

Web-HUMAN Sample Experiment

Emphysema Simulation

(a sample clinical simulation)

(updated August 18, 2011)

All web-HUMAN experiments, like their wet lab counterparts, involve changing one or more parameters and monitoring the response of relevant physiological variables. In inducing pathology, the method is no different but the parameter(s) picked are those specific to pathology induction. The process is illustrated below via creating a condition similar in some ways to emphysema.

Simulation of a clinical condition involves changing the values of key physiological variables so that the simulation 'behaves' like the clinical condition. HUMAN has many built in tools directly designed for this purpose (e.g. see CLAMP, a renal artery clamp to induce Goldblatt hypertension or CAD to induce coronary artery disease).

This particular example simulates aspects of emphysema by reducing the mean surface area (MSA) available for gas diffusion in the lungs.

1) To begin

To set up HUMAN, prior to inducing the disease state (i.e. control), at the opening screen (see below)

web-Human Physiology Teaching Simulation
(Physiology in Health, Disease and During Treatment)

Login for Personalized Features

Your login name:

Your password:

Login

No account? [Register for a free personal account.](#)

Start a Physiology Experiment

or

Run a HUMAN Patient.

Welcome to web-Human Version 9.

Click

- **Start a Physiology Experiment** (see above, middle).

* always remember that if you wish to Save your experiment you must log in first (above, top)

This results in the typical opening "**Output from Web-Human**" experiment screen seen below.

Skidmore College		Output from Web-HUMAN Physiology Simulation				Manual	Ver. 9.1-47 (7/29/11)
DAY/HR	AP	COL	O2DEBT	MFLOL	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	

2) To set up your experiment

HUMAN is now ready to be set up with a reduced mean lung surface area for a 30 plus day experiment while

tracking various respiratory and cardiovascular variables in its tables. The steps involved in this setup are shown in the experiment navigator picture below and then described sequentially in the text that follows.

The screenshot shows a software interface for an experiment. At the top, the 'View Output' section contains six dropdown menus for variables: AP, COL, PO2PV, RAP, VENT, and MSA. Below these are six 'as:' dropdown menus, all currently set to 'text'. A dropdown menu for RAP is open, showing 'text' (checked) and 'graph' options. The 'Experiment Controls' section features a table with three columns: 'Change Variable', 'Enter New Value', and 'Info on Variable'. The first row shows 'MSA' selected in the first column, '20' in the second, and '100%' in the third. The second row has 'Choose' in the first column and empty fields in the others. Below the table, it says 'Run Experiment: for 30D minutes at 10d minute intervals.' with 'Go' and 'Start Over' buttons. On the right, the 'Help' section has 'Help info on: Choose', 'Tips: How Do I?', and a 'View' section with 'Variable Value: Choose', 'Patient Charts or Lab tests: Choose One', 'Graph Style' (set to 'Normalized, one graph'), and 'Size: 600'.

To reduce mean lung surface area

- roll down under the **Change Variable** column in the **Experiment Controls** section to MSA and reset it from its default value (100%) to a new value of 20.
- This reduces lung surface area available for gas diffusion by a full 80%. (a more realistic long term slow, progressive loss of lung surface could also be simulated if desired).

To select more useful tables for viewing variables relevant to the results in this experiment

- Under the **View Output:** section (top), mouse click and the roll down each of the six available output variables to select of the *new variables* indicated above in columns 1-6.
- These are (left to right) arterial pressure(AP), cardiac output(COL), pulmonary vein PO2(PO2PV), right atrial pressure(RAP), lung ventilation(VENT) and lung/capillary mean surface area(MSA).

To insure tabular output (i.e. no graphing in this case)

- simply leave the **as:** choice (line 2, top) in its default text position (see RAP above).

To **select** an appropriate **time span** in which to view the developing situation under "Run Experiment:" pick a 30 day (30D or 30d) period with data views at 10 day (10D) intervals.

To **begin** the **simulation** click on <Go>.

3) The output of your experiment

Results of the first 30 days are shown directly below.

Skidmore College		Output from Web-HUMAN Physiology Simulation			Manual	Ver. 9.1-47 (7/29/11)	
DAY/HR	AP	COL	O2DEBT	MFLOL	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	
Pulmonary Membrane Surface Area (100%)					=	100.00	
Pulmonary Membrane Surface Area (100%)					=	20.000	
30.0000	Days	are	43200.0	Minutes			
10.0000	Days	are	14400.0	Minutes			
DAY/HR	AP	COL	PO2PV	RAP	VENT	MSA	
1-12:10 AM	99.69	5.425	97.34	-.5223E-01	5.673	20.00	
11-12:10 AM	127.8	4.887	42.03	-1.174	14.92	20.00	
21-12:10 AM	147.2	4.799	42.10	-.8949	19.71	20.00	
31-12:10 AM	167.1	4.897	42.53	-.4250	21.14	20.00	

Notice (see above)

- the sharp drop in pulmonary vein PO2 (PO2PV).
- the sharp (and unsuccessful) compensatory rise in ventilation (VENT) induced by the peripheral chemoreceptors and the hypoxic hypertension.

4) Experiment output - other viewing options

Individual other variables (not in your tables) could be viewed at this point in time

- Under the **View** section (see left, below), use the "Variable Value <Choose>" option. Simply mouse the Variable value of your choice, here arterial PO2, and then click <Go>.
- This results in an output (see right, below) in which the last line gives you the current value (at day 31) of the blood arterial O2 tension.

View

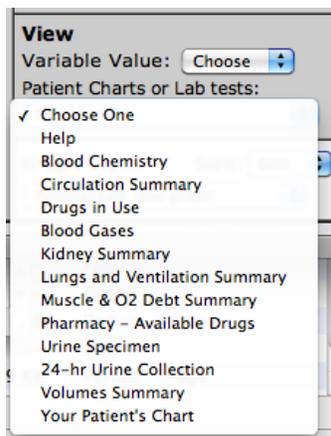
Variable Value:

Patient Charts or Lab tests:

Graph Style Size:

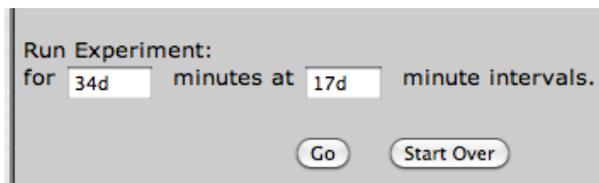
DAY/HR	AP	COL	PO2PV	RAP	VENT	MSA
1-12:10 AM	99.69	5.425	97.34	-.5223E-01	5.673	20.00
11-12:10 AM	127.8	4.887	42.03	-1.174	14.92	20.00
21-12:10 AM	147.2	4.799	42.10	-.8949	19.71	20.00
31-12:10 AM	167.1	4.897	42.53	-.4250	21.14	20.00
O2 Tension - Arterial (98. mmHg)					=	42.533

Entire system profiles (cardiovascular, renal, respiratory, etc.) can be viewed with the "Patient Charts .." option under the **same View** section (see above left & below).
Again simply select your Chart choice and press <Go>.]



5) Continuing the experiment

To continue the experiment out to Day 65, in Run Experiment: we enter values as below



The results of continuing the simulation out to 65 plus days are shown below:

DAY/HR	AP	COL	PO2PV	RAP	VENT	MSA
65-12:00 PM	219.7	5.596	44.41	1.149	20.97	20.00
65- 3:00 PM	219.7	5.664	40.59	1.229	21.57	20.00

ALERT -- Loss of Consciousness !
Sorry -- This individual has perished.
Get autopsy report from 'Next > E'.

a) Notice (above) that at Day 65 -slightly past 12:00 P.M.- most key values have markedly worsened (PO2PV is down to 44 mmHg, AP has risen to 219 mmHg).

b) Also note that at (Day) 65-3:00 PM the model gives a message of

"ALERT -- Loss of Consciousness !"

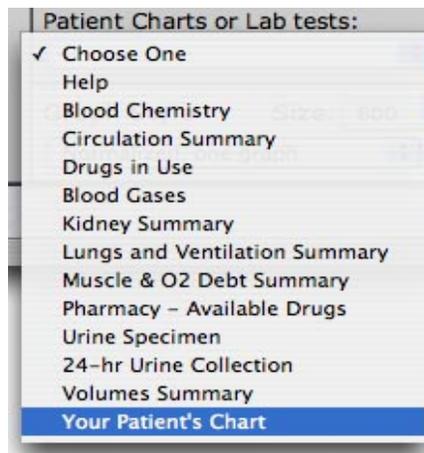
followed by

"This individual has perished."

and that the user is prompted to

"Get (an) autopsy report".

The autopsy report can be obtained by rolling down the "Patient Charts or Lab tests: " option and asking for "Your Patient's Chart" (see below) and then pressing <Go>.



The autopsy results due to this request appear below.

```
$Mr. Norm L. Subject
+      DAY: 65      TIME: 6:10 PM
This individual has expired.
Findings at Autopsy:
  Some Signs of Hypertensive Vascular Disease.
  Distended and Engorged Left Ventricle.
  Fluid in the Lungs.
  Respiratory Disease.
..... YOUR PATIENT'S CHART .....
Age: 40
Male
Height: 175. Cm.      69. Inches
Weight: 71.5 Kg.     157.3 Pounds
Systolic/Diastolic Blood Pressure: 253/208 mmHg
Heart Rate: 84
Temperature: 37.4 Cent.      99.3 F.
Respiration Rate: 26
```

To summarize

- Clinical situations can be simulated by selecting the appropriate variables and forcing the physiology in the desired pathologic direction.

- Finding HUMAN's pathology induction variables

1) In **Help**, using Tips: <How Do I> --> Induce Pathology will reveal a wealth of built-in mechanisms to induce various physiologic pathologies.

2) In **Help**, variables inducing pathology can also be sought out by clicking on Help info on: <Choose>

and then clicking on the View summary of all variables option, This allows one to search all variables.

3) Advice on how to make use of these variables is detailed both via the links on these screens and in the Annotated List of Variables & Parameters in the Manual.

An additional example of the induction of pathology can be found in the User's Manual section "Using the more advanced features of web-HUMAN" sub-section/ Create Physiological Pathology where a pheochromocytoma patient is created and stored for future use.

