

# Studies on Onion cells (*Allium cepa*) With a Foldscope

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**Abstract**—Foldscope is the cheapest microscope, and easy to examined. We used onion cells (*Allium cepa*) for the study because onion cells easy to identify and easy to study. It's examined by conventional light source. In that study was done by Methylene blue stain, which prepared wet mount slide for the identification of onion cells and its nucleus. Observed cells under foldscope at 140X magnification it seems the good visualize for other microscopes.

**Index Terms**— Foldscope, *Allium cepa*, Mobile mounted foldscope, Portable microscope, Onion cells, 140X magnification, Mobile microscope.

## 1 INTRODUCTION

In recent years, foldscope is an origami-based optical microscope that can be assembled from a flat sheet of paper in less than 10 minutes. Manu Prakash invented first prototype foldscope in 2010 later he made foldscope with some new features and presented in TED global at 2012, His thinks is many children around the world have never used a microscope, even in developed countries like the United States. A universal program providing “a microscope for every child” could foster deep interest in science at an early age. In addition, foldscope is a small, easy handled; paper-based microscope comes with magnetic coupled lenses with a light-emitting diode (LED) light source with watch battery. Cost value is less than 1 USD. It held up to the eye for visualize specimen at 140X and it can provide over 2,000X magnification with submicron resolution, Weight less than 8.8 grams [1], And its very small enough to fit in the pocket, unbreakable, made up of water resistant plastic papers. It has X, Y and Z axis adjustments. In that spherical ball lens attached with magnetic coupler, So we can easily attached our mobile phone camera with foldscope. It's very easy to take images directly from our mobile phone camera without any software [2].

Moreover, onion (*Allium cepa*), is one of the most consumed and grown vegetable crops in the world [3]. An onion is made up of layers that are separated by a thin membrane. Consists of an inner fleshy and outer dry membranous scaly leaves [4, 5]. *A. cepa* is an edible vegetable; the onion contains some substances which contain sulfur. Cutting an onion releases these sulfur compounds. Sulfur is an irritant to both our noses and eyes, when these sulfur compounds come in contact with the water in our eyes, It produces sulfuric acid [6, 7, 8]. *A. cepa* is also used as a bioactive compound, medicinal virtues

and numerous pharmacological properties, including antimicrobial, anti-diabetic, analgesic, anti-inflammatory, antioxidant, anti-hypertensive and immunoprotective effects [9, 10, 11]. In the present study, we have observed cells under foldscope at 140X magnification it seems the good visualize for other microscopes.

## 2. MATERIALS AND METHODS

Foldscope purchased from Department of Biotechnology (DBT), Government of India. Foldscope comes along with printed instructions accompanying each foldscope kit are very detailed and easy to follow. Assembled a foldscope microscope by used this instructions1. Onion was commercially available in markets. Methylene blue and Microscopic slide purchased from MERCK Scientific India Pvt Limited. Mobile tab (Samsung Tab A-SM- T285) purchased from Amazon.in.

### 2.1. STAINING AND OBSERVATION

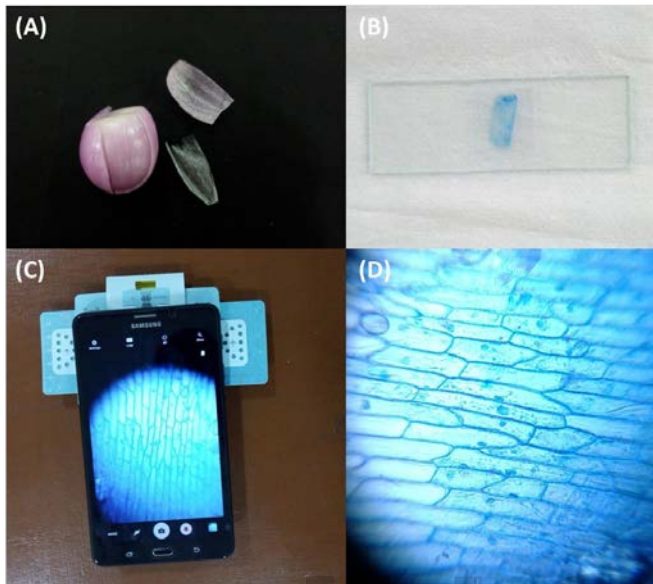
We prepared a wet mount slide for observation. Cut the onion and separated layer by layer using tweezers. Onion peel was obtained inside of the onion layer, then peeling out (Figure 1A) and placed directly onto a glass microscopy slide. Methylene blue added for 10- 15 secs. Later add some drops of a distilled water (H<sub>2</sub>O) then cover with a glass coverslip and wipe-out the additional water with tissue paper (Figure 1B). Methylene blue can easily attach to the dead cells, so easily identify the cells. Similarly was examined with foldscope is a low and high power light source (LED) [1, 12, 13]. In addition, foldscope attached with Samsung Tab A-SM-T285 (Figure 1C).

## 3. RESULTS AND DISCUSSION

The layers of an onion contain simple sugars like carbohydrates some of which are stored as starch granules. Methylene blue leads to bind with starch molecules make them visible under the microscope. Foldscope by the study of onion cells results, the Large, square and rectangular cells homogenized with another cells, its seems like a bricks builded wall without cement appeals, Cells contains cell wall, Blue pigmented

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nucleus, Large vacuoles at centre of the cell and cytoplasm around the nucleus joining to the cell membrane. It is clearly visible on foldscope (Figure 1D). Methylene blue stained nucleus seems dark blue in colour and unstained cell nucleus are not visible. It shows cell wall and cell membrane only.



**Figure 1.** (A) Onion peel out from onion. (B) Temporary wet mount slide, Onion peel examined with methylene blue and covered with coverslip. (C) Onion cells observed in Samsung Tab A-SM-T285 attached with foldscope. (D) Observed square and rectangular shaped cells visualized by foldscope at 140X magnification.

In this study, Foldscope is very excellent apparatus to observe and studied onion cells. So we can observe microorganisms and live species by this foldscope. Foldscope, a portable and versatile microscope made mostly out of water proof paper and magnification lens with small battery powered LED light. So we can see the samples or objects using without electrical power and no need a laboratory environment we can take and use outside or anywhere no need to take the samples to laboratory. Its weight less than 8 grams, costs less than a dollar (USD). Foldscope is more affordable than compared with other microscope. It had limited sensitivity, but excellent specificity.

## 4 CONCLUSION

The current review of studies focused on foldscope functions and magnification aspects. Its gives a good magnification to see inner parts of the cells and stained nucleus. Other microscopy should not be taken to outdoor and field work. But we can take foldscope to field work and outdoor collection. Schools and colleges have some amounts of microscopes only and they can't provide to all, Cost value and time affects. Foldscope couldn't affect any cost value and time. It's easy to handle no worries about damage and break at all. Foldscope

magnification around 140X without oil immersion. Usually this much magnification is enough to study all micro things and cells. I hope foldscope become useful tool for the study of all biological things, diagnosis and microorganisms isolation. In future, every children's will carry foldscope within them bag.

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