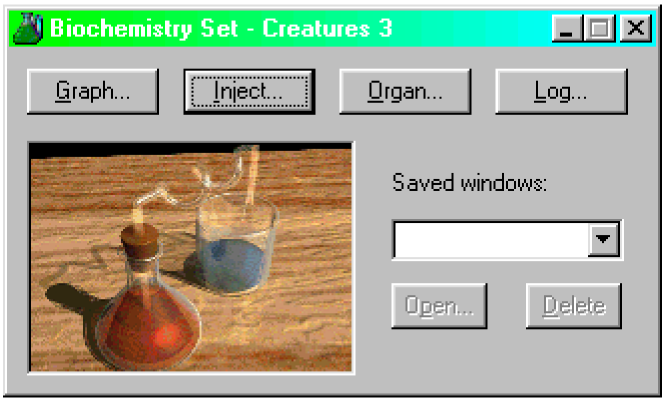
Biochemistry set for C3

This kit has grown out of the biochemistry applet in Creatures 2. The new kit is very simple to use, but surprisingly flexible, and will probably give you more information about your creatures' biochemistry than you can use ☺

Once you have the kit installed and open it, you will see a very small grey box on your screen, with four buttons and a list. The buttons relate to the four major functions of the kit – *graph* (a graphing function), *inject* (an chemical injector), *organ* (a log of what is going on organ-wise inside the creature) and *log* (which allows you to log the levels of chemicals over a long time to a file, such as an Excel file).

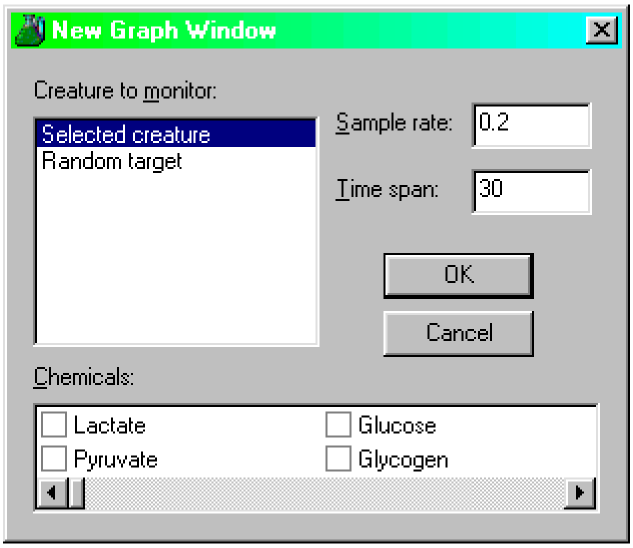
Saved windows

The 'saved windows' list stores the names of any previous saved windows. You can use this facility to store the set-up of any graph or injection you find useful, effectively creating your own templates (for example you might want to set up a graph to plot all reproductive chemicals; if you save this and call it 'reproduction', the name will appear in this list next time you open the kit up, and can be retrieved from here). This is useful if you have several creatures to monitor the same set of chemicals for.



Graph

Once you click on the graph button, you will be presented with a box listing some chemicals. If you open it out until you can see all of the chemicals listed, you will then be looking at the entire biochemistry list for Creatures 3. This has been radically reorganised, so it might take you a few minutes to find the chemicals you want to graph.



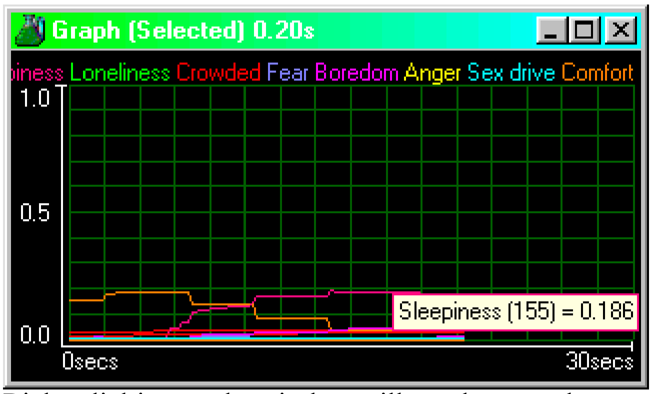
You can select individual chemicals to graph by clicking on the box next to the name. There is no limit on how many chemicals you can graph at the same time, but more than 10 on a graph does tend to become difficult to read! If you really wanted to plot all the chemicals (perhaps when using the log option to export to a spreadsheet during a wolfing run for example), then right clicking on one of the boxes will give the option to 'tick all'.

As well as choosing the chemicals to graph, you can also choose the sample rate that chemicals are displayed at. This is set in seconds – so a sample rate of 0.2 will display the value of a selected chemical every 0.2 seconds. For a slower rate (perhaps your chemical should have a constant value, or changes very slowly) you can just type in a different value such as 2.0, and then the chemical will be sampled every two seconds instead.

The second box shows you how many seconds of time the graph will display at once – set at 30 seconds as a default. If you have a chemical that may change in value very slowly, this is fine. If your chemical changes much more quickly, then you might like to play around with a lower value here (20 seconds for example), which will give you a much clearer graph.

Each graph can relate to only one creature at once, although you can open multiple graphs at a time if you want data from more than one creature. The selection box has 'selected creature' and 'random creature' as defaults, but as new creatures are born in the game (including Grendels and Ettins), they will appear in this list as 'female Norn' or 'male Grendel'. If you name your creatures and then open up a graph page, the names will appear in the list; doing it this way round makes life much easier than trying to guess which 'female Ettin' it is you want.

Okay, so you have now selected a creature, set a sample rate, decided how much time your graph should display at once and chosen your chemicals to graph. Once you click 'ok', a small graph window will appear. This can be stretched or turned into a full-screen version if you have a lot of chemicals to make out. Each chemical is a coloured line on the graph, and if you hold your mouse over any coloured line, a box appears telling you what the chemical is, the chemical number and the value at that point.

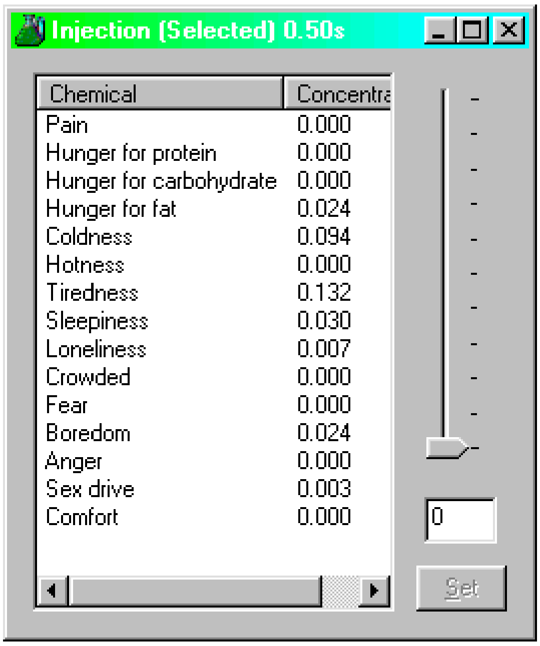


Right clicking on the window will produce another menu. This lists *inject* (open an injection window displaying all of the chemicals selected for the graph), *log* (create a file of all the results from the graph), *clone* (open another window with the same set-up, but change the creature or the chemicals), *properties* (open up the initial page to alter the chemicals being graphed, the sample rate, display time or creature selected in the same window) and *save Window* (which will save the set-up you have specified for the window, a bit like a template. This is useful if you want to use this set-up again for another creature). So once you have a graph displaying the chemicals you are interested in, it is easy to save it, change it (including what chemicals the graph is displaying) or open an injection window to manipulate the chemicals directly.

Injection

Clicking on injection brings you to a similar screen to the graph screen. From here you can select individual chemicals to monitor, or even all 255 chemicals if you want to. You can also change the rate that these chemicals are sampled at (the default is every 0.5 seconds) and the creature that is being observed.

Once you have decided on your chemicals, and clicked on 'ok', then a small screen with a list of chemicals and numbers will appear. The chemicals are the ones selected, and the numbers are the values (between 0.0 and 1.0) of those chemicals currently in the Norn. If the sample rate is high, these numbers may appear to flicker slightly as they are updated constantly. There is also a slider in this window, and a box for another value. If you move the slider up and down (click and drag on the bar), then you will see the value in box beneath it change.



If you select a chemical from the list, and then either move the slider until the value in the box is at a level you want, or even type in a value between 0 and 1, then clicking the 'set' button will immediately alter the concentration of that chemical in the creature to the value you have just specified. This means you can not just add chemicals to the creature, but *also take chemicals out of the creature*! Used in conjunction with the graph to get a more detailed picture of what is going on, this is very useful for tracking not just single chemicals, but also groups of interlinked chemicals.

Again, by right clicking on the window, you can add to or change the chemicals in the list, and open a graph displaying those chemicals. You can also alter the sample rate and change the creature being sampled. From this menu, options to clone, log and save window set-up are available.

Organ
This mode allows you to see exactly what is happening in terms of organ damage, cost, life force and so on. If you click on the organ button, a box appears to allow you to choose which creature to monitor and the sample rate for checking the organs. From here, after clicking on 'ok', another screen appears, loaded with data.

Organs have become a little more complicated in C3 with the ability to set up receptors on reaction rates; instead of having several organs, each with a reaction, the rate of which is altered using a receptor, it is now possible to combine several reactions under one organ, but to have their rates independently set using receptors. A good example of this is the Liver Anabolic and Catabolic organs in C3 creatures – the reactions now grouped together in these two organs used to be spread over several organs, each with just one or two reactions inside.

Before talking about each column, here's a little refresher on injury and healing. All organs have two 'life forces' which are determined genetically on the organ gene and called short-term life force and long-term life force. When damage is done to an organ (toxins or antigens detected by receptors on the organ and numbers written to the injury locus of the organ), both life force values start to decay, but the short-term force decays faster. When the organ begins to be healed (prostaglandin detected by a receptor and values written to the repair rate locus), the short-term life force stabilises, and starts to go back up. At some point, the still-decaying long-term life force and the rising short-term life force will meet, and the difference between this value and the value they started at is the amount of permanent damage the organ has suffered. If the organ heals quickly (lots of prostaglandin produced), then the meeting point between the two life forces will be high, and so little damage will have been done. If the organ is very susceptible to damage, and the short-term life force rises slowly (little prostaglandin produced), then the damage will be much more. Of course, this means that once an organ has suffered damage, the life forces will never be able to go back to maximum again, and each time the organ is damaged, the life force of the organ gets lower. Once the long-term life force reaches 0, the organ is dead, and all of the functions it carries out will no longer take place.

Organ (Selected) 1.00s

Organ	Receptors	Emitters	Reactions	Clock rate	Short term locus	Repair factor locus	Injury to apply locus	Initial life force	Short term life force	Long term life force	Long term damage rate	Energy cost	Damage when no energy
0	0	0	0	0.500	0.944	0.000	0.000	500000.000	472093.969	472093.969	0.039	0.008	3906.250
1	23	0	0	0.498	0.944	0.006	0.000	1000000.000	944405.000	944405.000	0.016	0.017	369.089
2	6	0	3	0.502	0.944	0.005	0.000	1000000.000	943980.313	943980.313	0.078	0.011	1968.474
3	12	0	7	0.502	0.944	0.005	0.000	1000000.000	943970.875	943970.875	0.078	0.015	1968.474
4	10	0	6	0.502	0.944	0.006	0.000	1000000.000	943970.875	943970.875	0.078	0.014	1968.474
5	13	0	5	1.000	0.891	0.005	0.000	1000000.000	891488.250	891488.250	0.078	0.015	1968.474
6	10	5	3	0.502	0.891	0.005	0.000	1000000.000	891488.250	891488.250	0.078	0.015	1968.474
7	7	1	3	0.472	0.891	0.005	0.000	1000000.000	891488.250	891488.250	0.078	0.012	1968.474
8	9	11	0	1.000	0.891	0.005	0.000	1000000.000	891488.250	891488.250	0.078	0.016	1968.474
9	5	0	3	0.502	0.891	0.004	0.000	1000000.000	891488.250	891488.250	0.078	0.011	1968.474
10	5	0	1	0.282	0.891	0.004	0.000	1000000.000	891488.250	891488.250	0.078	0.010	1968.474
11	8	0	0	0.502	0.944	0.000	0.000	1000000.000	943980.313	943980.313	0.000	0.011	0.000
12	5	2	0	0.502	0.944	0.005	0.000	1000000.000	943970.875	943970.875	0.078	0.011	1968.474
13	10	4	5	0.502	0.944	0.005	0.000	1000000.000	943980.313	943980.313	0.078	0.015	1968.474
14	5	0	4	0.502	0.944	0.004	0.000	1000000.000	943970.875	943970.875	0.078	0.011	1968.474
15	4	0	14	0.471	0.891	0.004	0.000	1000000.000	891488.250	891488.250	0.078	0.015	1968.474
16	4	0	10	0.000	0.891	0.000	0.000	1000000.000	891488.250	891488.250	0.078	0.013	1968.474
17	4	0	8	0.000	0.891	0.000	0.000	1000000.000	891488.250	891488.250	0.078	0.013	1968.474
18	18	18	0	0.200	0.977	0.000	0.000	1000000.000	977289.125	977289.125	0.078	0.022	1968.474
19	12	0	26	0.502	0.944	0.079	0.000	1000000.000	943980.313	943980.313	0.078	0.023	1968.474
20	6	0	2	0.455	0.891	0.004	0.000	1000000.000	891488.250	891488.250	0.078	0.011	1968.474
21	15	1	0	0.502	0.944	0.004	0.000	1000000.000	943970.875	943970.875	0.078	0.014	1968.474

Right, let's return to the biochemistry kit, and take a look at the organ page. From left to right, these figures show you:

- Organ – the number of the organ (given to the organ as the creature is hatched).
- Receptors – the number of receptors attached to that organ. Along with the next two columns (number of emitters and number of reactions attached to an organ), this can be very useful to identify an organ if you don't know it's number.
- Clock rate – the clockrate of the organ currently. This is based on the genetically specified clock rate (set via the organ gene) and is moderated by the action of any regulating receptors, to give an indication of how often that organ is updated.
- Short term locus – NO IDEA
- Repair factor locus – This locus determines how fast the life force of an organ increase, which is a long way of saying how fast it heals after damage. This is the value stored in the repair rate locus, and is regulated by reception of prostaglandin by the organ.
- Injury to apply locus – This relates to the value held in the injury locus of an organ (usually written to by the reception of an antigen or toxin by an organ) and indicates how fast the short-term life force will be decreased; ie how quickly that organ will be damaged.
- Initial Life force – the life force that the organ started with as specified in the organ gene
- Short-term life force – Any damage or healing is applied to the short-term life force, which begins to decrease when damaged and increases again when healing starts.
- Long term life force – The current value of the long-term life force. Once this reaches zero, the organ is classed as 'dead'.
- Long Term damage rate – This is the rate at which the short-term life force and the long-term life force converge on each other after damage has occurred. The longer it takes, the more damage will have been caused to the organ.
- Energy cost – the amount of energy the organ uses every tick to maintain itself and update all receptors, emitters and reactions.
- Damage when no energy – how susceptible the organ is to damage if the creature runs low on ATP or energy.

Log
This function allows you to export the data from a session using the biochemistry kit to an external package, such as Excel, so that you can manipulate the data any way you want. During the final testing phase for Creatures3, this function was used extensively during overnight wolfing runs. The data of all chemical levels was exported, and could then be manipulated to look at isolated groups of chemicals (immunity reactions or reproductive cycles for example). You can set up a log for each creature in your world, and then leave them to get on with it, coming back later to look at what has gone on biochemically. Great for wolfing runs ☺