**Ways Microorganisms Get Around and Protect Themselves**

**Background**

 Microorganisms perform many functions that may not be obvious to the naked eye. They may have external structures such as flagella and type IV pili which allow them to move. They can also produce external molecules such as biofilms. Biofilms can also provide a different service to microorganisms, in addition to facilitating motility, they can also protect from their environment. These mechanisms increase the survival rate of the microorganisms by also allowing it to avoid the host immune system. They can also increase virulence in a host during infection.

 Motility is an essential part of many microorganisms. It enables microorganisms to travel from an area of lower nutrient concentration, to an area of higher nutrient concentration. It can also be used to travel away from a toxic or undesirable environment, or to get away from other colonies that may be competing for nutrients. This motility can be achieved by different modes such as gliding, twitching, swimming, and swarming. Certain types of motility are achieved by using external structures such as type IV pili in twitching. Type IV pili are hair like structures that pull the microorganism in a certain direction, like a ship with multiple oars rowing. Another example is flagella in swimming and swarming, which rotates like a propeller on an airplane or a rotor on a boat. In swarming, although microorganism s use flagellum to move, it can be difficult to swarm on rough surfaces. There for the microorganism facilitates it by producing a semi solid surface like a biofilm.

 Biofilms are a compilation of molecules that are produced by microorganisms for various functions. Some of these functions include facilitated motility, protection, and adhesion. To facilitate motility, microorganisms produces a semi-solid surface so that the microorganism can swarm over it instead of trying to swarm over a solid or rough surface. Another function of biofilms is the protection of the microorganism. Microorganisms can hide underneath the biofilm to protect themselves from external toxic molecules, antibiotics, or even other microorganisms. Without their biofilm, bacteria such as Pseudomonas aeruginosa are more likely to die. [1] Lastly, biofilms also allow for adhesion to surfaces. This helps bacteria that may be in unstable environments where they could be washed away or isolated. This is a way that can protect a microorganism from external factors.

 Virulence can be described as something that can cause harm to a host. There are multiple forms in which this is done. Some include damage to tissue, and production of toxic molecules. These traits can be inhibited by the host’s immune system, but when motility and biofilm are present, they allow the microorganism to avoid the immune system or protect itself from the host’s immune system. Virulence can also be increased by the prolonged survivability and uptake of nutrients to produce toxic byproducts.

 To conclude, microorganisms have a variety of abilities to get around, protect themselves, and ultimately survive. Though these methods may have their weaknesses, when using a multitude of these mechanisms they can be very difficult to remove from a host, or suppress their growth.

References:

1) Oluyombo, Olubukola, Christopher N. Penfold, and Stephen P. Diggle. "Competition in Biofilms between Cystic Fibrosis Isolates of Pseudomonas aeruginosa Is Shaped by R-Pyocins." mBio 10.1 (2019): e01828-18. Web. 07 Feb. 2019.