribute.

For a microscope to function properly, it must meet certain minimum requirements. These include an eyepiece, a tube through which the viewer looks, and a lens for magnification. The microscope must also have a component that can hold a specimen and move from side to side to explore different areas of the specimen. Furthermore, a mechanism to bring the specimen into focus, usually accomplished by moving it closer to or farther from the lens, is necessary. Finally, a light source is required to illuminate the specimen.

An ideal microscope would be made with the best performing materials and mechanisms for each component. However, such a microscope would likely be enormously expensive. On the other hand, a cheap microscope may not be able to deliver high performance. Prakash and Cybulski experimented with various designs and materials in order to find a suitable compromise. While many manufacturers might have settled for a middle ground between these two extremes, Prakash and Cybulski were determined to create a microscope that was both inexpensive and high-performing, while remaining accessible to all.

After drawing various designs on paper, Prakash and Cybulski realized that paper could be an excellent medium for their microscope. It was cheap, easy to cut and fold with precision, and widely available. They faced many challenges during their attempts to develop the perfect design. Ultimately, they settled on waterproof cardboard paper with a small glass ball lens and named their invention the Foldscope.

The Foldscope provides a magnification of 140 times, making it capable of examining blood cells, bacteria, and single-celled organisms. It is incredibly portable, weighs just 8 grams, fits easily in a pocket, and requires no external power source. Moreover, the Foldscope is built to last, capable of surviving a three-story fall. Its usefulness is further enhanced by its compatibility with phone cameras, allowing users to take pictures and record images of the specimen. It is also possible to project a high-resolution image on a wall using the phone light. It is no surprise that over 1.8 million Foldscopes have been distributed in over 160 countries, making it an invaluable tool for scientists worldwide.

The Foldscope has been utilized for various purposes beyond malaria diagnosis. In Nigeria, it has also been instrumental in detecting fake antimalarial drugs. The drugs are responsible for over 100,000 deaths annually in sub-Saharan Africa, mostly among children under five. When crushed into powder and examined under a Foldscope, real drugs appear as uniform particles, while fake drugs appear as mere powder. Furthermore, over 400 scientific papers have been published using Foldscope data, and around 1,200 projects are currently in progress in India. In the United States, Foldscope programs in public libraries have introduced many children to the wonders of science. If Prakash and Cybulski had given up on their idea of the Foldscope, these achievements could not have occurred.

As billions of people lack access to health care and thousands of preventable deaths occur, science is playing a crucial role in finding solutions to these challenges. Tools like the Foldscope, which make science accessible to everyone, are becoming increasingly important.

Further Reading Text – Lesson 4

Helping Hands

Whenever a new technology emerges, there are people who want to use it for the benefit of the community rather than just for themselves. When 3D printing began to be more affordable, some scientists and engineers wanted to use this technology to create artificial arms and legs for people who could not afford to buy the traditional ones. In 2014, a global community of volunteers was established for this purpose. They create artificial hands and arms for children and adults at a very low cost. They also allow anyone to access their website and download the codes for free to create hands and arms on their own using 3D printing technology. They provide resources and training, too. Scientists' efforts to use science and technology for the benefit of people are now expanding to include animals. Recently they have used 3D printing technology to design artificial legs for animals.