HUMAN Sample Experiment
High Altitude Simulation
(a one variable experiment)

(version 5/04/06)

Students wish to simulate an ascent to the summit of Mount Mckinley (12,500 ft.), perhaps to compare the simulated data with actual data from a published experiment. The approximate barometric pressure at this height is 480 mmHg.

1) To set up HUMAN at sea level before ascending (i.e. control), at the opening screen (see below)

Select

- Pick Experiment number 1 (see above left)
- Run for 0 minutes with 0 minutes between printouts.

Click on **<Run>** (lower right)

- this results in the "Output from Human Program" shown below (top)

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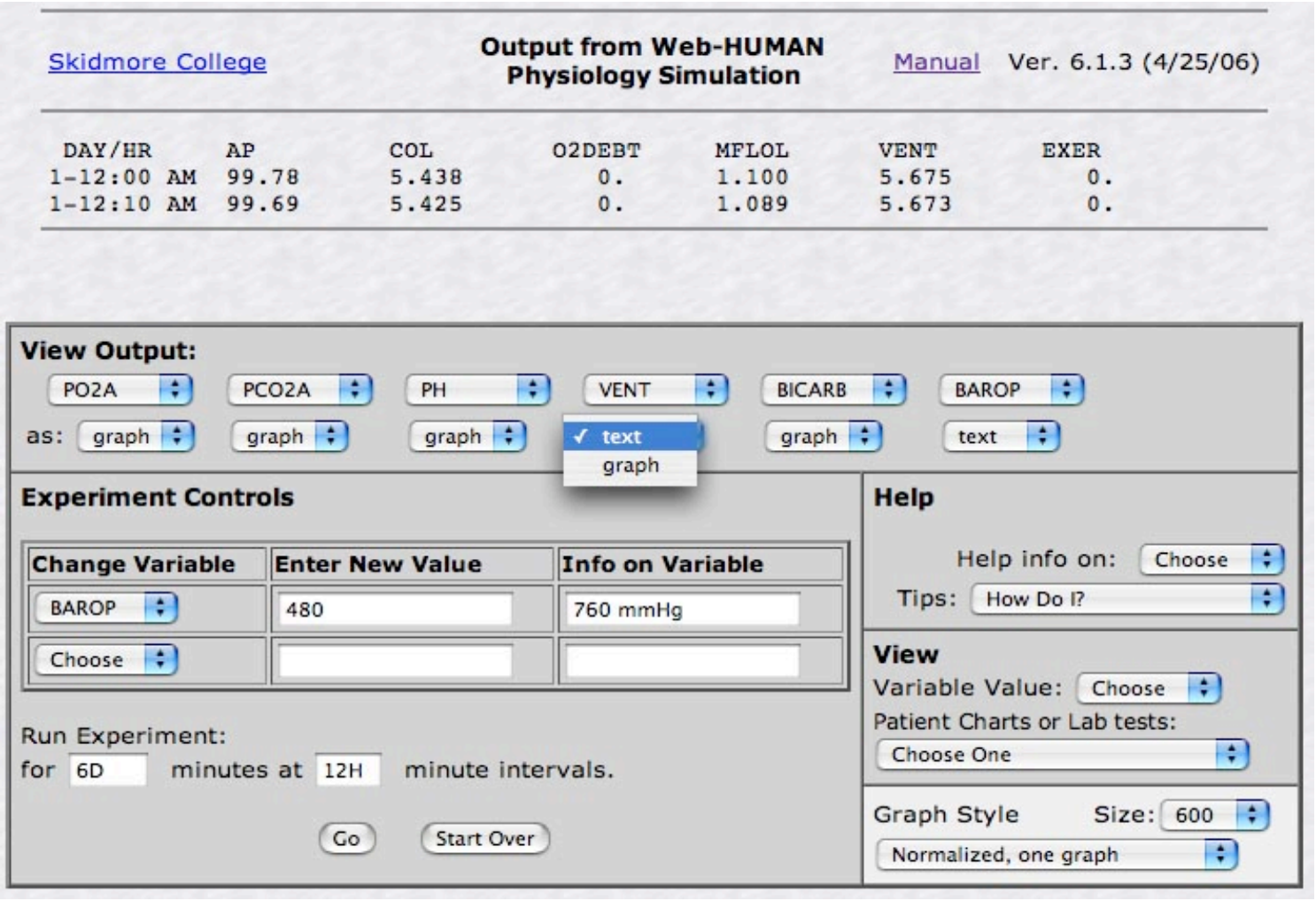
2) HUMAN is now ready to be set up at high altitude for a 6 day experiment while tracking the respiratory and blood gas responses in its tables. The steps involved in this setup are shown below.



a) To change the barometric pressure (BAROP) from sea level value (760 mmHg) to 12,500 ft. value (480 mmHg).

Under **Change Variable** scroll down to BAROP and enter the new desired value (480).

b) To change the table columns to read out ventilation and blood gas variables.

Under **View Output:** scroll down in columns 2- through 7- to obtain values for

HUMAN Variable	Physiologic variable
PO2A	Alveolar partial pressure O2 (mmHg)
PCO2A	Alveolar partial pressure CO2 (mmHg)
PH	Arterial blood pH

VENT	Lung ventilation (Liters/min.)
BICARB	Plasma bicarbonate (meq./Liter)
BAROP	Barometric pressure mmHg

c) To set up the graph to plot all 6 of these variables (be certain your browser popup blocking is off!)

1) Under **View Output as:** (upper left, 2nd row)

change each variable to as: **graph** from its default as:**text** (see VENT as an example)
(This will result in output both as a Table and as a Graph)

2) Under **Graph Style** (lower right) simply retain the default choices of

- a normalized plot (values will be shown as change from baseline control values) and
- one graph (all 6 values will be shown on one single plot)

d) To setup to gather data for 6 days at 12 hour intervals

Under **Run Experiment**

- for experiment duration type in 6D (default is minutes, D = days, H= hours)
- for printout intervals type in 12H to yield printouts every half day

e) **Click** on **<Go>**
- this runs the experiment resulting in a tabular and a graphic output window.

- Click on the Tabular window to bring it to the foreground as shown in the "**Output From Web-HUMAN Physiology Simulation**" below.

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3) The output of the high altitude experiment, beginning on Day 1 at 12 a.m. (column #1)

Skidmore College **Output from Web-HUMAN Physiology Simulation** Manual Ver. 6.1.3 (4/25/06)

DAY/HR	AP	COL	O2DEBT	MFLOL	VENT	EXER
1-12:00 AM	99.78	5.438	0.	1.100	5.675	0.
1-12:10 AM	99.69	5.425	0.	1.089	5.673	0.

Barometric Pressure (760. mmHg) = 760.00
Barometric Pressure (760. mmHg) = 480.00
6.00000 Days are 8640.00 Minutes
12.0000 Hours are 720.000 Minutes

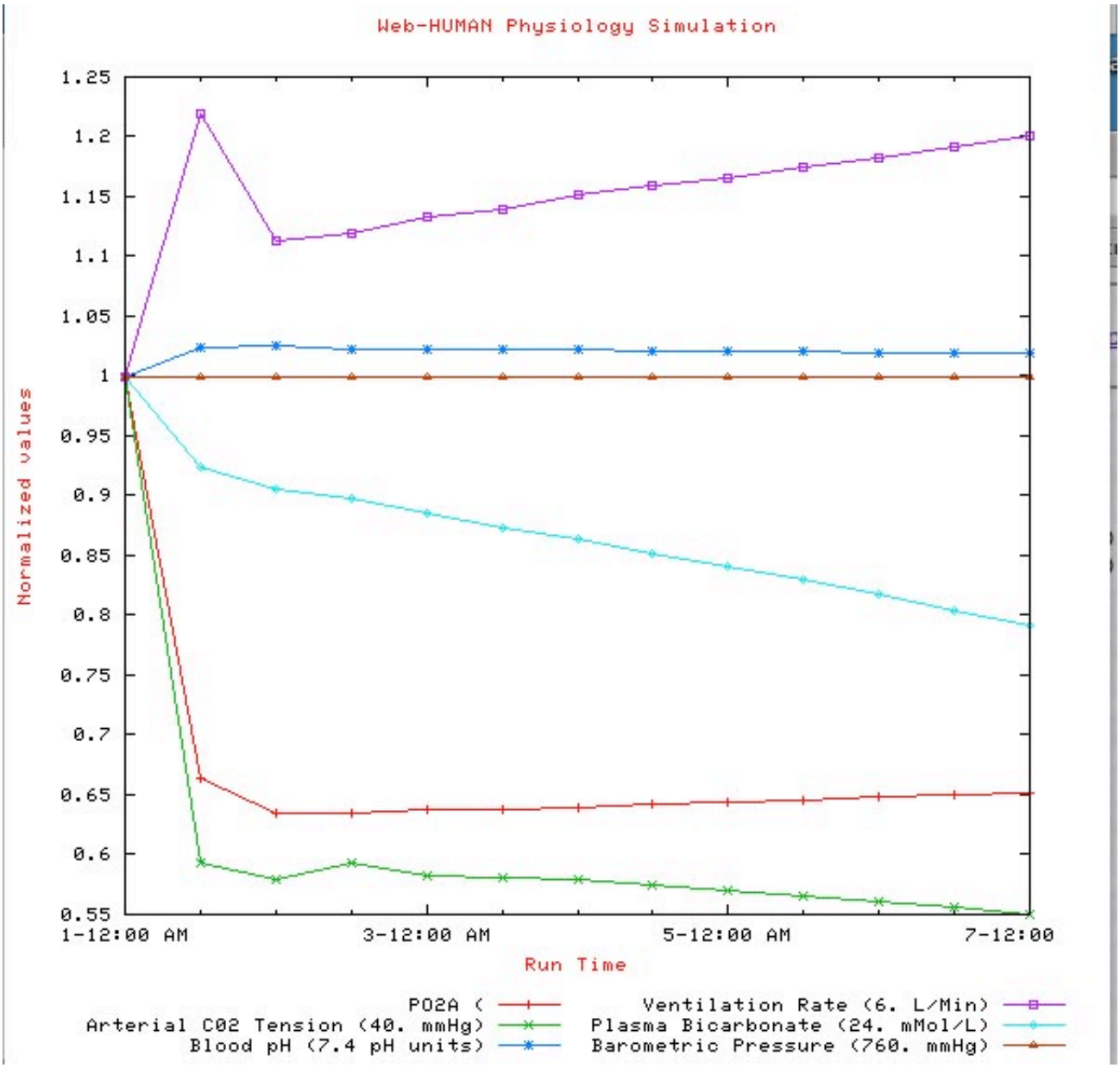
DAY/HR	PO2A	PCO2A	PH	VENT	BICARB	BAROP
1-12:10 AM	97.34	38.27	7.410	5.673	23.69	480.0
1-12:10 PM	64.68	22.67	7.584	6.916	21.87	480.0
2-12:10 AM	61.91	22.15	7.596	6.316	21.45	480.0
2-12:10 PM	61.88	22.67	7.581	6.352	21.25	480.0
3-12:10 AM	62.19	22.26	7.580	6.429	20.96	480.0
3-12:10 PM	62.24	22.24	7.576	6.467	20.70	480.0
4-12:10 AM	62.39	22.19	7.571	6.533	20.45	480.0
4-12:10 PM	62.60	21.99	7.568	6.579	20.19	480.0
5-12:10 AM	62.78	21.80	7.565	6.620	19.92	480.0
5-12:10 PM	62.97	21.59	7.561	6.663	19.65	480.0
6-12:10 AM	63.16	21.40	7.558	6.713	19.36	480.0
6-12:10 PM	63.35	21.38	7.553	6.762	19.06	480.0
7-12:10 AM	63.57	21.20	7.548	6.816	18.75	480.0

Graphing selected: Click here if graph does not appear.

shows

- an immediate hypoxia (drop in PO2A-column 2) due to the drop in BAROP.
- an increase in ventilation (VENT-column 5) in an attempt to compensate for the PO2 drop.
- a hypocapnia (PCO2A drops- column 3) due to the hyperventilation
- an increase in pH (column 4) indicating a respiratory alkalosis as a result of the PCO2 drop
- a plasma HCO3- drop, at least initially due to the hypocapnic hyperventilation.

Click on the graph to bring it to the foreground. It appears as shown below.



The graphic output also clearly illustrates each of these trends.

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4) Some other possibilities

a) observations in this data- the beginnings of a compensatory kidney-induced acidosis

b) observations by setting up new tables
Use the <List all variables> option (see figure 2 above) to track the developing polycythemia, increased hemoglobin, increased red cell production and increased blood viscosity.

c) new variations on the experimental design
- can the high altitude hypoxia be fully relieved by breathing 100% O2 (FO2AT) [fraction of O2

in atmosphere]?
- how compromised is the model's exercise endurance on Mckinley as compared to sea level (adjust EXER and XERMIN, testing in each environment at comparable exercise levels).