# Introduction

In writing this paper my goal was to demonstrate the wonderment of discovery that is contained within mathematics. Instead of focusing on a rigorous proof like treatment of the subject matter, I hope instead that the reader will feel that they have journeyed through the questions with me to suitable answers.

## Viruses: General Background

Long before Adolf Mayer in 1883 began the process by which viruses would be recognized they existed and plagued human life. As further studies and discoveries revealed, viruses are fascinating micro-organisms that manage to continue their existence without the ability to replicate their own genetic material or build proteins. They have developed special defense capabilities to transmit their genetic material from one host cell to another, and unique ways to introduce their genetic material to host cells. For instance, bacteriophages have developed protective heads to encase their DNA and cylindrical tails by which they attach to bacteria and inject their DNA[[1]](#endnote-1)[1]. Additionally, viruses have drastic wide ranging effects upon life. They do as little as cause a sniffle, or as much as end life in multiple painful ways (consider the HIV and cancer causing Papilloma virus).

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## A History of Virus Structures

In 1956 F. H. C. Crick and J. D. Watson wrote a paper based on a very simple yet powerful hypothesis: “a small virus contains identical sub-units, packed together in a regular manner” [[2]](#endnote-2)[2] . They based this hypothesis on the physical observation at that time that most known viruses were either rods or spheres. From here they sought to understand why this was. For rod shaped viruses there was already X-ray work that could show that the rods were helical in nature and made up of identical protein sub-units each inhabiting the same environment centered about a central axis of symmetry. For spherical viruses, there was not clear enough X-ray work to establish the exact nature of spherical shells, but Crick and Watson did establish a few basic concepts. First, they believed that the structure would have cubic symmetry. This was based largely upon the establishment by Caspar that bushy stunt virus had cubic symmetry. Second, they allowed that the asymmetric units which build the symmetry elements may in fact consist of even smaller identical sub-units joined in an unsymmetrical fashion.

1. [1] Campbell biology [↑](#endnote-ref-1)
2. [2] Crick and Waston [↑](#endnote-ref-2)