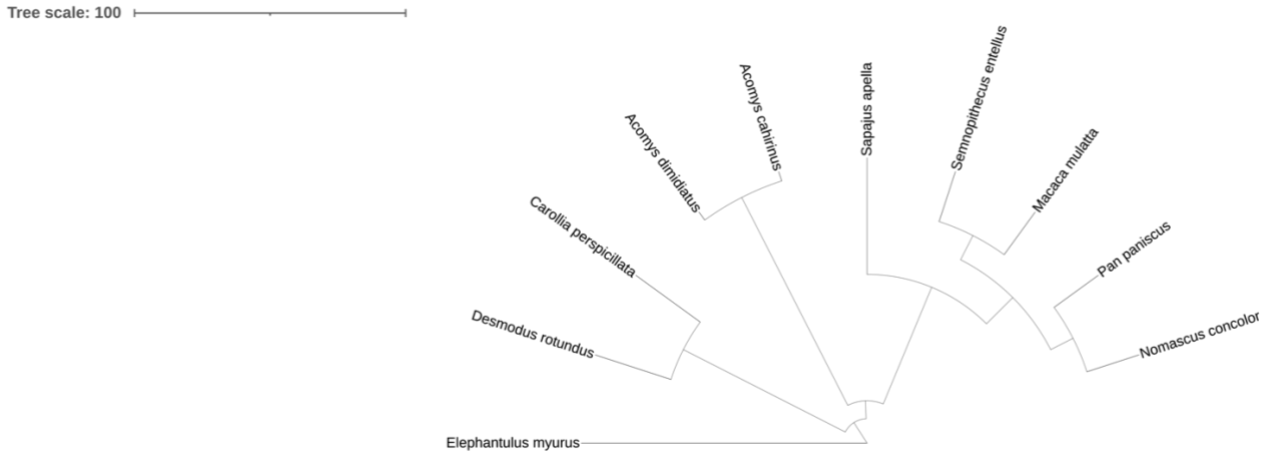
BIOS S-26 Summer 2021 Final

Part 1: Endometriosis

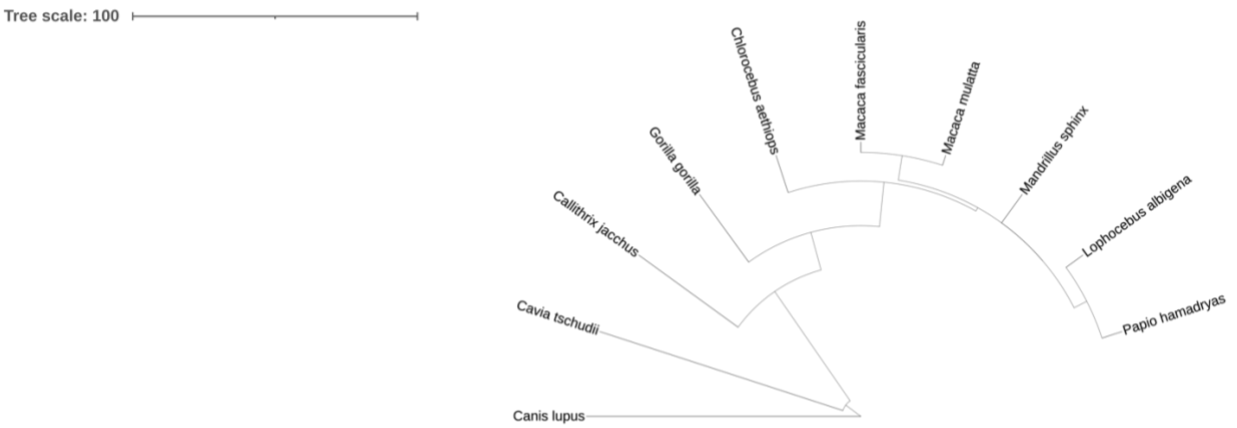
a)

The phylogeny of menstruation:



b)

The phylogeny of endometriosis:



Taxonomy of menstruation:		Taxonomy of endometriosis:	
Macaca mulatta	Sapajus apella	Cavia tschudii	Papio hamadryas
Carollia perspicillata	Desmodus rotundus	Callithrix jacchus	Mandrillus sphinx
Elephantulus myurus	Pan paniscus	Macaca mulatta	Macaca fascicularis
Acomys dimidiatus	Semnopithecus entellus	Ceropithecus aethiops	Cercocebus albigena
Hylobates concolor	Acomys cahirinus	Gorilla gorilla	Canis lupus

c)

For the ability to produce offspring, all female mammalians have a system to keep their sexual ability intact. Higher primates experience menstrual cycles, whereas all other mammals experience estrous cycle. Both processes basically keep sexual ability of mammalians ready to produce offspring. Yet, they have a main difference when fertilization doesn't take place: in menstrual cycle, there is a regular appearance of menses due to the shedding of the endometrial lining of the uterus; however, in estrous cycle, the endometrium tissue is reabsorbed by the uterus walls (Differentiate between the Menstrual Cycle and the Oestrus Class 12 Biology CBSE, n.d.; Estrus Cycle - an Overview | ScienceDirect Topics, n.d.). If we were to look these cycles from an endometriosis - happens when tissue like the lining of the uterus (womb) grows outside of the uterus (Endometriosis | Office on Women's Health, n.d.) - perspective, basically speaking, retrograde mensuration - menstrual blood containing endometrial cells flows back through the fallopian tubes and into the pelvic cavity (Endometriosis - Symptoms and Causes - Mayo Clinic, n.d.) - would be a very simple and elegant causation. This is because retrograde menstruation can easily explain the endometriosis: endometriosis needs menstrual blood to flow in from the uterus, and retrograde menstruation achieves this as in this type of menstruation menstrual blood flows inside from the uterus. Also, it can be inferred that, mammals not experiencing menstrual cycle but having estrous cycle do not experience endometriosis because in their natural mechanism, they can reabsorb unfertilized egg including endometrium tissue. Yet, according to a recent study conducted by Bandi et al. (2017) a guinea pig (Cavia tschudii) and according to a recent study conducted by a German shepherd (Canis lupus) (Paiva et al., 2015) – mammals that are not a higher primate and experiences estrous cycle – experience endometriosis. Also, in the mensuration phylogeny, guinea pig and German shepherd are not present. However, in the endometriosis phylogeny they are present. Thus, it can be understood that retrograde

menstruation can be an incorrect theory of causation for endometriosis. Furthermore, study of Bandi et al. (2017) demonstrates that at molecular level, during the embryogenesis, a perturbation could occur causing problems in the fine-tuning of female genital system, which in turn could cause the displacement of endometrial tissue at the beginning of organogenesis. In conclusion, it can be said that retrograde menstruation is likely to be an incorrect theory of causation for endometriosis; however, molecular problems that can happen in embryogenesis could cause problems in organogenesis causing disturbance in female genital system's tuning which in return could cause endometriosis.

Part 2: Feather-Plucking and Trichotillomania

a)

An animal species that experiences hair plucking/hair pulling is cat, Felis catus ('Hair Pulling', 2005)

b)

A bird species that experiences feather-plucking is parrots, Agapornis roseicollis (Costa et al., 2016)

c)

Ontogeny basically means "the development or course of development of an individual organism" (Definition of ONTOGENY, n.d.). Although it can be seen at all ages, mostly, in humans, trichotillomania is seen around adolescence. Also, in the case of feather-plucking disorder, parrots experience it around adolescence, too. Mostly, these ontogenetic rises of trichotillomania and feather plucking disorders are in adolescence due to some common behaviors that occur and cause these disorders in puberty. One example for these behaviors is sexual frustration. Humans, in adolescence, are most vulnerable to anxiety: they may have trouble at school, trouble at home, or excessive worries about school or family. Thus, these stressors causing the anxiety could lead to trichotillomania in humans (Trichotillomania (Hair Pulling Disorder), 2021; Trichotillomania in Teens and Young Adults, n.d.). Also, parrots: when they reach to adolescence, they are at their most anxious lifetime. They are threatened by predators, and they do not have any experience in either fleeing or feeding individually which in return can cause stress, and so feather-plucking (Feather Picking In Pet Birds - Zupreem Pet, n.d.). In conclusion, both disorders have similar ontogeny that makes them mostly arisen in adolescence.

d)

- While having feather-plucking disorder may cause physical damages such as skin infections and other serios complications, the feather-plucking may be adaptive because it can protect them from having high body temperatures which in return might have caused hyperthermia (Hyperthermia: Symptoms, Treatment, and More, n.d.; Hypothermia (Low Body Temperature), n.d.; Why Does My Bird Pluck His Feathers?, n.d.)
- To test this adaptive ability, I would design an experiment testing if standard feather plucking behavior helps lowering body temperature. There would be two groups of parrots, *Agapornis roseicollis*, used in this experiment. They would be 50 individuals at total, 25 parrots in each group. All these parrots will be given a non-lethal virus causing them heightened body temperatures, hyperthermia. Yet, the experimental parrot group would have a funnel around their neck hindering them to use their beaks to pluck feathers. The other group, the control group, would have nothing around their neck. This experiment will be carried out in a lab environment that is artificially turned into natural parrot habitats for decreasing any possible effects that can cause varying outcomes because these outcomes will be the representative of "wild-life parrots". In this artificial habitat, there will be thermal cameras that are specially equipped to detect any thermal change of body temperatures of parrots. Also, there will be cameras that are specially equipped to detect any possible feather-plucking behavior. The time phase of this experiment will be 1-2 days because even though the virus is non-lethal, it is still dangerous to keep the body temperature of parrots high for a very long time. After the hyperthermia causing virus is given to the parrots, 24-48 hours of time span will be waited. In this time span, thermal cameras will record the body temperatures if the feather-pluckable parrots' body temperatures decrease as they

pick their feathers. Also, the other specially equipped cameras will record if the body temperature decreasing parrots pluck feathers. If the body temperatures of parrots come back to normal after hyperthermia through the natural feather plucking disorder, and if there is a positive correlation found between feather plucking behavior and body temperature decrease, then, it can be concluded that natural feather-plucking behavior is beneficial to lower body temperature. In other words, it can be said that natural feather plucking behavior occurs in parrots as an adaptation to high body temperature, hyperthermia.

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