Directions
This report is designed to supplement your knowledge of mosquitoes – as ectoparasites and vectors of many diseases – by combining the data you gained in laboratory with information derived from several publications. The pages in this file provide the background and directions for completing your report. The file you will be submitting is the Report file with your answers filled in. This file will be turned in online at Turnitin.com. To do so, you will need to register on the website. The Class ID is 24004002. The enrollment password is mosquito. The assignment is due no later than March 23. Late assignments will receive an automatic 20 pt deduction for each 24 hrs.
To receive full credit for this report, you must do the following:

1. Answer all questions correctly. This means knowing the data we collected in class, reading the appropriate publications, and interpreting the climate data that is provided to you.
2. **Answers must be written as complete sentences unless otherwise stated**. Grammar and syntax (sentence structure) counts. Poorly written but correct answers will not receive full credit. All species names must be *italicized*. This is convention in scientific literature. Also, recall that a species name is a binomen (two part name): the first part (the genus) is always capitalized; the second part is never capitalized. A species name may be spelled out completely (*Homo sapiens*) or the genus name can be abbreviated (*H. sapiens*). Some of the publications you will examine have taken an alternative convention to species of *Aedes*: they use two letters to abbreviate the genus name, e.g., *Ae. aegypti*. That is also acceptable.
3. You may in some cases need to reference a particular publication in your answer. For example, if I ask you a question about mosquito development and your answer includes data or interpretation from a publication, make sure to reference it correctly. In your answer, cite the publication as Author (YEAR) or Author et al. (YEAR) for a publication with more than two authors. For example, an answer may reference a publication as follows: “Egg hatching is known to occur at temperatures down to 35 F (Couret et al. 2014)” OR “Couret et al (2014) state that eggs can hatch at 35 F.” Note that “et al.” is a way of referencing a publication with three or more authors. If a publication has two authors, then both author names must be included in the citation (e.g., Mickelson and Michaels (1969)).
4. Quotes are never acceptable and direct plagiarism is also unacceptable. Plagiarized answers or quotes will receive zero credit.
5. Submit only the questions/answers portions of the report with the answers – **do not submit this page or the background material.**

Background. In our studies, we took a batch of eggs of *Aedes aegypti* (a laboratory-reared strain known as the *Gainesville* strain (from Florida)) and attempted to hatch them in mosquito incubation chambers of approximately 500 ml water at different temperatures and with different oxygen levels to determine if either affects development. Mosquitoes larvae were fed a simple yeast powder once prior to egg hatching and then not again. It is assume the yeast promoted bacterial growth. Bacteria can do two things:

1) serve as a source of nutrition for larvae; 2) utilize available oxygen and therefore make the water more anaerobic over a period of time. Temperatures were not monitored 24/7 so we don't know if fluctuations were present or not. For the sake of this experiment, let's assume the temperatures remained consistent.

On the website will be a pdf file labeled **Climate Data Lowell (2019)**. This file contains tables of climate data that include minimum and maximum temperature data for every day of each month, beginning in January and ending in December, 2019.

There are also **Publications** for background data.

Mohammed, A. & Chadee, D.D. 2011. Effects of different temperature regimes on the development of *Aedes egypti* (L.) (Diptera: Culicidae) mosquitoes. Acta Tropica 119: 3843.

Martin et al. (2019). Surveillance of Aedes aegypti indoors and outdoors using Autocidal Gravid Ovitraps in South Texas during local transmission of Zika virus, 2016 to 2018. Acta Tropica 192: 129-137.

Important Cautions.

1. Some publications use the word “eclosion” to mean an egg that hatches to yield a larva. Others might use the same word to indicate a pupa that successfully completes metamorphosis to the adult stage – the adult emerges from the pupal case sort of like an egg hatching.
2. In scientific studies, we find that similar experiments can yield different data, which may lead to different interpretations of this data. Keep this in mind as you answer your questions.
3. Also, as biologists, it is imperative you understand that natural variation is a part of life, which may or may not figure into our understanding of why identical experiments might yield different results.

For the purposes of this report, we are going to make several assumptions about our data, the climate data, and the mosquitoes (some assumptions are real, others are fictional and only considered relevant for this assignment).

1. For Lowell Climate Data, air temperatures and water temperatures are identical. This is of course not true, but it eases our analysis.

2. There are maximum and minimum temperatures for each day. Both last 12 hours (again, not true, but let's pretend it is). You **MUST** pay attention to **both** temperatures to answer the questions properly.

3. The eggs of *A. aegypti* can withstand temperatures to 0º F, meaning the embryos will only die below that temperature. Minimum temperature for the eggs to hatch is the minimum temperature we examined in class. We are going to use **68º F** as our minimum.

4. Larval instars 1-3 cannot enter diapause and will die if temperatures drop **below 45ºF** for any period of time.

5. The time from hatching to the pupal stage is 4 days (minimum) - 14 days (maximum). Assume the quickest period of development can happen rapidly (4 days) at any temperature above their minimum acceptable temperature (70ºF). The 7 day maximum may be achieved for reasons other than temperature (e.g., food is not abundant, which delays development).

6. Pupae (instar 4) generally develop in 2 days to the adult mosquito stage provided the temperature is not below some thresh hold. For example, pupae die if temperatures drop **below 30º F** for any period of time, and will not metamorphose to adults at temperatures **below 45º F.** Pupae can also delay development (this is not diapause) by as much as 6 additional days (for a total of 8 days in the pupal state) if the temperatures are below their ideal temperature and above the temperature that kills them. If pupal development lasts more than 10 days, they die.

7. Total time from egg to adult is 6 days under ideal conditions (4 days to pupa, 2 days to adult); 22 days maximum under minimally acceptable conditions (14 days to pupa, 8 days to adult)

8. Adult female mosquitoes can live a few weeks when active, but are only active at temperatures **at or above** 45º F; when temperatures drop **below** 45º F, they enter diapause quickly (within hours) and can remain in diapause for up to 60 continuous days. They can only enter diapause once; after they exit diapause, they cannot reenter it. They can exit diapause quickly (within hrs) provided the temperatures are at or above 45º F. Adult females die if temperatures drop **to 20º F or below** for any length of time (diapause cannot withstand temperatures below 20º F).

9. Female *A. aegypti* have nectar feeding patterns similar to *Culex tarsalis*.

10. Males live only live for three days and can only live at temperatures **at or above 45º** F. They cannot diapause.