Circadian Rhythms Evaluate Activity Name _____

RUNNING OUT OF TIME

> *"Most animals are content to obey their SCN and let it orchestrate the expression of a multitude of circadian rhythms. Humans, however, have a mind of their own and often use this mind to disobey their 'internal clock'" (Vitaterna, p. 91)*

The USA Olympic track and field team travels from New York City to Madrid, Spain on a non-stop flight. When they arrive in Madrid it is 9:30 a.m. local time but in New York it is 3:30 a.m. During their first day in Madrid, many of the athletes are bothered by jet lag. They feel like going to sleep in the afternoon but they're awake in the middle of the night. Many complain about digestive problems. The coach is very concerned about how this will affect the athletes' performance. As an expert about circadian rhythms, they have contacted you. Here's how to use your knowledge!

1. What is the reason that the athletes are having difficulties getting up in the morning? Explain how the trip has influenced their sleep cycles. Identify whether the phase shift is an advance or a delay.

2. What are the connections between the SCN and the liver and the problems they athletes are experiencing? How has the trip caused problems with their activity/rest cycle and their digestion?

3. What would you recommend to the coach to fix the athletes' *zeitgebers* and why is it necessary to try and entrain more than one *zeitgeber*?

4. How might the transcription and translation of genetic information explain the athletes' jet lag?

5. The Olympic cycling team is planning to travel from New York City to Lima, Peru. The distance is almost the same as the track team traveled to Madrid. The coach and athletes are worried because of what happened with the track team. What would be your advice? [Hint: NYC is at 74° West longitude and Lima is at 77° West longitude.]

6. Explain how your knowledge of the fly and rodent circadian biology helps you to understand human jet lag.