

## A massive breakthrough at microscale: Foldscope as a microscope

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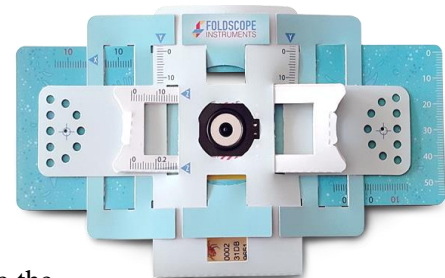
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### Introduction

Man has been in the pursuit of deciphering the unintelligible codes of nature since time immemorial. The voids in our understanding of the universe and its components have gradually disappeared with advancement in technology and laboratory tools.

One such revolutionary invention was that of the microscope. Before the microscope, scientific understanding was limited to only what the human

eye can see. Hypotheses might have been proposed by scientists to suggest the existence of life at micro size but it was a microscope that bridged the gap between that hypothesis and it actually becoming a fact. The microscope advanced over the time. It grew smaller, handier and more efficient in terms of resolution. The chances of fallibility reduced. While advanced models of the microscope made it to world class research facilities to enable path breaking discoveries, the simpler versions went in the hands of school and college goers. Hence, the invention and gradual advancement of the microscope was fulfilling the needs of mass scientific education and elegant research.



**Figure 1: Foldscope**

While contributions were being made in the direction of making the microscope more complicated to enable finer research, there were two men who thought of going backwards. Backwards in the sense of making microscopes are more ergonomic and portable. These men were Dr Manu Prakash and Jim Cybulski, the brain behind the foldscope microscope. You see, in developing countries like India, the reach of microscope and its use in pathological diagnosis was still rare for a large chunk of

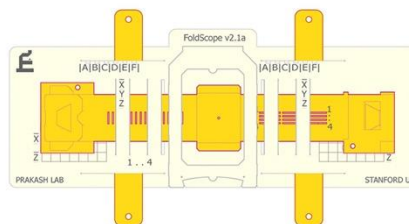


Figure 2: Dr. Manu Prakash with foldscope. Left, schematic diagram of the foldscope.

population. Malarial epidemics are still a common annual affair in many parts of India. This gap inspired Dr. Prakash to develop a microscope that could be used anywhere. It was a great leap in terms of affordability when compared to a conventional lab microscope. The conventional microscopes are heavy, bulky, require proper maintenance and are expensive. Through extensive field survey on the use of conventional microscopes in developing countries like India and Thailand, Dr. Prakash's students also observed that even in places where a microscope was available, either it was poorly maintained and had fungus growing on it or wasn't used at all due unavailability of skilled persons to handle it. Through proper analysis of the problem, the idea of foldscope emerged.

### What Is a Foldscope?

A foldscope is a completely functional microscope. It offers all the facilities of an advanced microscope like fluorescence, bright-field, polarization and projection. It is called 'foldscope' because the basic design of the microscope has been developed by folding a paper, much like a paper cut-out game we had played growing. It is a single sheet of paper which has different components that can be used to assemble a fully functional microscope. There are 3 stages namely, the optical stage, illumination stage and mask holding stage along with micro-optics in the sheet. The placeholder for the slide is a rectangular cut out in which required focus is achieved by simply sliding it through the paper slits. The user can magnify pictures by use of a smart phone which gets connected to foldscope with the help of magnets provided in the assembly of foldscope. The foldscope is a rugged device and therefore, does not require delicate maintenance. Based on the presence of stain, foldscopes are also



Figure 3: Children with foldscope



developed to specifically diagnose a particular disease like Malaria or Tuberculosis. It is a onetime use device and cost only 50 cents in US currency. In India one can purchase it for 300 to 500rs from various online sources. This device has potential to revolutionize science by providing hands-on education experience to students. Also, global health care will experience a great leap with affordable and self-diagnosis of diseases like Malaria and Tuberculosis.

Every year the Delhi national capital region experiences a malarial epidemic. This can be contained if people receive the power of early diagnosis of the disease enabled by a foldscope. It is just like the COVID testing process that moved from lab sample testing to self-testing kits. The foldscope is an important step towards promoting citizen science.

India is a very large country with an overwhelming population of about 138 crores. The disparity of wealth is so much that it astonishes economists all over the world. On one hand, we have industrialist's owning multimillion air companies and innovative startups mushrooming every day. On the other hand, we perform poorly in global poverty index year after year and most population is denied of even basic scientific services. In such a scenario it becomes impossible to progress as a nation fully without an adopting an approach of two-way development catering the needs of both the extremes simultaneously. Once initiated and properly directed, the developments at abundance end can serve to reduce the problems of the other end. This will create a cyclic effect and lead to exponential progress of our country in transitioning from the status of developing to develop. The invention of foldscope is the perfect example of this approach. It is a very sophisticated device manufactured in one of the world's best universities to cater the needs of the poorest of poor. Such ergonomic inventions that take up the challenge to eradicate poverty are essential to help make our world a better place to live in.

### **Picture References**

1. [Foldscope device picture](#)
2. [Dr Manu Prakash with foldscope and a schematic diagram of foldscope](#)
3. [Children with foldscope](#)

