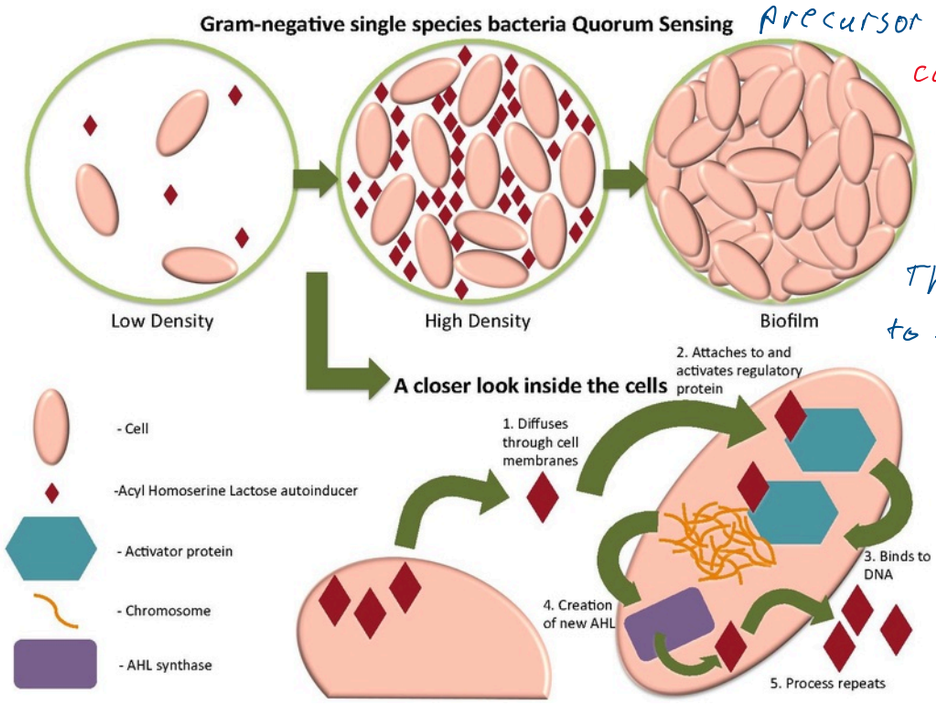
Life Sciences 11
Bacteria 3

Name:_____

The minimum number of votes needed for a valid election

Quorum Sensing and Biofilms

In order for life to become multicellular, like us, most plants and many fungi, a few precursors were necessary. The first is intracellular communication, how cells of the same type "talk" to each other. This allows cells to form tissues. The second precursor was intercellular communication, so different cells could communicate with each other. This allows tissues to form organs, groups of tissues working together.



From https://en.wikipedia.org/wiki/File:Quorum_sensing_of_Gram_Negative_cell.pdf

Quorum sensing in bacteria starts with the production of **AHL synthase** regulated by genes on the bacterial DNA. AHL synthase produces a hormone (a cell product that affects a cell other than the one that produced it), an AHL autoinducer, which is released from the bacterium to be picked up by other bacteria.

The autoinducers that are picked up signal the DNA to make more AHL synthase, which makes more AHL autoinducers, resulting in an increase in the density of autoinducers, like a positive feed-back loop. If the population is low, the AHL autoinducers simply diffuse away. However if the bacterial population is large enough **group action** is initiated, like the formation of biofilms and all **bacterial pathogenicity** ("disease" "origin") (origin of bacterial disease) All bacterial disease are a result of quorum sensing.

Quorum sensing also produces autoinducers that are picked up by other bacterial diseases. Biofilms often have more than one bacterial species.

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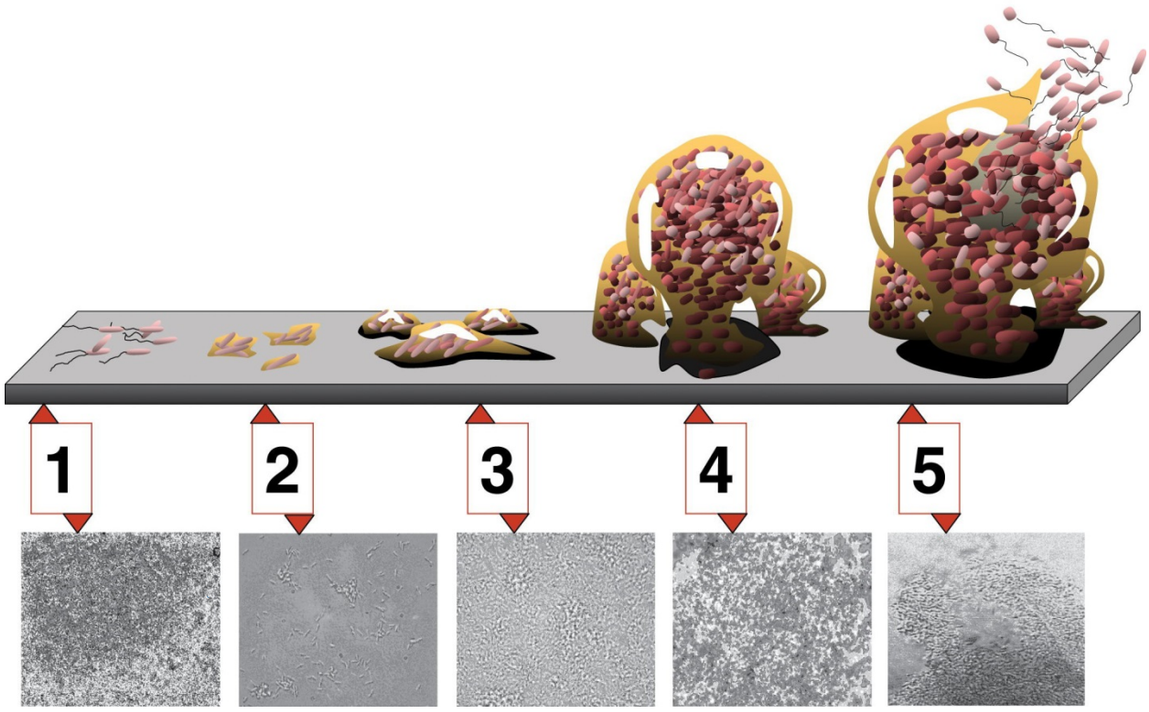
Five stages of biofilm development: (1) Initial attachment, (2) Irreversible attachment, (3) Maturation I, (4) Maturation II, and (5) Dispersion. Each stage of development in the diagram is paired with a photomicrograph of a developing *P. aeruginosa* biofilm. All photomicrographs are shown to the same scale.



By D. Davis - From: Looking for Chinks in the Armor of Bacterial Biofilms Monroe D PLoS Biology Vol. 5; No. 11; e307 doi:10.1371/journal.pbio.0050307 http://biology.plosjournals.org/perlserv/?request=slideshow&type=figure&doi=10.1371/journal.pbio.0050307&id=89595; CC BY 2.5 https://commons.wikimedia.org/w/index.php?curid=3364284

1. Attachment - When planktonic (drifting) bacteria settle on a surface, like a toilet bowl, bread board, teeth, skin, open food jars, etc, and attach because of their capsule. Bacteria without capsules can secrete sticky substances.
2. Irreversible attachment - The bacteria activite completely different genes than during their planktonic stage. These different genes code for proteins, lipids and sugars that will make up the Extracellular ("outside" cell) Polymeric ("many" "pieces") Substance (EPS).
3. Maturation I - the bacteria metabolize materials on the surface, or that float by, allowing them to grow and divide. The EPS forms a 3-dimensional structure that help protect the bacteria.
4. Maturation II - other bacteria may join the biofilm, which now houses a complete community including the corpses of dead bacteria, channels for fluids to flow and lots of autoinducers from quorum sensing.
5. Dispersion - pieces of the biofilm will slough off and may form new colonies, that is biofilms. Daughter cells will leave and revert to the original gene expression, floating as planktonic bacteria until they settle once again.