# CHAPTER 1

# INTRODUCTION

## 1.1 Background

Sexually transmitted infection (STI) is one of the major public health problems worldwide. Once acquired through sexual contact, STI affects the quality of life directly or indirectly, impairing the reproduction, health condition of newborns, long-term health, and individual economic status following treatment. STIs can be caused by several pathogens such as bacteria, viruses, and parasites. Common examples of bacterial STIs include chlamydia, syphilis, and gonorrhea caused by *Chlamydia trachomatis*, *Treponema pallidum*, and *Neisseria gonorrhoeae*, respectively. Examples of viral STIs include acquired immunodeficiency syndrome and herpes caused by the human immunodeficiency virus and HSV, respectively.

According to the World Health Organization, there are more than a million STIs acquired every day, and in 2012 there are 131 million cases of chlamydial infection. Chlamydial infection is the most common bacterial STI worldwide that usually affects sexually active young individuals in both genders (CDC, 2019). In females, chlamydial infection can cause mucopurulent cervicitis, salpingitis, and urethritis, and increased risk of developing a pelvic inflammatory disease, tubal factor infertility, and ectopic pregnancy (Cheong, et al., 2019). While in males, it causes non-gonococcal urethritis, seminal vesiculitis, epididymitis, prostatitis, and epididymo orchitis, leading to reduced semen volume, sperm DNA fragmentation, apoptosis of spermatozoa, and infertility (Cheong, et al., 2019). Also, the genital chlamydial infection will increase the risk of HPV coinfection, besides causing conjunctivitis and lower respiratory tract infection in newborns on perinatal exposure (CDC, 2019). This bacteria can also induce active arthritis by disseminating to the joint that causes inflammation (Cheong, et al., 2019).

Chlamydial infection is caused by bacteria infection from the *Chlamydiaceae* family which includes *Chlamydia trachomatis*, *Chlamydia pneumoniae*, *Chlamydia psittaci*, and many more. This

bacteria can infect both humans and animals. They have their unique life cycle, pathogenesis, and defense mechanism. Their life cycle will require a host cell to replicate because they are obligate intracellular bacteria. They have a cryptic plasmid that contains eight open reading frames. Each of them expresses different proteins that contribute to the survivability of the bacteria. One of the proteins is Pgp3 protein, which mainly contributes towards the pathogenesis of this bacteria.

There are some studies regarding this protein, but further study should be accomplished to understand its impact on human cells. Since this protein plays many roles regarding *Chlamydia* pathogenesis, thus making this protein as a drug target. This project focuses on analyzing differences in gene expression of Pgp3 stimulated cells, which will provide a further understanding of the effects of this protein towards the genes in the HeLa cells and assist future development to counter the infection. This study will be classified as a transcriptomics study to investigate the gene expression from a certain genome from cells.

**1.2 Research Objectives**

The study aims to analyze expressed genes in Pgp3 stimulated HeLa cells using nSolver 4.0 from NanoString technologies (*in silico*). The expressed genes analysis result will be in the form of log2 ratio and fold changes, which will be used to generate heat maps and volcano plots to visualize and interpret the downregulated and upregulated genes effectively.