

Teach Yourself How To Use *Web-HUMAN* Exercise Physiology - An Introduction To The *web-HUMAN* Systems Physiology Teaching Model

(Version for HAPS 07, San Diego, May 25, 2007)

Welcome to HUMAN and the HAPS 07 workshop! We will be examining systems exercise physiology via the tutorial below. Save this document as it will allow you, step-by step and screen by screen, to review on your own how to use *web-HUMAN*. You will also find an on-line copy under Workshops in the HUMAN manual [Human is at <http://placid.skidmore.edu/human/>].

As we learn how to run an exercise simulation will also find yourself equipped to learn how to run any other HUMAN procedure on your own.

Step 0 – Startup

To reach the main model screen, on seeing the opening HUMAN screen, simply click the <Run> button (see below, lower right).

Run the Model

Set up Experiment / Patient

Experiment number Run for min. Printing every min.

Patient

Preset Experiments

This brings you to the main screen where you see the experimental navigator (below). The navigator contains all of the of controls that we will be using in this tutorial.

View Output:

AP COL O2DEBT MFLOL VENT EXER

as: text text text text text text

Experiment Controls

Change Variable	Enter New Value	Info on Variable
Choose <input type="button" value="v"/>	<input type="text"/>	<input type="text"/>
Choose <input type="button" value="v"/>	<input type="text"/>	<input type="text"/>

Run Experiment:
for minutes at minute intervals.

Help

Help info on: Choose

Tips: How Do I?

View

Variable Value: Choose

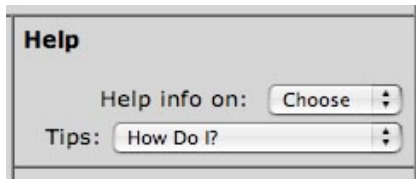
Patient Charts or Lab tests:
Choose One

Graph Style Size: 600

Normalized, one graph

Step 1 – Using Help to Learn How To Run a Procedure (i.e. exercise)

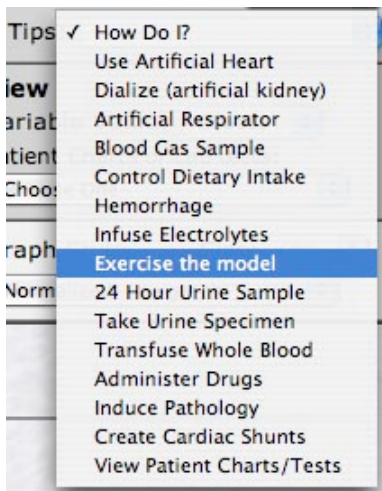
Find the **Help** section in the navigator (as shown below)



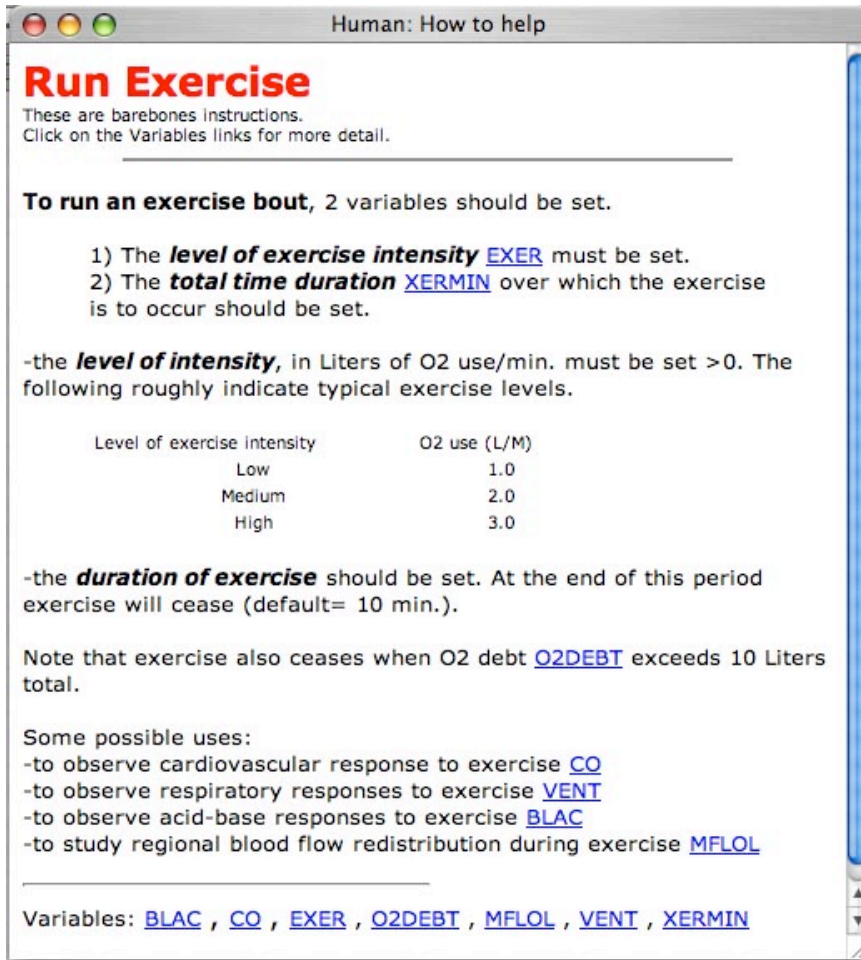
In **Help**, locate Tips: <How Do I? > and mouse it.

You see various procedures (Use Artificial Heart, Dialyze ...).

Roll your mouse down to Exercise the model (see below).



The Help Run Exercise screen appears. (if it doesn't you need to turn your *pop-up blocker off*)



Above: The Help Run Exercise Screen

We notice (top) that to exercise we need to set two variables

- 1) EXER - the level of exercise intensity and
- 2) XERMIN – the duration of the exercise bout.

We also notice that to achieve a medium level of intensity of exercise we must set EXER to 2.0.

There are numerous other useful pieces of information and exercise-related links on this screen that we will not follow for now.

Step 2 – Setting Up the Model to Exercise

Now that we know what to set (EXER & XERMIN) we proceed to actually set them in the model.

Find the **Experiment Controls** section (see below)

Experiment Controls		
Change Variable	Enter New Value	Info on Variable
Choose ▾		
Choose ▾		

To enter a value for EXER of 2.0

Under **Change Variable** click on <Choose>

You see a list of variables (A2INF, ADHB, etc.); scroll down to EXER & release your mouse.

Experiment Cont	
Change Variable	
✓ Choose	
A2INF	
ADHB	
ALDOB	
ALDOP	

EXER now appears in the box (see below) along with its units (L O₂/Min.) and possible values (0-10 L O₂/ Min.).

We desire a moderate level of exercise of 2.0. Type this value into the box (don't edit the units box).

You now have the screen below.

Change Variable	Enter New Value	Info on Variable
EXER ▾	2.0	0-10 L-O ₂ /Min
Choose ▾		

We wish the exercise duration to be a large value so as to not terminate the exercise bout. Here is how to set it to 60 minutes.

- Mouse the lower <Choose> choice.
- Type XE and your browser should skip down the list to XERMIN.
- Release your mouse. XERMIN is now in the lower box.
- Type in the desired value of 60 (below).

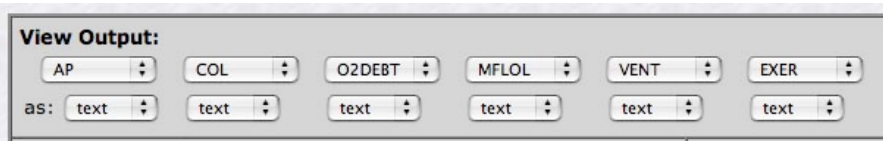
Change Variable	Enter New Value	Info on Variable
EXER ▾	2.0	0-10 L-O ₂ /Min
XERMIN ▾	60	10 Minutes

You have completed setting up the input variables for this exercise experiment.

Step 3 – Setting up the output variables – picking variables to view

With exercise now set up to run at an intensity of 2.0 L O₂/min. for 60 minutes we now turn to the question what variables we wish to see the effect of exercise upon.

HUMAN shows which variables it is set up to monitor in its **View Output:** section as below.

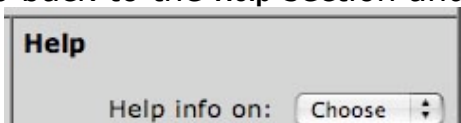


Across the top line we see the six variables the model will now give us data on as they respond to exercise. These are, from left to right, AP (arterial pressure), COL (cardiac output, Liters/min.), O₂DEBT (oxygen debt), MFLOL (muscle flow, Liters/min.), VENT (lung ventilation) and EXER (level of exercise).

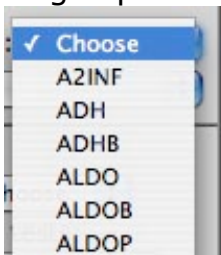
This forms a very reasonable sub-set of HUMAN's variables for an exercise experiment.

Nevertheless, let us assume we wish to change one of them (or perhaps find out information on any variable). Let us do so for the variable COL.

We go back to the **Help** section and click on Help info on: <Choose> .

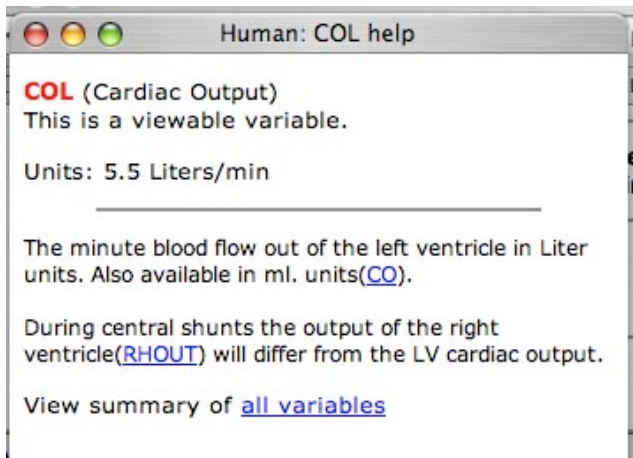


This brings up a scrolling list of variables whose output can be followed in HUMAN.



We then scroll down to COL, our variable of interest, and release the mouse.

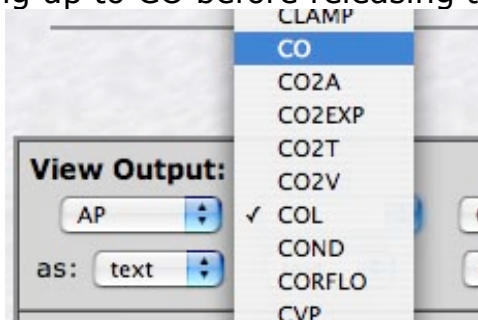
This brings up the help screen for COL as below.



At the top we see the definition of the variable (Cardiac Output) and its resting value and its units (5.5 Liters/min). The remainder of the screen gives us variable-related information including that (if we so wished) HUMAN could *display the cardiac output in ml/min units if we substitute CO for COL*.

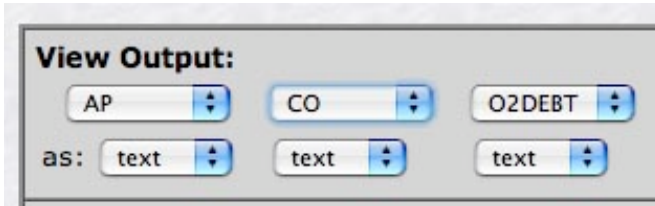
We now have the information we need to substitute one variable (CO) for another (COL) in the output.

We make the substitution by going back to **View Output:** , clicking on COL and scrolling up to CO before releasing the mouse (below).

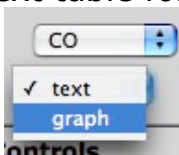


Step 4 – Setting up the output variables – picking a variable to graph.

By default, HUMAN's output is a six column text table. This can be seen by reexamining the **View Output:** screen now in front of you. We notice in the second line that all variables are now output as: <text>.



We wish to change the output of CO so that it is also graphed. To do so, we pick it and select graph (below). Now the output will be in both graphic and text table formats.



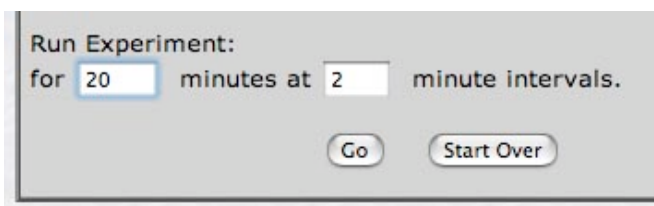
We now also do this for the other five variables thus yielding the final **View Output:** section below.



Step 5 – Running the experiment.

In the Run Experiment: section (see below) we pick the *total time* we wish to run for (20 minutes) and the *interval* at which we wish our data to be displayed (at 2 minute intervals).

If we now click the <Go> button the exercise experiment we set up (moderate exercise) will take place.



Summary

Below is the final setup in the experiment navigator screen of all the choices made above in setting up this exercise experiment.

View Output:

AP CO O2DEBT MFLOL VENT EXER

as: graph graph graph graph graph graph

Experiment Controls

Change Variable	Enter New Value	Info on Variable
EXER	2.0	0-10 L-O2/Min
XERMIN	60	10 Minutes

Run Experiment:
for 20 minutes at 2 minute intervals.

Go Start Over

Help

Help info on: COL

Tips: Exercise the model

View

Variable Value: Choose

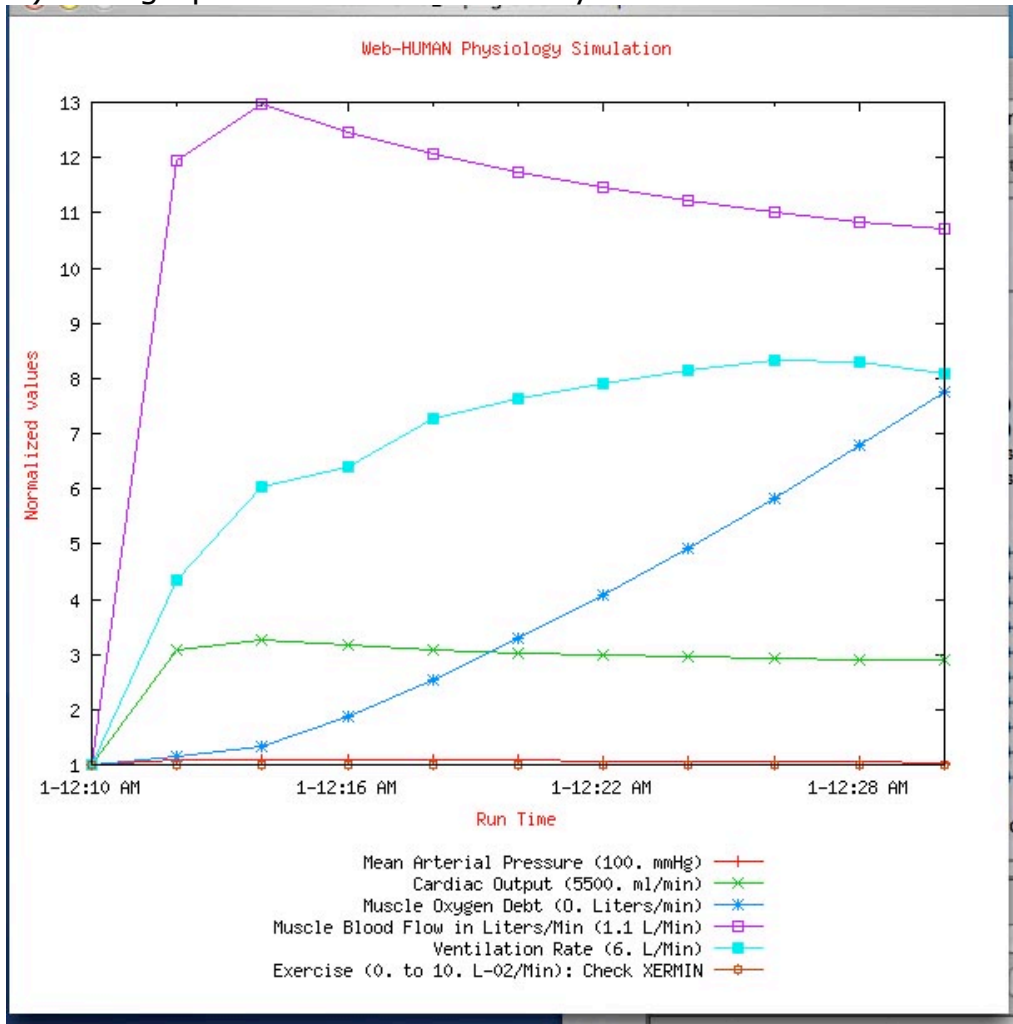
Patient Charts or Lab tests: Choose One

Graph Style Size: 600

Normalized, one graph

Step 6 – Viewing the results

Our exercise results appear as a graph and as a table (the default output form for HUMAN). The graph is shown immediately below.



We notice that the plot is normalized thus showing change since the onset of exercise. The variables plotted are keyed below the plot.

In particular we notice that

- Ventilation (squares) rises much more than cardiac output (green) suggesting that the cardiovascular system and not the respiratory system is more limiting in endurance exercise.
- That the exercise is not quite aerobic (notice the steady climb of O₂ DEBT (blue)).
- That mean arterial pressure (AP, red) hardly rises at all at this level of endurance exercise.

- That muscle flow (purple) increases much more than cardiac output (green) suggesting that vascular conductance in the skeletal muscle beds has opened up greatly (vasodilation).

Human also generates a tabular output providing time series data on the six variables (see below) that equally supports the physiological conclusions above.

Skidmore College		Output from Web-HUMAN Physiology Simulation				Manual	Ver. 3
DAY/HR	AP	COL	O2DEBT	MFLLOL	VENT	EXER	
1-12:00 AM	99.78	5.438	0.000	1.100	5.675	0.000	
1-12:10 AM	99.69	5.425	0.000	1.089	5.673	0.000	
Exercise (0. to 10. L-O2/Min) ** Check XERMIN **					=	0.0000	
Exercise (0. to 10. L-O2/Min) ** Check XERMIN **					=	2.0000	
Duration of Exercise (Minutes)					=	10.000	
Duration of Exercise (Minutes)					=	60.000	
DAY/HR	AP	CO	O2DEBT	MFLLOL	VENT	EXER	
1-12:10 AM	99.69	5425.	0.000	1.089	5.673	2.000	
1-12:12 AM	107.7	0.1663E+05	0.1476	13.02	24.59	2.000	
1-12:14 AM	107.7	0.1765E+05	0.3352	14.12	34.20	2.000	
1-12:16 AM	109.1	0.1719E+05	0.8786	13.58	36.22	2.000	
1-12:18 AM	108.9	0.1676E+05	1.549	13.14	41.17	2.000	
1-12:20 AM	108.1	0.1643E+05	2.285	12.79	43.25	2.000	
1-12:22 AM	107.1	0.1618E+05	3.080	12.49	44.78	2.000	
1-12:24 AM	106.1	0.1601E+05	3.929	12.23	46.22	2.000	
1-12:26 AM	105.1	0.1588E+05	4.831	12.00	47.17	2.000	
1-12:28 AM	104.4	0.1580E+05	5.778	11.80	47.12	2.000	
1-12:30 AM	103.9	0.1574E+05	6.759	11.65	45.87	2.000	

In the workshop we will now proceed to explore thermal physiology as a teaching "lever" given student's intuitive familiarity with it.

Step 7 – What you might explore next on your own

- One could continue the experiment by typing into the Run experiment: section new additional values for minutes and display intervals and click <Go>.

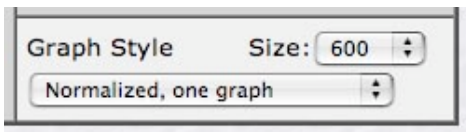
Run Experiment:
for minutes at minute intervals.

[Login for personalized features](#)

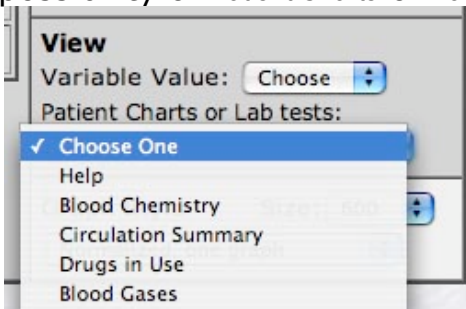
[Skidmore College](#)
**Web-HUMAN
Physiology Simulation**

- One could save the exercise experiment you just set up & executed for future use by clicking on [Login for personalized features](#) and then selecting Save experiment.

- One could click on the web-HUMAN Manual link (not shown above) to see ideas for many more experiments of multiple types (renal, water balance, acid-base balance, respiration mechanics, cardiovascular, clinical patients and much more).
- One could examine the **View:** section of the interface where you will find other possibilities not covered in this tutorial including
 - a wealth of other graphing options (see below, we simply accepted the default settings) and



- the possibility of Patient Charts or Lab test results (see below).



We hope you find the exercise physiology capabilities of the model useful in your teaching ! Enjoy!

Your feedback is always appreciated.

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