Taste and Smell.

- There are some senses which operate based on chemical stimuli which it detects from the environment. The two primary senses which function in said way is smell and taste.
- The human taste pallet can identify five basic tastes; Salty, Sour, Sweet, Bitter and Umami (Meaty/savory taste).
    - As previously mentioned, there can be an interconnection between senses in which one sense may receive sensory information from another one to emphasise a certain experience. This can be seen in taste especially, as taste can be intensified if the food we it is smelt as well.
- We taste foods by their chemicals exiting receptors on the tongue.
    - These receptors are not to be confused with ***papillae*** (the dot-like lumps on your tongue). Taste buds are located on the sides of papillae and within those taste buds are clusters of 50-150 receptors. These receptors come in contact with ***tastants*** (things which can be tasted) by entering into ***taste pores.***
        - Each taste cell is sensitive to only one of the 5 basic tastes and has a life of about 5-14 days, which means the taste cells are continuously regenerating.
        - Some of the sensory capabilities in the tongue excel beyond taste but can also detect temperature such as hot or cold food.
    - Despite common thinking that only certain tastes can be experienced at certain areas of the tongue, this is not true, you can experience all tastes at all areas of the tongue, however, some areas of the tongue are more sensitive to certain tastes than others.
- Different taste stimuli are received and inputted to the brain using different mechanisms including simple molecules acting on the membrane of taste receptors and metabotropic secondary messenger mechanisms.
    - ***Salty***: Since salt is a make-up of sodium (Na+) and Chloride (Cl-) it is perhaps easy to understand that salty tastes and processed in the brain through he depolarization of neurons through the influx of sodium ions in the salty foods. Blocking the sodium receptors, however, does not completely eradicate salty tastes. This suggests that there is a secondary source of input prone to taste salty tastes. This is believed to be a variant of ***TRPV1.***
    - ***Sour:*** The mechanism underlying the processing of sour tastes are not fully understood, however, since sour foods are acidic, research has made evident that all acidic foods release Hydrogen (H+) ions. Although there are no discrete conclusions on how we taste sour foods, sour-specific taste cells all appear to depend on one particular type of ion channel, ***PKD2L1***, for their preliminary function.
    - ***Sweet***: Unlike sour and salty tastes, sweet, bitter and umami tastes do not operate based on ionotropic receptor mechanisms but rather through metabotropic receptor mechanisms – that is they use G-protein coupled receptor molecules resulting in activation of asecondary messenger as

opposed to directly causing depolarization in taste cells. Sweet tastes, specifically, operate on receptors made up of simpler protein subtypes belonging to two families – ***T1R*** and ***T2R*** – combined in various ways. When two members of the T1R family combine – ***T1R2*** and ***T1R3*** - (heterodimerize), they create a receptor that selectively detects sweet tastants. However, some sweet tastes have different molecular structures, for example, sugar, saccharine and aspartame, how can they all be detected using one single receptor? This is due to the different types of sweet tastants interact with different recognition sites on the receptor complex (T1R2+T1R3). There is also believed to be a secondary source to input sweet tastants, but has not been currently identified.

  - ***Bitter***: Bitter tasting foods are more complex as they are evoked by many different tastants, this suggests that there is more than one receptor to bitterness. It is believed that most of the T2R family – with its 30 or so members – are widely involved in tasting bitterness. These taste cells are widely sensitive to a number of bitter tastes but have difficulty distinguishing between them. There appear to be people who can minimally taste bitterness, known as ***nonstasters*** and those who have a heightened sensitivity to bitterness, known as ***supertasters.*** This is believed to have a genetic underpinning.
  - ***Umami***: There are two relatively well understood mechanisms which input umami tastants. The first is a variant of the metabotropic ***glutamate*** receptor which is expressed in certain taste buds and most likely respond to the amino acid glutamate, which is found in large portions in meats and dairy. Another umami receptor lies within the T1R family (similar, but not the same as the combination of T1R2 + T1R3 receptors sensitive to sweet tastants). This is a heterodimer of ***T1R1*** +T1R3. There are also believed to be more receptors which are yet to be discovered.

- It is important to understand the neural circuit which is involved in the tasting sense, otherwise known as the ***Gustatory system.*** The specialized path for this system begins at the taste sensory receptors which extent along a series of afferent fibers to the ***brainstem nuclei*** and reach toward the ***thalamus*** before reaching the cerebral cortex. This pathway involves transmitting through three ***cranial nerves*** – the ***facial (VII)***, ***glossopharyngeal (IX)*** and ***vagus (X)*** nerves. The gustatory fibers in each of these run to the brainstem from which the second-order gustatory neurons project to the ***ventral posterior medial nucleus*** of the thalamus. After another synapse, third-order gustatory fibers extend to the cortical taste area located in the insula.

- Another sensory system which relies on chemical input is the sense of smell.
  - In general, human's ***olfactory system*** (smelling system) is weak compared to most other species, which is believed to be due to survival.
- The human olfactory system perceived information from the external environment (chemicals) using its receptors in the nasal cavities.
  - This begins with a sheet of cells on the surface of the nasal cavity walls called ***olfactory epithelium*** which is split into three types of cells; ***basal cells***, ***supporting cells*** and ***olfactory receptor cells***.