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The Boss: Behaviour in All the Organisms

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Abstract

Behaviour of eukaryotic organisms (fruit flies). Behaviour of prokaryotic organisms (bacteria). Decision-making. The Boss.

Keywords: Organisms; Eukaryotes; Chemotaxis in Eukaryote Drosophila; Prokaryote; Bacteria; Chemotaxis in Bacterium Escherichia Coli; Biology; Metabolism; Genetics; Neurobiology; Psychology; Biochemistry; Neuroscience

Introduction

The glory of human life but the glory of all life (Figure 1).

The response of organisms to stimuli has been described in both eukaryotes - people, animals, plants, eukaryotic microorganisms-and in prokaryotes-archaea and bacteria. In this report I would like to present a further comparison of the eukaryotes and the prokaryotes. Yes, all organisms sense external and internal stimuli, but how this information is then used by the adult organism is different for different organisms. For example, some adults eat chemicals (as in parts further below), some adults eat plants, some adults hunt animals, some adults use sunlight for energy: as examples see C Weibull 1960 [1], Julius Adler 1965 [2], Ran Nathan et al. 2008 [3], Ken Jarrell & Mark McBride 2008 [4], Sydney Brenner 2018 [5], N. Wadhwa & Howard Berg 2022 [6]. An example of some of the adult responses is the case how adults hunt animals; this is shown for an adult plant in the Figure 2. Another example of how adults hunt animals is shown in "The Leopard Legacy", this is an excellent movie about the behaviour of leopards, presented by Nature, please consult it.

The Boss Directs the Behaviour of Eukaryotes and the Boss Directs the Behaviour of Prokaryotes

Articles On Behaviour and On the Boss

Helen Barbas discovered in the rhesus monkey [7,8] Figure 2 that the orbitofrontal cortex receives information from the sensory cortices, namely the visual, auditory, somatosensory, gustatory, and olfactory data as it is just received, and in addition from the amygdala, which contains data about emotion and memory of past events. Then the information from the sensory cortices and from the amygdala fuse in the orbitofrontal cortex.

Barbas says that "the orbitofrontal cortex is thus capable of sampling the entire external and internal environment and may act as an environmental integrator". And then this brings about a response by the organism, she tells (Figure 3).

Barbas in later papers reviews and expands all this, and she tells that in humans some accidents or strokes cause partial damage here. An example she gives is the case of Phineas Gage, whose brain was damaged by an iron rod passing from his eye to the top of the frontal lobe and thus damaging his orbitofrontal cortex. "The prefrontal cortex controls our thoughts and guides our behaviour to act flexibly...Disconnection with areas associated with cognition and emotion appears to describe the symptoms of schizophrenia, autism, depression, phobias, panic disorder, and posttraumatic stress disorder. For a more complete description of this, see Eric Kandel [9]. The disordered mind: What unusual brains tell us about ourselves. Barry Stein & Alex Meredith [10] discovered that the sensory receptors in the cat's brain lead to all of them merging together. See next Figure 4. This place of merging then decides which of the various sensed information should yield a response.

I did research on the behaviour of bacteria for 40 years (1960 to 2000). This is summarized in a review "My Life with Nature" [11]. Then I started research on non-bacteria, namely *Drosophila melanogaster* fruit flies, and "found" The Boss: see Figure 5 below.

I proposed there that The Boss is the thing that directs behaviour in organisms. This was described further in my review "A Search for The Boss: The Thing Inside each Organism that Is in Charge", published in Anatomy Physiology & Biochemistry International Journal in 2016 [12]. Thus it was proposed that organisms have something in charge of them. This is called "The Boss". It is a novel idea. Before this, it was believed that each organism has properties that are largely independent of each other. Now it is suggested that all the properties are controlled by a single kind of factor, The Boss, which directs both the interior and the outside of the organism. The Boss is to be found in all organisms. All the things that an organism does are controlled by The Boss, but this control is not always direct: many aspects are delegated to managers, who delegate to foremen, who delegate to workers. So far it is largely the workers that have been studied, and sometimes the foremen are revealed, and rarely the managers, but The Boss has remained largely hidden. By itself, or by delegating, The Boss controls.

Figure 1: Behavior is the response to sensing stimuli.

Figure 2: Example showing that some animals and plants hunt other organisms for their food. In this case a Venus fly trap hunts a house fly. Photo from National Geographic Education.

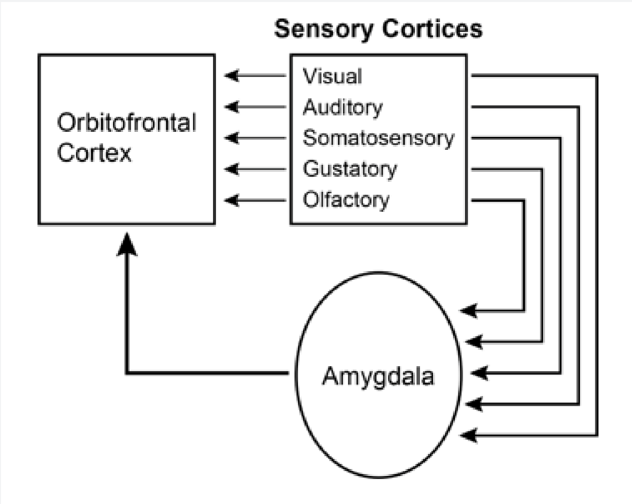

Figure 3: Taken from Figure 3 of Barbas [8].

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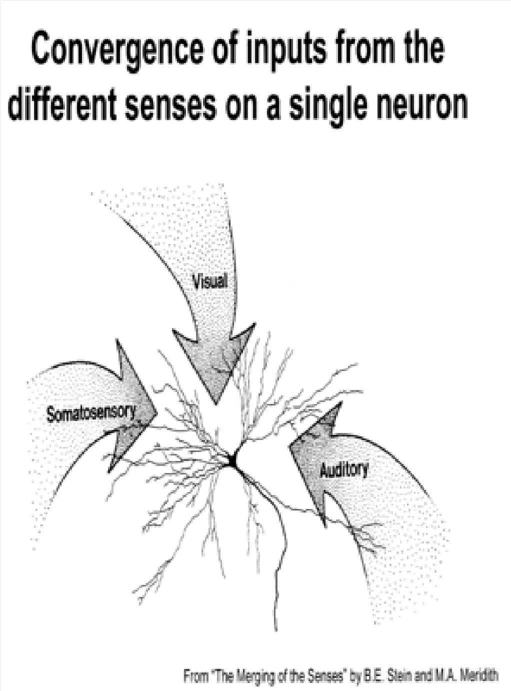

Figure 4: This figure shows Figure IV.1 of Stein and Meredith, page 108 of their book "The Merging of the Senses".

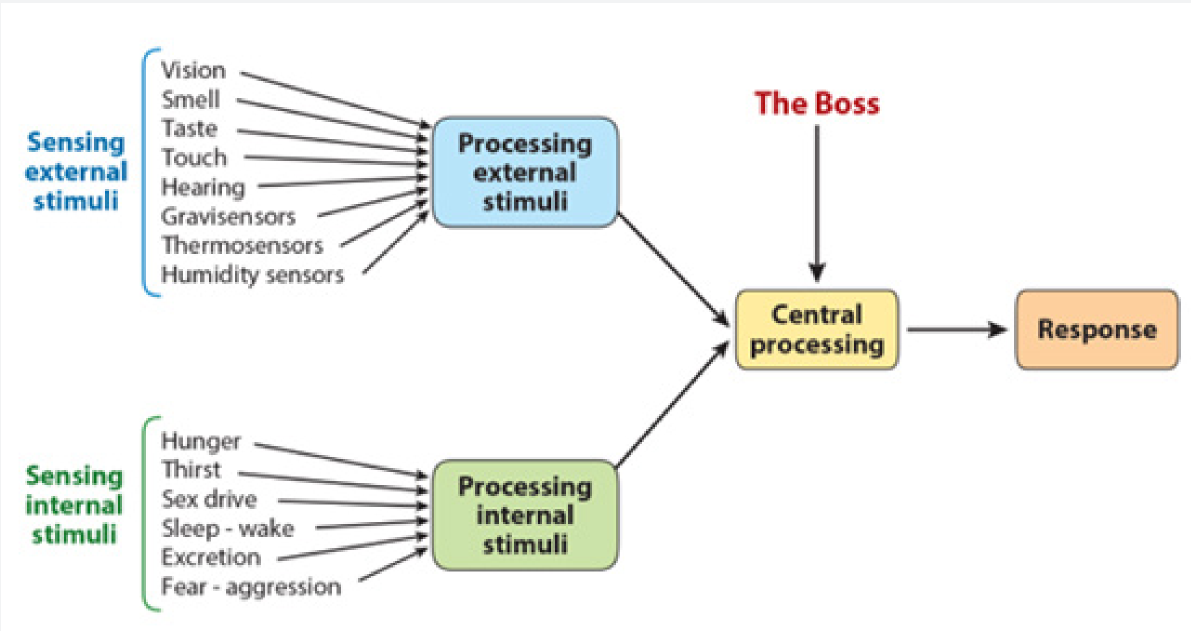

Figure 5: This is Figure 13 of page 60 of "My Life with Nature", which says: "The mechanism of behavior. This applies to all organisms: microorganisms, plants, animals, including humans." Note The Boss.

Sometimes there is a conflict between several attractants, or between several repellents, or between an attractant and a repellent. In the case of attractant together with repellent, there are reports of such conflicting behavior, for example in people [13,14], in cats [10], in insects Zhang et al. 2007, [15-19], in nematodes [20], and in bacteria [21-23]. Mutants of some of these

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are being studied, see next, and are proving valuable for learning about how The Boss may act in behaviour.

Mutants in the Boss

To try to find evidence that might test existence of The Boss, we looked for mutants missing The Boss in Drosophila fruit flies. These are mutants that are motile but can't decide what to do. A summary of such mutants found is presented next.

a) We isolated motile mutants that lack all behavioural responses at an elevated temperature presumably by lacking The Boss there, but they do have the responses at room temperature where The Boss still exists [19].

b) In addition, we isolated motile mutants that lack all behavioural responses at both elevated temperature and room temperature by presumably lacking The Boss altogether [24]. (Then there must be some alternative way to allow survival.). What do these mutants tell? The conclusion appears be that The Boss exists.

Synthesis of DNA, RNA, and Protein in Relation to the Boss

The proposal here is that there is a master control, The Boss, that dictates what shall be the synthesis DNA, RNA, and Protein. Our knowledge of how DNA, RNA, and protein are made, and how this is controlled, is now extensive for DNA synthesis [25], Zakrzewska Czerwinska et al. 2007, [26,27], for RNA synthesis [28-30], and for protein synthesis [31-35]. The Boss is turned off in sleep. (Then in sleep a large variety of other systems may take over, but this will not be discussed here.)

Chemistry of the Boss

The gene for The Boss would seem to be made of DNA, but not necessarily. Since RNA would have been present in organisms before there was any DNA, according to ideas of [36-38] and since The Boss may already have occurred in these earliest organisms, The Boss might well be RNA that does not go through any DNA at all, like many of the known RNA viruses [36], such as covid-19, the corona virus [39,41].

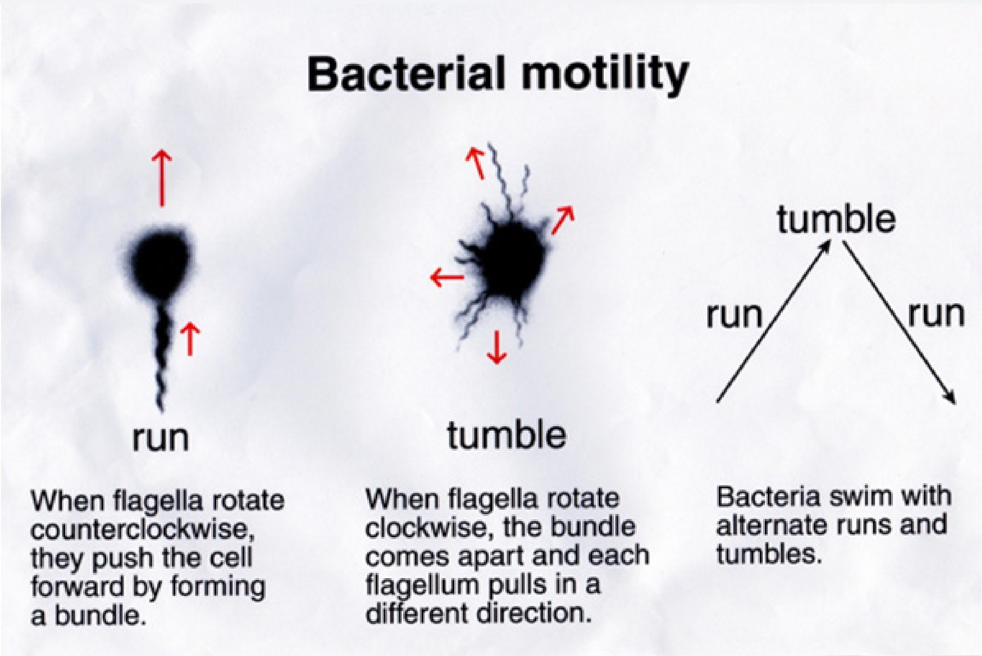

Figure 6: Running and tumbling. This in accord with Howard Berg & Robert Anderson [60], Michael Silverman & Melvin Simon [158], and Steven Larsen, Robert Reader, Edward Kort, Wung-Wai Tso & Julius Adler [124].

The Boss in Bacteria

The motility of bacteria is diagrammed here (Figure 6)

Imagine a gradient between a low and a higher amount of attractant. A bacterium that happens to swim from the higher into the lower amount of attractant suddenly stops or becomes apparently uncoordinated for an instant or jumps back, that is it tumbles. Instead, if a higher amount of attractant is encountered, the bacterium swims in a straight line without tumbling in order to be in the direction of higher amount of attractant. The net result is that the bacterium avoids the lower amount of attractant by tumbling and accumulates in the region of higher amount of attractant by not tumbling.

Does The Boss exist in bacteria? I think so. Here I quote Adler & Tso [22]; "Apparently bacteria have a data-processing system that receives opposing signals from the chemoreceptors for positive and negative chemotaxis, sums these signals, and sends

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the result to the flagella for action". The data-processing system can now be termed "The Boss", or likely there may be a still unknown step ahead of the data-processing system that controls data-processing.

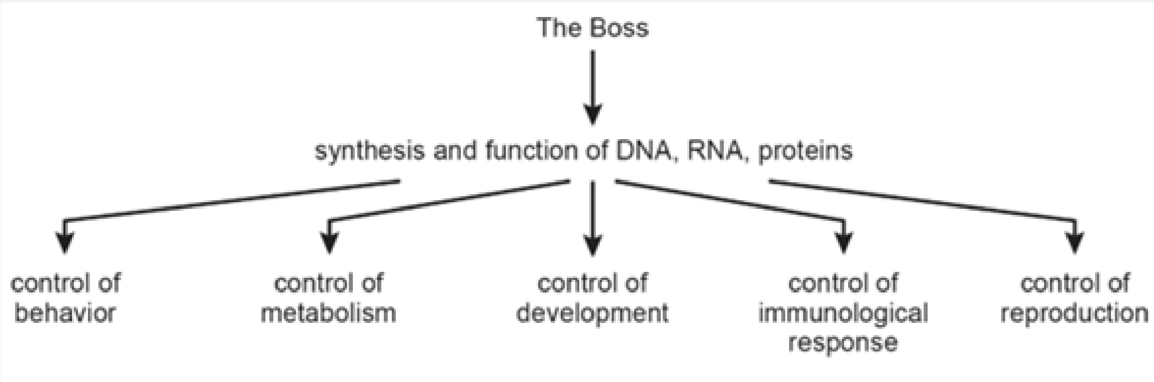

Figure 7: Summary of the role of The Boss.

Summary about the Boss

The Boss is the thing in every organism that is in charge of the organism. The Boss is fundamentally similar in every organism. The Boss directs the synthesis and activity of DNA, RNA, and protein, and thereby is in charge of behaviour, metabolism, development, immunological response, and reproduction (Figure 7):

Articles on Behaviour and On the Boss by Adler and Collaborators 2010 To 2023

a) 2012. "Simple ways to measure behavioural responses of Drosophila to stimuli and use of these methods to characterize a novel mutant." L.L. Vang, A.V. Medvedev, J. Adler. PLoS ONE [41].

b) October 2023. "Mechanism of behavior". J. Adler. Anatomy Physiology & Biochemistry International Journal [42].

c) 2016. "Decision making by Drosophila flies". J. Adler., L.L. Vang. bioRxiv [19].

d) 2016. "Drosophila mutants that are motile but respond poorly to all stimuli tested: These may have a defect in interaction with stimuli or in executive function". L.L. Vang, J. Adler. bioRxiv [43].

e) 2018.. "Drosophila mutants that are motile but respond poorly to all stimuli tested: Mutants in RNA splicing and RNA helicase, mutants in The Boss". L.L. Vang, J. Adler. bioRxiv [24].

f) July 2016. "A Search of The Boss, The Thing inside each organism that is in charge". J. Adler. Anatomy Physiology & Biochemistry International Journal [12].

g) October 2023. "The behavior of organisms and how the response is directed." J. Adler. Anatomy Physiology & Biochemistry International Journal Anatomy [44].

h) August 2023. "Every organism has its own The Boss. Behavior of bacteria compared to behavior of eukaryotes." J. Adler. Anatomy Physiology & Biochemistry International Journal [45].

Behaviour of Drosophila Fruit Flies Compared to Behaviour of People

"Little fly, am not I a fly like thee. Or art not thou a man like me?" by William Blake quoted by Ralph Greenspan & Hermann Derick [46], who say "The fruit fly Drosophila melanogaster and humans share a great many of the same genes in common. As a consequence, the fruit fly has taken on some surprising new roles as a potential model for human biology and genetics." Berrak Ugur, Kuchuan Chen & Hugo Bellen [43], report "The Drosophila genome is 60% homologous to that of humans, and about 75 % of genes that causes disease in humans are also found in fruit flies

Nerves and Behavioral Genetics

How many nerve cells are there in each organism? Table 1 shows this for a variety of organisms:

Table 1: Number of nerve cells.

bacterium	1?
yeast	1?
nematode	302
fruit fly	250,000
zebra fish	10,000,000
mouse	71,000,000
human	86,000,000

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Bacteria and yeast are single celled, so of course they only approximate a nerve cell, hence the question mark above. By now the genetics of behaviour has been extensively studied by many scientists and deserves overall reviews [47-173].

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