The **multiplicity of infection** or **MOI** is the ratio of infectious agents (e.g. phage or virus) to infection targets (e.g. cell). For example, when referring to a group of cells inoculated with infectious virus particles, the multiplicity of infection or MOI is the ratio defined by the number of infectious virus particles deposited in a well divided by the number of target cells present in that well.

Interpretation

The actual number of phages or viruses that will enter any given cell is a statistical process: some cells may absorb more than one virus particle while others may not absorb any. The probability that a cell will absorb n virus particles when inoculated with an MOI of m can be calculated for a given population using a Poisson distribution.

$$P(n) = \frac{m^n \cdot e^{-m}}{n!}$$

where m is the multiplicity of infection or MOI, n is the number of infectious agents that enter the infection target, and $P(n)$ is the probability that an infection target (a cell) will get infected by n infectious agents.

In fact the infectivity of the virus in question will alter this relationship. One way around this is to use a functional definition of infectious particles rather than a strict count, such as a plaque forming unit.

For example, when an MOI of 1 (1 viral particle per cell) is used to infect a population of cells, the probability that a cell will not get infected is $P(0) = 36.79\%$, and the probability that it be infected by a single particle is $P(1) = 36.79\%$, by two particles is $P(2) = 18.39\%$, by three particles is $P(3) = 6.13\%$, and so on.

The average percentage of cells that will become infected as a result of inoculation with a given MOI can be obtained by realizing that it is simply $P(n > 0) = 1 - P(0)$. Hence, the average fraction of cells that will become infected following an inoculation with an MOI of m is given by:

$$P(n > 0) = 1 - P(n = 0) = 1 - \frac{m^0 \cdot e^{-m}}{0!} = 1 - e^{-m}$$

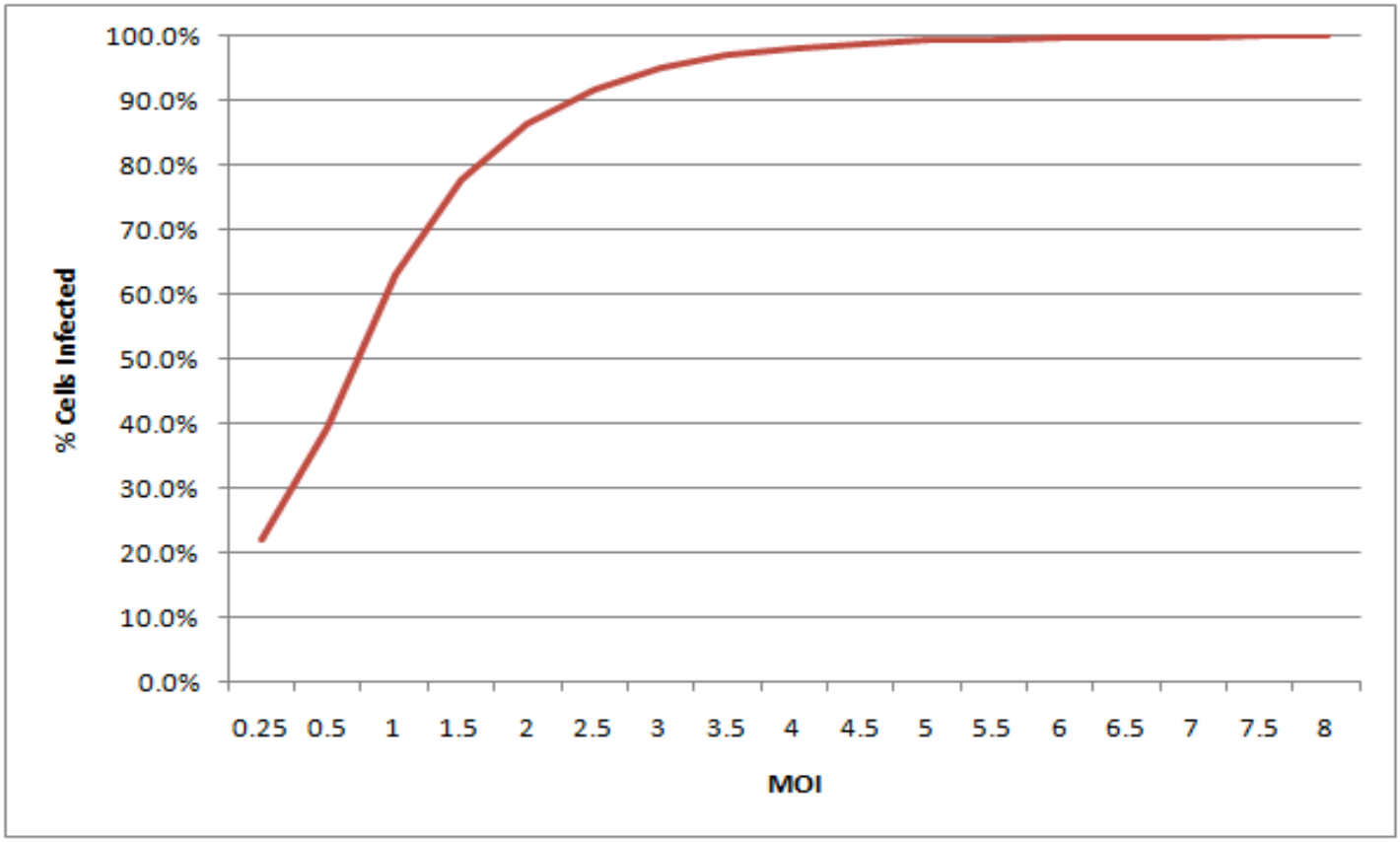
which is approximately equal to m for small values of $m << 1$.

MOI Examples

Percentage of cells infected based on MOI.

As the MOI increases, the percentages of cells infected with at least one viral particle also increases.

MOI	% Infected
1.0	63.2%
2.0	86.5%
3.0	95.0%
4.0	98.2%
5.0	99.3%
6.0	99.8%
7.0	99.9%
8.0	100.0%



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