# A mechanism for the formation of unconditioned reflexes

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# A mechanism for the formation of unconditioned reflexes

**V I Syryamkin, V N Shumilov**

National Research Tomsk State University, Tomsk, Russia
E-mail: vnshumilov@rambler.ru

**Abstract.** The paper considers a possible mechanism for the formation of unconditioned reflexes in organisms with the nervous system before their birth, that is, before the environmental impact on a certain organism. The effect of the environment is detected by receptors. It generates signals coming from the receptors into the nervous system, which organizes the organism's reaction to the environmental effect. Inter-neuronal connections, which carry out unconditioned reflexes, realize input of signals about the environmental effect from the receptors in the nervous system.

## 1. Introduction

There are unconditioned and conditioned reflexes. Conditioned reflexes are produced by organisms during their own lives and may be replaced by new reflexes if necessary. Conductive connections are formed between excited neurons. Let us discuss the beginning of the formation of conditioned reflexes, when neurons appear in the developing organism and there are no connections between these neurons. Because of the lack of connections, neurons cannot be excited, and therefore, connection between them cannot be formed. The development of the nervous system (the formation of conditioned reflexes) begins with unconditioned reflexes that arise in the organism unconditionally regardless of the environmental effect on it [1].

Unconditioned reflexes are normally formed in all organisms of a given species before the birth of the organism. At the beginning of life, neurons of the nervous system still have no connections with other neurons, through which they could be excited. That is, neurons cannot be excited without connections at their input; they cannot react to events, and therefore, cannot record traces of events.

The formation and development of reflexes (chains of cooperative neurons) to a certain extent is similar to the appearance and development of frost patterns on a clean windowpane. These patterns begin to develop from some place (usually from an edge with favorable conditions to the pattern initiation) and grow along the edge of the pattern in the direction of cold air movement. On new places of free space (in isolation from the previous pattern), new patterns are formed rarely because of absence of initiating basis for them [2, 3].

How are unconditioned reflexes formed? They are formed in the course of evolution in all average organisms and are formed in each individual organism during its development in the mother's womb or in the egg.

Evolution is the result of two main processes - stability and variability. Stability is provided by replication (self-copying of body cells). Variability is caused by mutations. Evolution of the species is a natural development of organisms' line, their adaptation to the environment (there is always something to improve). In addition, the environment may change, and organisms must also adapt to these environmental changes. Mutations occur at the level of initial (maternal) sell when the life of each organism is initiated, at the moment of conception of each new embryo. If the mutation proves to

be useful, its results contribute further to the survival and expansion of a growing and mature organism, that is, to the continuation of the organism and its descendants with the properties caused by mutations. This means that the successful mutation contributes to the survival and expansion of the species. An organism that carries a harmful mutation is more likely to die without producing descendants. Evolution occurs with the survival and expansion of organisms that are best adopted to the current environmental conditions (existing at the given time in a given location).

## 2. Unconditioned reflexes are the basis of the personal development

Organisms of sufficiently highly developed species are born or come out of the egg with a set of unconditioned reflexes, which form the basis for the further development of the nervous system of organisms [4].

In the organism, the variety of possible useful processes and mechanisms on their basis is limited because of the limited amount of information contained in the original maternal cell. Therefore, we can conclude that the mechanism for forming connections between neurons that make up the chain of unconditioned reflex cannot significantly differ from the mechanism of forming conditioned reflexes because such a difference would require the existence of additional mechanisms [5].

The information capacity of the initial cell is limited; therefore, processes occurring during the cell development in the embryo and during the further development of the embryo can only be the simplest and natural in the emerging conditions.

Unconditioned reflexes are short and simple chains of neurons from receptors to effectors. Connections are formed between neurons that realize the unconditioned reflex. To generate short reflex chains, less information (conditions) is required. The mechanism for forming connections that realize unconditioned reflexes cannot significantly differ from the mechanism of forming connections between neurons that were excited by signals from other excited neurons through their input connections. However, at first, neurons do not have input connections, therefore, they can be excited only by means of almost random self-excitation.

By conducting signals about the environmental effect on the receptors, unconditioned reflexes provide the possibility of excitation of neurons, between which associative connections are formed during the life of the organism. Random self-excitations of neurons in mature organisms do not happen very often. With such excitations, random connections can form. There is little benefit in these random connections between self-excited neurons. Such connections do not reflect anything; therefore, their benefit is only in expanding the possibilities for forming connections between a group of neurons (to which a neuron joins as a result of the neuron connection after its self-excitation) with other neurons. In the beginning, such connection does not correspond to any particular event.

For the further development of the nervous system (formation of associative connections), it is necessary that interneurons can be connected to the reflex chain [6, 7]. Because of the presence of connections between unconditioned reflexes, signals initiated in the receptors enter the nervous system, where neuronal chains begin to form; these chains reflect traces of events effecting the organism and fix the organism's experience. Figure 1 shows the processes of the nervous system functioning.

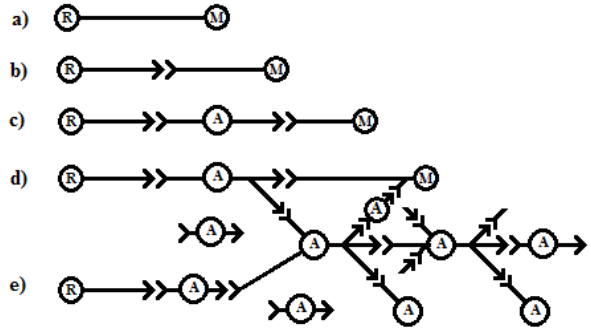


**Figure 1.** Appearance of unconditioned reflexes and their necessity for the nervous system.

In this Figure, *R* is receptors, *M* is manipulators (effectors), *A* is associative neurons.

a) Combined receptor and effector (manipulator) in the shortest chain of unconditioned reflexes.

b) Separate receptor and effector with increasing distance between them.

c) Appearance of interneurons allowing increasing distance from the receptor to the effector.

d) Connection of the advanced information processing systems that provide forming of complex conditioned reflexes to effector control.

e) Other receptors and still unused neurons A.

It is clear that the main condition for the formation of connections between neurons is their neighborhood in space and mechanical contact between them, which provide *an opportunity* for the formation of connections between them. The neighborhood of neurons is provided by the development of nerve tissues, when during the course of the organism's development, new cells are formed as a result of the division of the earlier formed cells starting from the original cell.

The mechanism for the formation of unconditioned reflexes is the same as the mechanism for the formation of conditioned reflexes. The difference is that self-excitations of neurons occur much more often at the age of the embryo than in an adult organism. The specific weight of neuron self-excitations is also much higher. This is because of the fact that the potentials and threshold values of the neuron excitation have slightly different values at the youngest age of the organism than in the adult organism. Moreover, during the development of the organism in the maternal womb, the excitation of various neurons occurs less frequently than in an adult organism with a large number of neuronal connections, and therefore the neuron's readiness for excitation increases to the maximum. In this period, the threshold level of neuron excitation is much lower because of the rarer neuron excitations. Therefore, during the period of intrauterine growth, self-excitation of neurons often occurs, which ensures the formation of connections between neurons realizing unconditioned reflexes, even in conditions of the absence of initiating neuronal stimuli.

The formation of traces of events results in accumulation of the organism's experience and formation of conditioned reflexes that provide an adequate response of the organism to current events by using various manipulators of the organism (limb muscles and glands producing necessary substances). Reflexes in the nervous system are realized as a set of neurons united in a single control sequence through information (associative) connections between neurons. These connections are formed under the influence of the environment in previous episodes.

During the period of intrauterine development, the organism cannot yet be fully affected by stimuli, which will appear only after the birth of the organism. At first, in the developing organism, there are still no neurons, connections between them, and connections of receptors with the subsequent neurons. Gradually, in the developing organism the number of neurons and connections between them grows. The question arises. How are associative connections between neurons formed if they do not yet have input connections for excitation of neurons by the initial stimuli?

Differences in the levels of neurons excitation in different organisms (along with other factors) determine the psychological type and the temperament of a person - some people are more excitable, others are more inert. Since the threshold levels affect the excitation of individual neurons, they also affect the formation of connections between neurons and the memory features of individuals.

The threshold of neuron excitation of specific organisms can be adjusted by appropriate nutrition or by taking special medications.

The set of unconditioned reflexes in different organisms can vary within some limits. Some reflexes can be expressed clearly, while others may be weak or nonexistent.

Thus, if for some reason (for example, because of unbalanced nutrition) the desired nutrients do not enter neurons in sufficient quantity, the self-excitation of the neurons will be less frequent than necessary for forming all necessary unconditioned reflexes. As a result, the embryo, which has already begun to develop (not yet born organism) will not have a sufficient basis for the formation of conditioned reflexes, which are necessary for the successful development and expansion of the organism.

The absence of any secondary unconditioned reflexes does not have a significant effect on the development of the child's organism. For example, conjunctival and scleral reflexes, which are often absent normally, do not have much significance for the development of the nervous system.

Functionality and the utility of the majority of unconditioned reflexes, which are formed during the intrauterine life of the organism, is obvious. At the same time, some unconditioned reflexes do not bring any visible benefit to the body. There are also other secondary effects (phenomena) outside the nervous system in various mature organisms. For example, the hair on various parts of the human body. Some of these signs are atavisms and are manifested through many generations from those times when these signs were useful. Some signs are purely secondary effects; they continue to persist in the species, although they are useless from them. At the same time, they are not harmful. More likely, lines of organisms with negative properties died because they did not stand up to collisions with the dangers during life. Therefore, organisms with negative features did not really advance into the future. Just secondary features did not facilitate but also did not impede the survival and expansion of the species [8, 9].

The mechanisms of both conditioned and hundreds of unconditioned reflexes are of the same nature. Therefore, unconditioned reflexes, which are not involved or used rarely in the postnatal period of the organism's life, fade away with time in the same way as conditioned reflexes, which do not receive frequent repetitions (reinforcements).

The absence of any standard unconditioned reflexes (observed in average statistical organisms of this species) indicates that in this organism there were no conditions for forming a complete set of unconditioned reflexes ensuring a normal successful development of the organism. What is the reason for insufficient development of unconditioned reflexes?

Sometimes the inadequate development of unconditioned reflexes is due to mutations in the organism when the organism is conceived, when the formation of a changed set of unconditioned reflexes is predetermined by genetic changes during the initiation of the organism (embryo). Another reason for the lack (underdevelopment) of certain unconditioned reflexes during the intrauterine development of the organism is the absence of conditions for forming missing connections between neurons. Such conditions may be, for example, in the lack of necessary nutrients and microelements resulting in an increase in the threshold excitation potential of the neuron, or in too high connecting potential even in case of contact between excited neurons.

The absence of any secondary unconditioned reflexes does not have a significant effect on the development of the child's organism. Moreover, even the complete absence of the sense organ (the provider of information to the brain), including organs of hearing or even sight, which are the most informative, does not deprive a person of the opportunity to become a full member of the human society. On the other hand, feral children who have lived isolated from human contact from a very young age (being raised by animals (monkeys or wolves)) [10], grew up with the psyche of animals and with a set of acquired reflexes inherent in the animal community that sheltered the child.

There are cases when people found such children (‘Mowgli’), took them away from their already habitual environment and tried to accustom them to life in the human environment. However, this never led to the complete adaptation and socialization of such children because during the period of forming foundations for perception of the world (“the period of laying the foundation for an individual”) such children lived with animals. Therefore, they grew up with habits, customs, and values of animal communities that sheltered them.

This proves that, although the person's personality is formed on the physiological basis of the available capabilities of the organism and its nervous system, which ensures the **delivery of information** to the brain, the resultant behavior of the organism and personality is influenced by the personal experience accumulated in the organism during its existence. The personal experience means the **information received** by the body from the outside world and acquired by it, that is, the values gained as a result of education.

## 3. Formation of conditioned reflexes in the prenatal period

Some scientific studies provide data that children of alcoholics are prone to alcoholism, but if such children are put with a good family, then they grow as normal people (Blakemore and Cooper, 1970). This proves that the mother's alcoholism during the period of intrauterine development results not in "alcoholic" genes, which are transferred to the newborn child, but in alcohol dependence, which develop in the alcoholic mother' womb. This dependence (the totality of reflexes) can be suppressed and replaced by education and by creating right reflexes in a good family.

## 4. Conclusion

The work considers the formation of unconditioned reflexes in the perinatal period (before the birth of the organism), which provide the simplest necessary reactions of the organism to the environmental effect. These reflexes are not a characteristic feature of a specific organism, but of the whole species of animals, to which this organism belongs. Reflexes are generated by the connections between the corresponding neurons that conduct signals about the environmental effect on the organism from receptors to effectors that perform an active response to the environmental effect. The number of connections forming unconditioned reflexes is relatively small because the amount of information about the structure of the future organism is small. This information is in a single initial maternal cell in a mediated form. In addition to the obvious function of transferring signals from receptors to effectors, chains of connections between neurons, which carry out an unconditioned reflex, provide input of signals from receptors to the nervous system consisting of a set of neurons that conduct signals and fix traces of events - the effects of the environment.

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