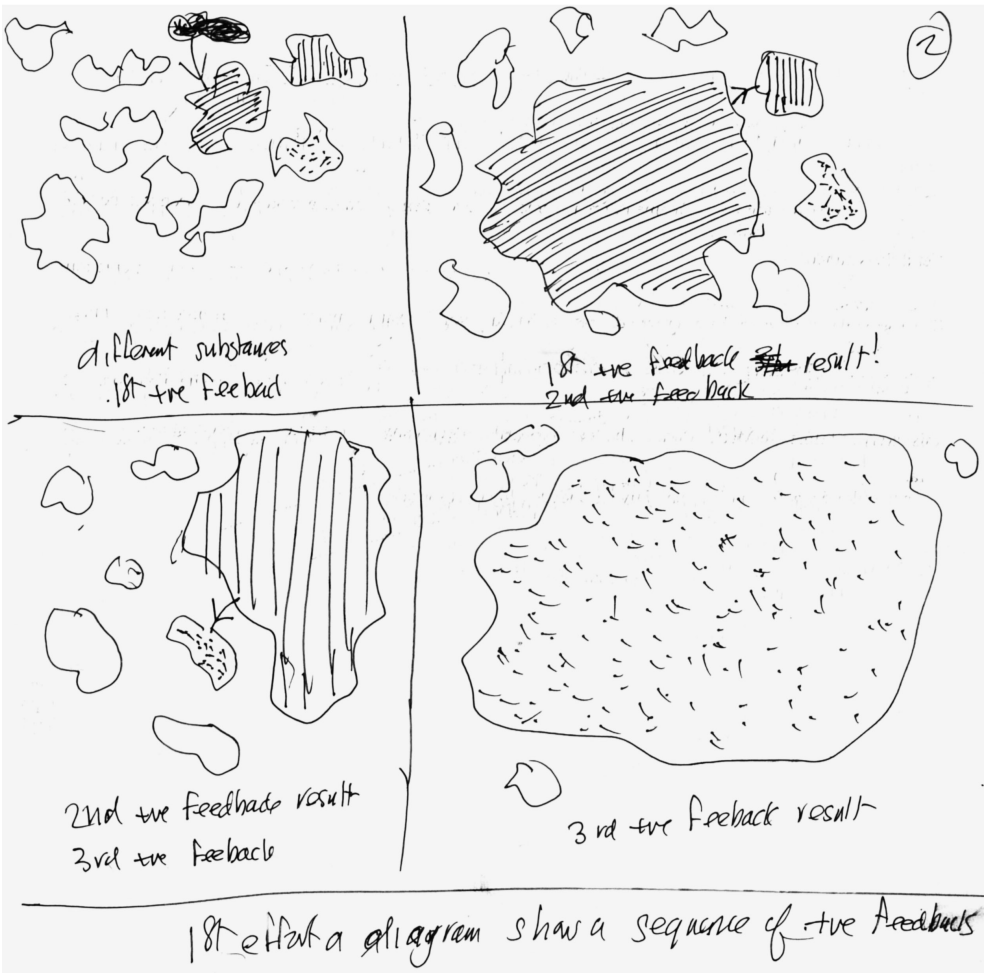
Sequences of Feedback

Possible Scenarios in Emergent Change

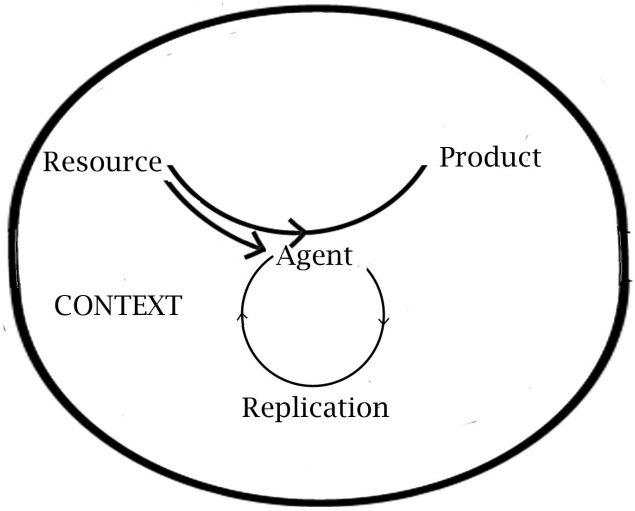
Reconsidering mechanisms such as positive feedback in Emergent Change (***Mechanisms of Positive Feedback*** – 18/06/06 by this author), the crucial thing about such processes is that they are only ever short temporary interludes. They cannot be permanent features of anything. This is because they are explosive and accelerating, and because they can do no other but ***transform their own context***. Obviously, as soon as such processes are triggered off, MAJOR changes must ensue. In transforming their own environment, the processes remove their own causes, while at the same time removing the pre-existing, stable situation forever. A new context with new possibilities is thrown up at the termination of every positive feedback situation, that is NOT merely stopped by running out of resource, and causing thereby a return to the previous situation.

> NOTE: We must not mix up positive feedback as such and its possible role in Emergence. While the former is relatively common, the latter is rare.

Studying the constraints on positive feedback in the above-mentioned paper, it soon becomes clear that ANY such situations will terminate due to a range of reasons, such as exhaustion of Resource, inhibition of any Agent process, and many others. But the certain termination, whatever happens in the more obvious cases of inhibition, will be that the positive feedback creates Product and reproduces its own Agents. These can do no other than ***change the context***. We therefore get a trajectory of Explosion, followed by inhibition due to change of context. In certain special; circumstances one burst of positive feedback, ***could*** produce a change in the environment conducive to **another** different bout of similar run away acceleration, using either the new context, or other previously non interacting elements, or both. We can thus, in very special circumstances, conceive of a whole **string** of such bursts of change, which could over a quite limited time period **reconstruct** the environment significantly.
This is what must happen in Emergence, when entirely new situations are created for the first time.



But, the above diagram is ***flawed***. It shows all participating substances available from the start, and doesn't show why a particular one became involved in a particular positive feedback. The constraint that inhibits any triggering could be insufficient resource, so the diagram does show the crucial proliferation of a Product due to positive feedback. Such a production could in turn be a Resource for a following and different positive feedback.
But Resource doesn't change into Product all by itself. It needs an Agent (or catalyst) which not only processes the transformation from Resource to Product, but also needs to replicate itself to accelerate the transformation process into a positive feedback.
A diagram to show this was started in the 18/06/06 paper but NOT developed as a sequence.



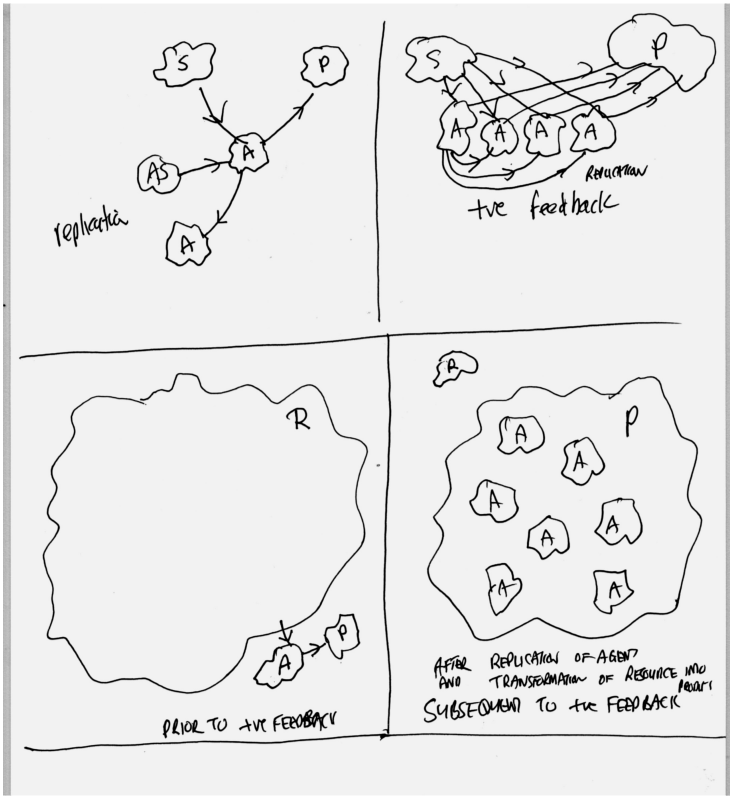
This is the Diagram from the 18/06/06 paper.

It shows the above described relationships between RESOURCE, AGENT and PRODUCT.

Notice that ***the positive feedback can only occur if the Agent can also rapidly reproduce***. That condition being fulfilled, the situation accelerates away until something constrains and even stops it.

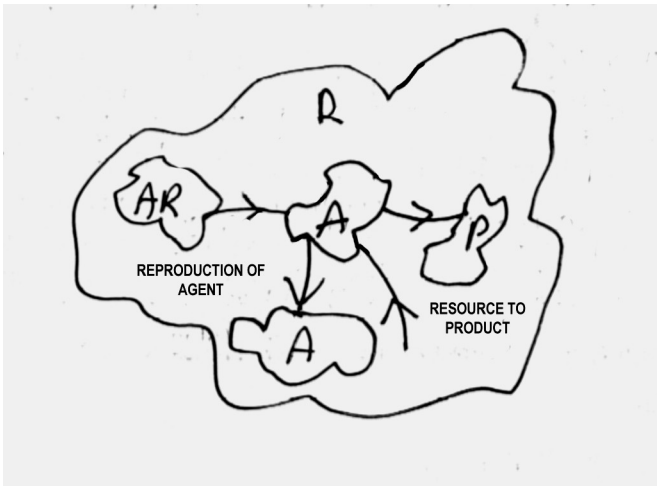
Below there is another set of diagrams which may be considered better.

All these are merely first drafts, and will need to be edited and improved until the positions are clear.



In this set a SINGLE process, is followed by a diagram showing a series of processes after some replication of the agent. The two diagrams below these, show the BEFORE and AFTER situations. The left hand image shows the situation with a large amount of Resource and an Agent delivering Product. The right hand diagram shows the situation when almost ALL the Resource has been turned into a now dominant area of Product, and also shows the resultant proliferation of agents as a result of replication.

This sort of process therefore requires some fairly demanding conditions to be triggered off. These are not the sort of conditions that abound all around us. They must be, and always were, particularly rare.
There is nothing remarkable about the Agent processing Resource into Product, or in the replication process of the Agent. But in order for these mundane conditions to trigger into positive feedback the requirement must be adequate resources to maintain the agent and its possible offspring, as well as sufficient Resource to be turned into Product. Only when BOTH of these simultaneous processes can be adequately supplied can the whole thing accelerate.
Another element MUST therefore be included in our diagrams . This is the Agent's own required Resources.



This diagram (much more realistic than our first effort at the beginning of the paper), shows the Agent(A) WITHIN an extensive area of Resource(R), and assuming that the SAME Resource supplies the Process to make the Product(P) AND the replication of the Agent, this will cover the triggering of the positive feedback.

Now, of course, NO positive feedback situation is eternal. Something must give to terminate the process.
A whole set of different causes for a termination, are possible.

1. The Resource can run out and the processes stop.
2. The Product in some way inhibits the production process and causes the termination.
3. The Product in some way inhibits the Agent replication process.

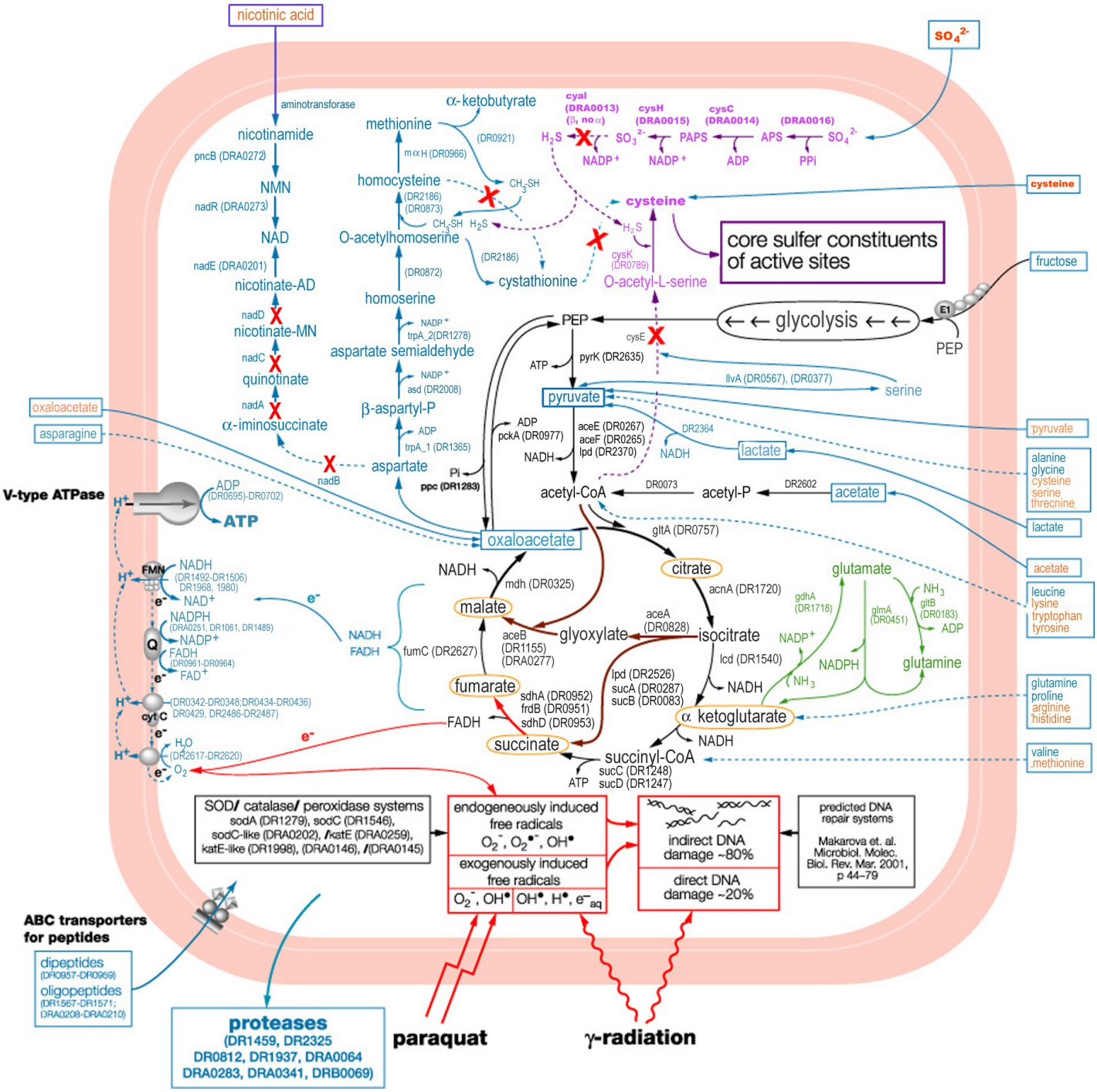
One or another of these, or something similar will ALWAYS bring about a termination.

Now all these diagrams are 2D, whereas, of course, they will be occurring in 3D space. In addition the various substances will not be clearly clumped as in our figures, but will be intermingled. Patches, or maybe only molecules, of all the participants will occur in several different places including inside one another (surrounded).

A simple Animation of this could illustrate positive feedback, and its ultimate inhibition very well.
The sequence would be

1. From a single Agent inside a quantity of Resource a single Product could be the starting condition.
2. The replication of the Agent, using Agent Resource, could produce another Agent, which then would itself begin to produce Product.
3. For each new patch of Product, the surrounding Resource would diminish in size as would the areas of Agent Resource with the appearance of new Agents. As the resources became very small, Agents would begin to disappear, and NO new Product would be produced. By the time we have NO Resources, we will have a certain amount of Product. Related to the size of the original Resource.. The amount of Agent will depend on how much Agent Resource there was from the start. Surely, this also would decline to vanishing point and all that would be left would be Product, where initially there was Resource, Agent Resource and Agent.
4. At this point, the focus could change to a new Agent, acting on the available Product as its RESOURCE, and a new cycle of positive feedback could run through as in 1, 2, and 3 above. With some obviously necessary extras, such as 2^{nd} , 3^{rd} and subsequent Agents being present from the start. This animation would be a useful illustration.

At this point it is most appropriate to mention Metabolic Pathways in life forms of all types. Though these are NOT run away situations, but on the contrary very controlled and stable situations, their origins MUST have been an Emergent Event, and their subsequent maintenance and stability must also have direct parallels in



Emeregence in general. These Pathways are a whole series of Agent enabled chemical processes where a given Resource is converted into a Product. For each individual process the Agent is termed a catalyst or Enzyme. And the whole system is an interdependent set of processes each enabling or inhibiting others so the system as a whole ebbs and

flows in a dynamic but highly controlled way. Such an elaborate system could only self generate by the sort of Emergent processes we are trying to understand here.

Metabolic Pathways

Though the above diagram may appear confusing, it soon throws up the crucial elements that we are discussing here. The larger text in the pathways are the Substances which are BOTH Resources and Products. Each Substance as a Resource is catalysed by the Agent (Enzyme) written alongside the process arrow. The thing to notice is the repetition of these substances all over the diagram. Crucial substances appear at various points as Products, and are taken up as Resources where required. Such a system must have had many failures before such a comprehensive self-maintaining system was finally established and maintained. Out of positive feedbacks everywhere, a STABLE system at a new level Emerged.

As outlined in another paper from earlier in 2006 the sources of the contributing elements of such dramatic processes are important. Not only in the sequential sense as described abovew, but in the inter-dependability of these elements.
A crucial question: Where does the Agens' replication Resource come from?
If it, along with all the other participating elements, is simply there from the start, the result can only be small scale and temporary. If, on the other hand, this important element is being produced somehow (maybe by another process) the situation radically changes. It becomes possible to think of processes of Replenishment as well as the obvious processes of Diminution. The continuing production of Agent Resource (as with the main Resource) will tend to allow continuation of the process. Indeed, as soon as multiple, simultaneous and inter-dependant processes are considered, the sought for inkling of Actaul Emergence seems to be possible. As in Metabolic Pathways as described above, whole systems of processes are replenished and inhibited by different sub or sister processes, and though initial changes may well be Revolutionary, the Emergence of a New stability is definitely conceivable. Instead of the temporary burst of positive feedback, we get the maintenance and modulation of such processes by mutual supply and effect. In metabolic Pathways the processes have to be considered "globally", because the resources, accelerators and inhibitors are constantly being produced, and the speed of the processes accelerated or slowed down in response to the amount of these available at any particular time.
They become a System.

And as such, relationships at the New, System Level appear. A Level has Emerged.

(1,691 words)