

Bio 112 Handout for Ecology 1

This handout contains:

- Today's iClicker Questions
- Handouts for today's lecture
- Information for Exam 3

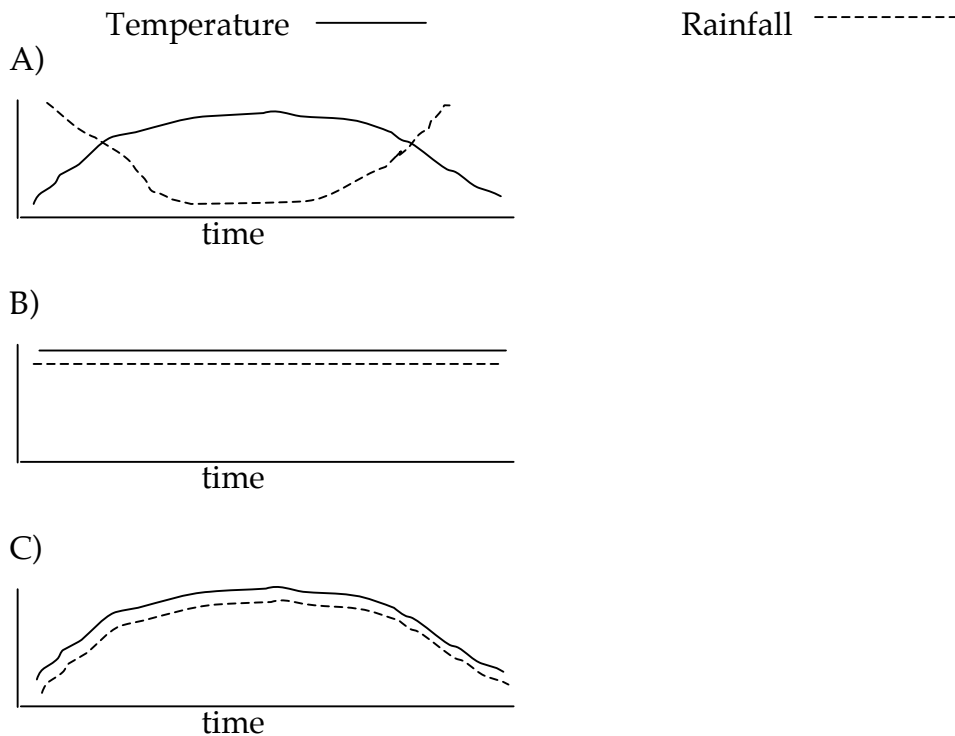
iClicker Question #29A - before lecture

Which of the following are true?

- A. The annual pattern of high and low rainfall is the same all over the world.
- B. Plants only require warm temperatures to grow.
- C. The temperature varies less over the course of a year in the tropics than elsewhere on earth.
- D. All of the above
- E. None of the above

iClicker Question #29B - after lecture

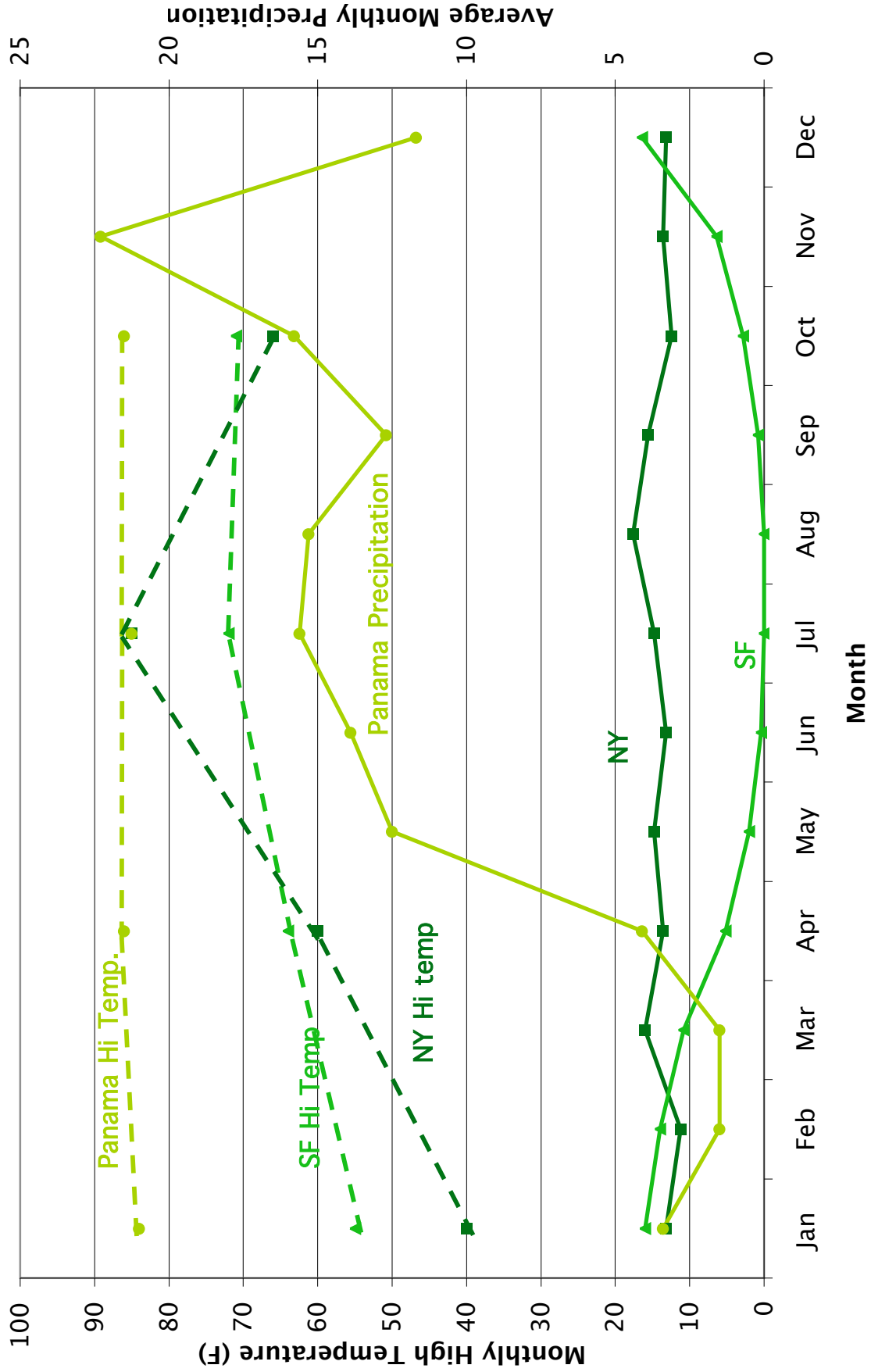
Which of the following climates would have the longest growing season?



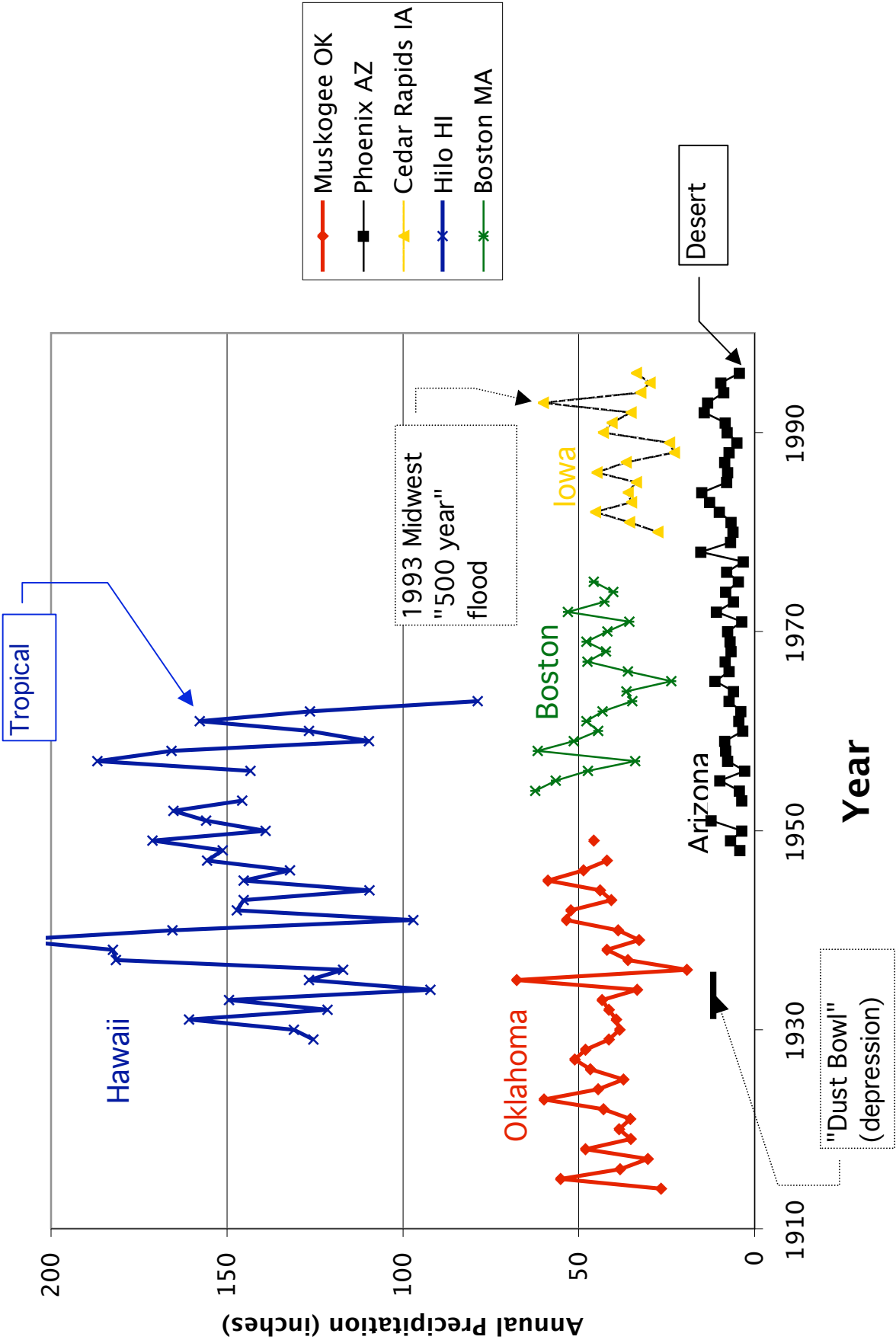
- D) All would have the same length growing season.

Figure out your answer and select the appropriate number (A-E) then send in your answer.

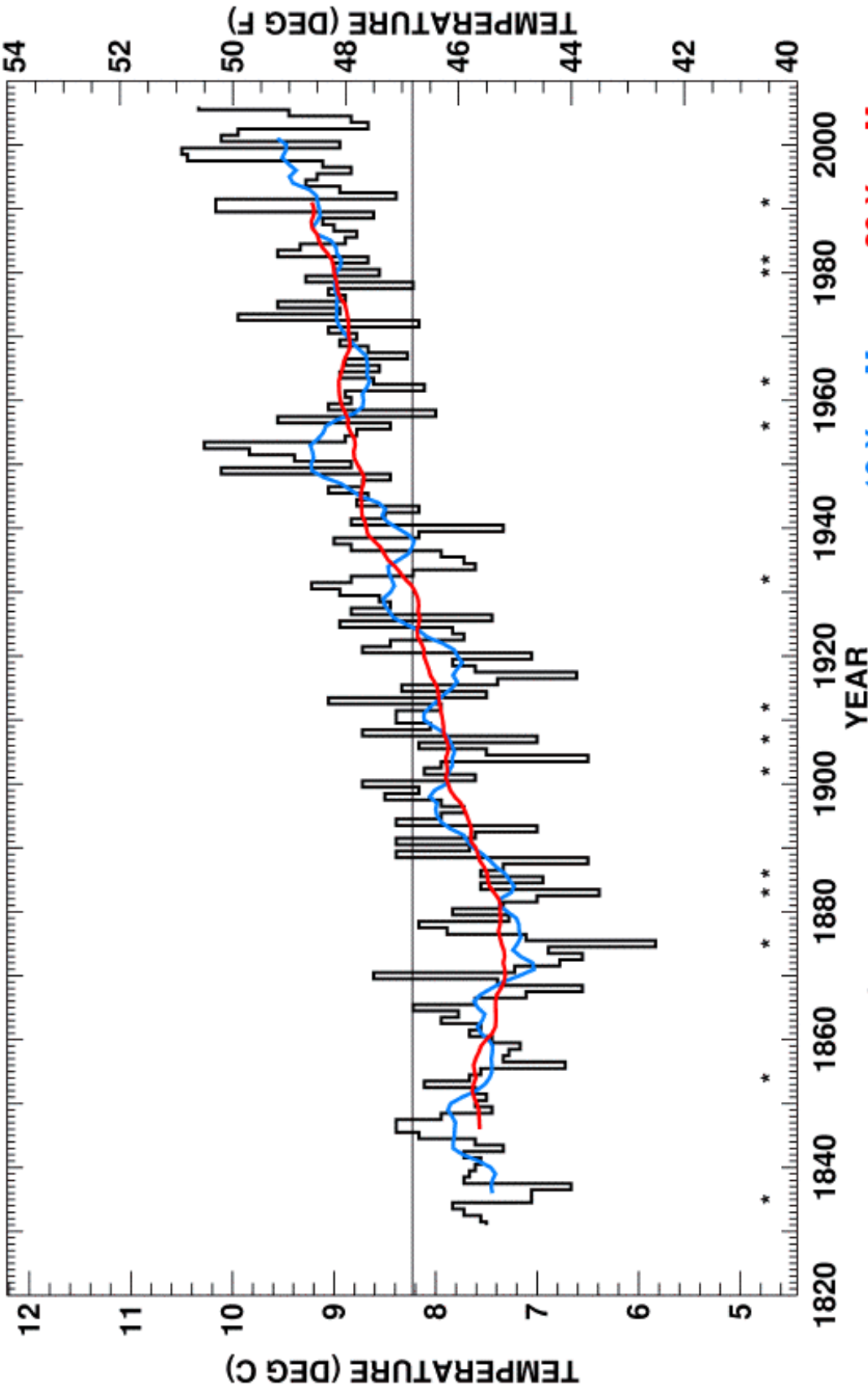
Precipitation & Temperature



Annual Precipitation in selected US cities



BLUE HILL OBSERVATORY ANNUAL TEMPERATURE, 1831-2006

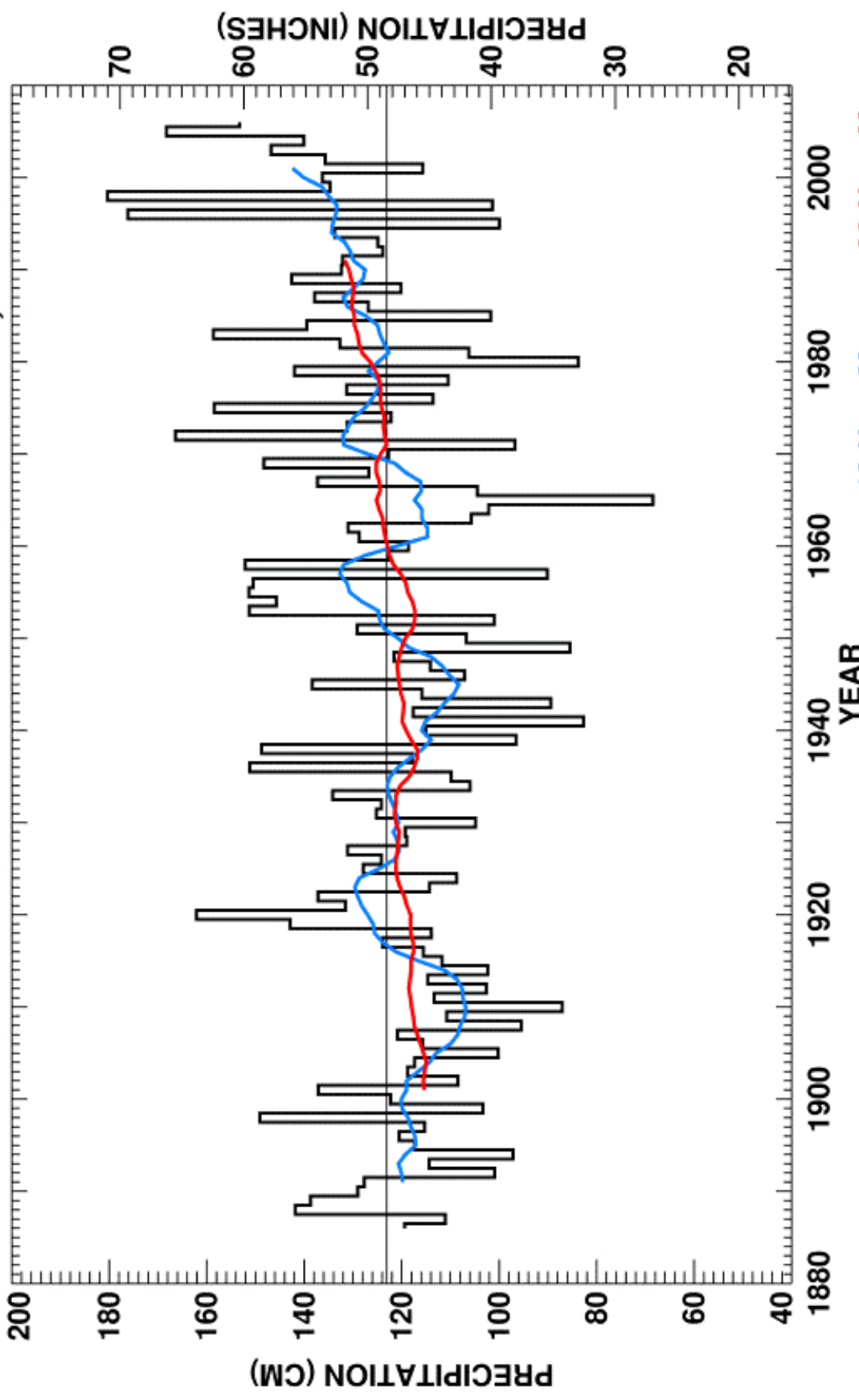


Maximum: 10.5 deg C (50.9 deg F), 1999
Minimum: 5.8 deg C (42.5 deg F), 1875
Record Mean: 8.2 deg C (46.8 deg F)

Note: Plot includes temperature data for 1831-1884 from Milton and Canton that were adjusted to the Blue Hill summit location.
 Michael J. Iacono, Atmospheric and Environmental Research, Inc. / Blue Hill Observatory



BLUE HILL OBSERVATORY ANNUAL PRECIPITATION, 1886-2006



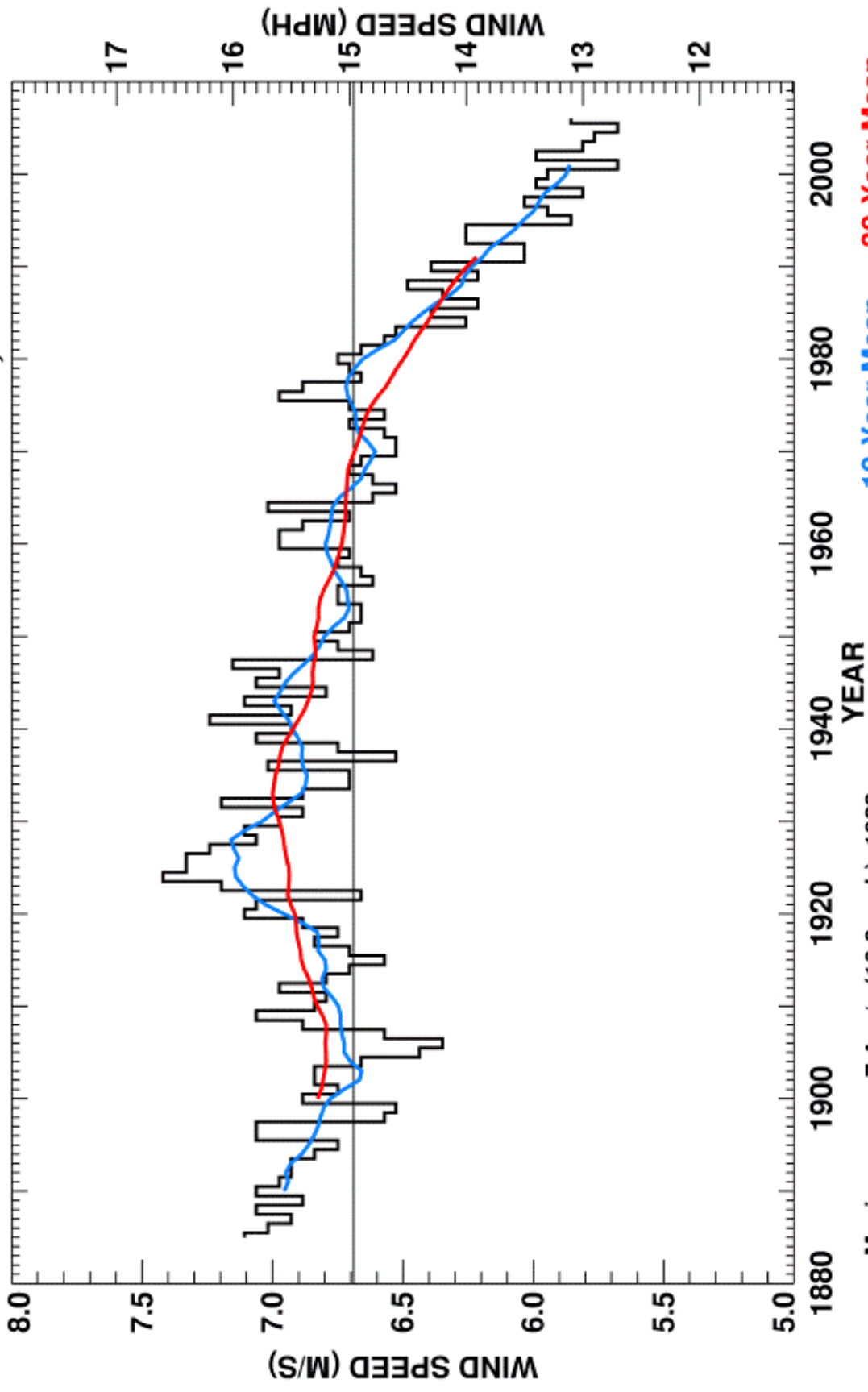
Maximum: 180.34 cm (71.00 in), 1998
Minimum: 68.48 cm (26.96 in), 1965
Record Mean: 123.09 cm (48.46 in)

10-Year Mean 30-Year Mean

Michael J. Iacono, Atmospheric and Environmental Research, Inc. / Blue Hill Observatory



BLUE HILL OBSERVATORY ANNUAL WIND SPEED, 1885-2006



Maximum: 7.4 m/s (16.6 mph), 1923
Minimum: 5.7 m/s (12.7 mph), 2001 and 2005
Record Mean: 6.7 m/s (15.0 mph)

Michael J. Iacono, Atmospheric and Environmental Research, Inc. / Blue Hill Observatory



Bio 112: Information for Exam III

Basic Facts

- The exam will be held in rooms TBA as listed in the syllabus from 12:00 to 12:50.
 - The exam will cover reading, lab, and lecture from Animals 1 through Physiology 8 as described below.
 - The exam will consist of approximately 4 questions. These will not be multiple choice; they will be problem-solving or short answer. In general, the questions will expect you to apply and make connections between the things I have talked about in lecture.
[Numbers in brackets refer to particular lectures]
-

– You need to know:

- what the systems in the “schematic animal” [Animals #1] do and in which of these systems the organs I mentioned in lectures function.
 - the 15 different properties of the 10 different groups of animals as specified on the “Animal Lecture Outline” handout. You need to know only the level of detail I presented in lecture. For the information I told you to know but did not cover in lecture, you should know it at a level of detail that is comparable with the details I presented in lecture.
 - how to explain the different adaptations of the physiological systems in terms of size, scale, habitat, etc.
 - how the movement of ions across a membrane can affect the membrane potential
 - the different ion channels, pumps, receptors, and enzymes I mentioned in lecture (Na^+/K^+ ATPase pump, K^+ channel, voltage-gated Na^+ channel, NT-gated Na^+ or K^+ channel, Acetyl-choline receptor, Acetyl-choline receptor, Ca^{++} pump in the SR, actin, myosin, ATP, Ca^{++} ions, ORP, G-protein, ATCase, cAMP, cAMP-gated Na^+ -channel), their effects on membrane potential (as appropriate), how their opening & closing are controlled (where appropriate), and their roles in the processes listed next.
 - The mechanisms of (at the level of detail I gave in lecture):
 - action potential
 - synaptic transmission
 - muscle contraction
 - stimulatory & inhibitory effects on neurons
 - resting potential
 - sensation of smell in the OSN cells
 - sensation of light in rod cells (this was not covered in lecture; you do need to know it at the same level of detail as smell sensation - see fig 50.21).
 - the material on excretion given in lecture [Physiology #7 & #8]
-

– You **do not** need to know:

- anything about the nemertean worm – it has been replaced by the rotifers
- the details of nasal anatomy, brain anatomy, or chemistry from the “smells” lecture
- the specific functions of any neurotoxins or drugs

-
- The exam will consist of questions like (also see exam from last year at end of lab manual; solutions are attached):
 - “what are the 2 major differences between the nervous systems of... explain how these differences reflect the organism’s lifestyle, habitat, etc..”
 - “there are 2 types of excretory systems, A and B, give an animal with each type”
 - “which ions are moving, in what directions, & thru what channels during the action potential (or inhibitory synapse, stimulatory synapse, etc.)
 - “what would be the effect on the muscles/sensations of an animal treated with neurotoxin X, which blocks the Y channel?”
 - “if I open the Z channel, which way will the Z ions flow & what effect will this have on the membrane potential/firing of an action potential”

NOTE: When noting differences, you must include both parts of the comparison. For example, if the question asked “Give one difference between a dog and a cat.”, and you answered “Dogs bark” or “Cats meow”, you would get very little credit. The full-credit answer is “Dogs bark and cats meow”. Also, simply restating the question (“One is a dog and the other a cat”) is not worth any credit.

- You may bring in a single sheet of (8 1/2 x 11 inch) paper with any notes you want. You may write on both sides.

Bio 112 Exam #3

4/28/08

Your Name: _____

PLEASE CIRCLE YOUR LAB SECTION:

- | | | |
|---------------------|------------------|----------------------|
| (1) Tues AM Aimee | (4) Weds AM Juan | (7) Thurs AM Alex |
| (2) Tues AM Tsering | (5) Weds PM Alex | (8) Thurs PM Martine |
| (3) Tues PM Martine | (6) Weds PM Juan | (9) Tues PM Tsering |
| | | (11) Thurs PM Aimee |

Write your initials on every page in the space provided.

This exam has 7 pages including this coversheet.

Check that you have pages 1-7.

This exam has four questions.

Make your answers as clear and precise as possible.

Answer all questions in the space provided.

Question	Value	Score
1	34	_____
2	20	_____
3	34	_____
4	12	_____
Bonus	1	_____
TOTAL:	101	_____

Ecology 1 - 7

Question 1: Animal Diversity (34 points)

a) Consider the respiratory systems of a nematode and a caterpillar:

i) What is the major difference between the respiratory systems of the two? (3 pts)

ii) Draw a rough sketch of each organism's respiratory system that shows this difference. Your sketch should only show enough detail to make this difference clear; label the directions of O₂ and CO₂ flow as appropriate. (8 pts)

nematode

caterpillar

b) Give two differences between the nervous systems of a nemertean worm and a jellyfish.

i) (2 pts)

ii) (3 pts)

Question 1, continued:

c) Give **three** differences between a roundworm (**nematode**) and a flatworm (**planarian**).

i) (2 pts)

ii) (3 pts)

iii) (4 pts)

d) Give **three** differences between a **squid** and a **sponge**.

i) (2 pts)

ii) (3 pts)

iii) (4 pts)

Question 2: Animal Diversity II (20 points)

Use the following animals to answer the questions on this page.

- sponge
- squid
- trout
- jellyfish
- caterpillar
- nemertean worm
- planarian
- earthworm
- nematode
- starfish

a) Give two animals from the list above that are capable of **regenerating** significant parts of themselves.

(2 pts)

(3 pts)

b) There are at least three different types of **digestive systems** we have looked at. For each, give **one** animal from the list above that has that type of digestive system. If more than one is possible, give only one. (3 pts each)

No digestive system _____

Gastrovascular cavity _____

Flow-through digestive system _____

c) Many of the animals we have discussed have one or more **hearts**. For each number of hearts, give one animal from the list above that has that number of hearts. If more than one is possible, give only one. (2 pts each)

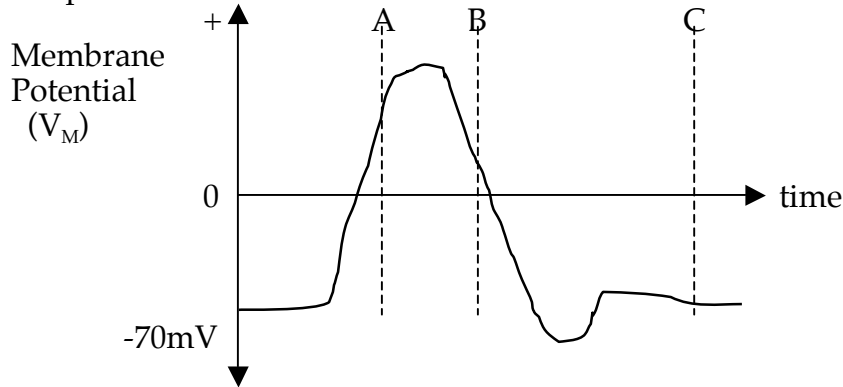
No heart _____

Only one heart _____

More than one heart _____

Question 3: Neurobiology (34 points)

a) Shown below is a plot of membrane potential at a single point on an axon as a function of time as an action potential travels down that axon:



For each of the three time points indicated, fill in the boxes in the following table with the appropriate term; choose from the terms in {braces} in the left column of the table. Please use the terms provided. (2 pts each)

Time Point	A	B	C
K ⁺ Flow through K ⁺ Channel {Into axon, Zero, Out of axon}			
Na ⁺ Channel status {Inactivated, Closed, Open}			
Na ⁺ Flow through Na ⁺ Channel {Into axon, Zero, Out of axon}			

b) Botulinum toxin is a neurotoxin produced by a bacterium; it is the active ingredient in the cosmetic Botox. Botulinum toxin prevents motor neurons from releasing Acetylcholine.

i) What would the effect of botulinum toxin be on the muscles of an animal? (5 pts)

not paralyzed

paralyzed & rigid

paralyzed & limp

Explain your reasoning briefly.

ii) Would botulinum toxin cause numbness in the animal? (5 pts) yes no

Explain your reasoning briefly.

Question 3, continued:

c) Consider a synapse. In this synapse, the neurotransmitter released by the pre-synaptic cell causes neurotransmitter-gated **potassium** (K^+) channels to **open** in the post-synaptic cell. (circle your answers).

i) When these channels open, in which direction will the K^+ ions flow? (2 pts)

flow into cell

flow out of cell

ii) What effect will this movement of ions have on the membrane potential (V_M)? (2 pts)

make V_M more +

make V_M more -

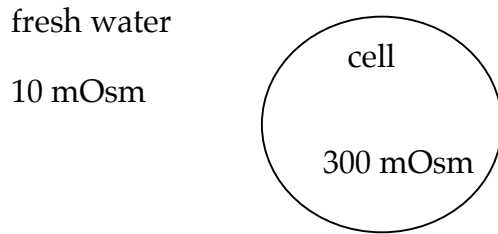
iii) What type of synapse is this? (2 pts)

excitatory synapse

inhibitory synapse

Question 4: Physiology (12 points)

a) Consider a cell in fresh water. This is shown below:



Which way will the water tend to move in this situation? Circle your answer and explain your reasoning. (4 pts)

- Water will move into the cell.
- Water will neither move into nor move out of the cell.
- Water will move out of the cell.

Explanation:

b) Consider an animal in seawater (1000mOsm); it has a problem with water loss to the surrounding seawater. For each of the following strategies, state whether or not this would solve the animal's water loss problem and explain your reasoning. (4 pts each)

i) The organism pumps water out of its cytoplasm into the surrounding seawater.

Explanation:

Would Would not

ii) The organism maintains a high concentration of amino acids in its cytoplasm so that there is the same amount of 'stuff' as in the seawater.

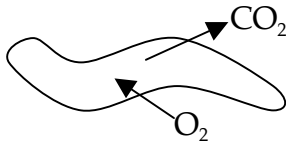
Explanation:

Would Would not

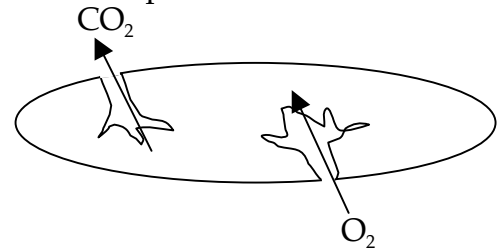
Bio 112 Solutions to Exam 3 from Spring 2008:

1) a) i) Nematode respire by diffusion through cuticle; caterpillar uses spiracles & tracheoles.

ii) nematode



caterpillar



b) Nemertean worm
has brain/ganglion
2 lateral cords ("ladder-like")

jellyfish
doesn't
nerve net

c) Nematode
excrete via canals
2 longitudinal nerve cords
flow-thru digestion
mouth at head
moves by undulation

Planarian
excrete via flame cells
4 longitudinal nerve cords
gastrovascular cavity
mouth/anus at center
moves by cilia

d) Squid
respire by gills
has circulatory system
has mouth
mobile
has nervous system
has flow-thru digestive system

Sponge
cells respire individually
doesn't
doesn't
sessile
doesn't
done by individual cells

- 2) a) Sponge, planarian, starfish
- b) None: sponge
Gastrovascular: jellyfish, planarian
Flow-thru: squid, trout, caterpillar, nemertean, earthworm, nematode, starfish
- c) None: sponge, jellyfish, nemertean, planarian, nematode, starfish
One: trout
More than one: squid, caterpillar, earthworm
- 3) a)

	<u>A</u>	<u>B</u>	<u>C</u>
K ⁺ flow	out	out	out
Na ⁺ status	open	inactive	closed
Na ⁺ flow	in	0	0
- b) i) Paralyzed and limp. Since no ACh can be released, the muscles cannot contract, so they will be paralyzed (unresponsive to brain control) and limp (always relaxed).
- ii) No. ACh acts only in motor neurons, so blocking its release will not affect sensory neurons.
- c) i) out of cell
- ii) make V_m more -
- iii) inhibitory synapse
- 4) a) Water will move into cell. Water moves from high water concentration (low mOsm) to low water concentration (high mOsm). Therefore, it will move into the cell.
- b) i) This would not help. Since the organism's problem is water loss, pumping water out would make things worse.
- ii) This would help. Since the cell and the surrounding fluid would be iso-osmotic, there would not be any net flow of water into or out of the cell.

