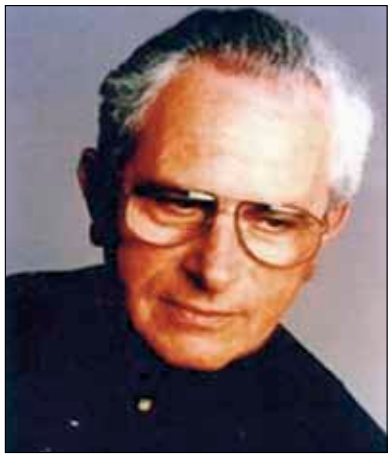
EDITORIAL

Georhinology
A history of 338 million years of the sneezing nose



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Writing a monograph on sneezing, I faced four geo-biologic phenomena, which, I consider, constitute a new paragraph in rhinology, "geo-rhinology". I dedicate this new paragraph of georhinology to the *2nd Congress of the Romanian Rhinologic Society* and to its Presidents, Prof. D. & C. Sarafoleanu.

To reach the expiratory burst of thousands of μic droplets, at high speed, 2 steps are needed previously:

1. An inspiration with maximal diaphragmatic contraction;
2. A closure of the glottis with contraction of the thoracic muscles.

In order to realize the sneeze (Figure 1): the following structures are needed: *nose*, lungs, diaphragm and rib muscles. When does the history of the geologic evolution of the sneezing nose start? Or the *nose evogram?*

Figure 1 Sneezing effect

Four georhinologic phenomena can be distinguished in the interrelationship nostrils - nose/sneezing:

1) aquatic animals without nostrils/nose & diaphragm (fish): do not sneeze;
2) aquatic animals with closing nostrils or blowholes, without diaphragm (frog, platypus, whales and dolphins): do not sneeze;
3) terrestrial animals with nose and diaphragm (reptiles & mammals): DO SNEEZE;
4) sneezing can be a factor of species extinction.

Oxygenation, a basic condition of life, is nose-related. Five types of gas exchange systems are known in animal biology:

1) Integumentary air exchange (reptiles);
2) Gills (fish and larvae);
3) Tracheal systems (insects);
4) Breathing in water and air (amphibians);
5) Atmospheric breathing in reptiles and mammals.

The first three types of oxygenation (Table 1) are characteristic for the Paleozoic era, between 544 and 338 million years ago (Cambrian to the early Carboniferous period). The breathing in water and air of the amphibians occurred in the last Carboniferous period to the Jurassic period, between 338 and 69 million years ago. The atmospheric breathing in reptiles and mammals appeared in the last Cretaceous years till today.

Fish breathe through mouth and g*ills. Gills* are aligned single cells, full of capillaries passing oxygen into the bloodstream (Figure 2).

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Table 1
Geologic eras

Paleozoic era 544 to 245 ma		Mesozoic era 245 to 65 ma		Cenozoic era 65 ma	
-Cambrian	544 to 505 ma	Triassic	245 to 208 ma	Tertiary	65 to 1.8 ma
-Ordovician	505 to 440 ma	Jurassic	208 to 146 ma	Quaternary	1.8 ma
-Silurian	440 to 410 ma	Cretaceous	146 to 65 ma	To day	
-Devonian	410 to 360 ma				
-Carboniferous	360 to 286 ma	ma = million years ago			
6-Permian	286 to 245 ma				

Figure 2 Face of a fish (no nose), oxygenation through mouth to gills

Figure 3 Frogs metamorphosis

The history of the nose starts with the appearance of *nostrils* and lungs in frogs (tetrapod vertebrates amphibians - 338 ma), when breathing became possible both in water and air. They undergo metamorphosis: from larva with gills into air-breathing adults with closing nostrils & lungs without diaphragm (Figure 3). Integumentary gas exchange via their skin is also possible. They do not sneeze.

The history of sneezing starts with the terestrial reptiles using nose, lungs and the musculature; the latter is used for both locomotion and breathing. A Brachiosaurus of the Cretaceous era - 18 meters long, weighing 20 tons, was able to sneeze through its 1.8-meter long nose with a force comparable to that of water spurting from a water hose 20 meters away. It is not hard to imagine that all the animals and objects within that distance would have been blown off.

Dinosaurs inhale and pass the air to the alveoli through elaborate bronchial passages (Figure 4). They lack the diaphragm, the function of which is assumed by the throat and the strong rib cage muscles.

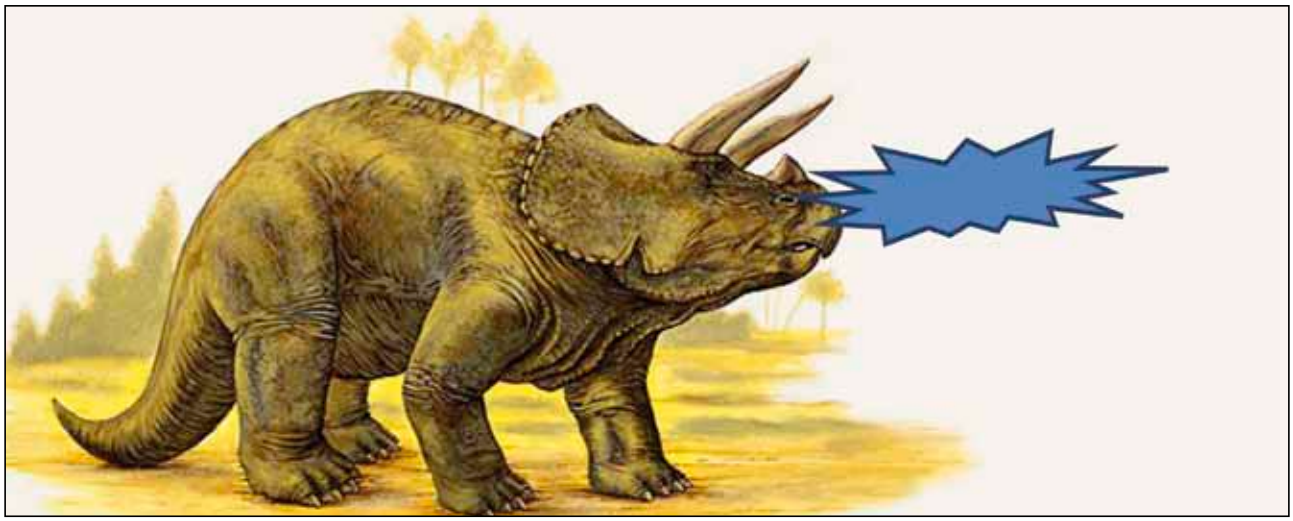

Figure 4 The dinosaurs' sneezing

In the last years of the Cenozoic period, terestrial reptiles and mammals breathing air appeared. Two major phenomena characterise the Cenozoic: 1) the tectonic reorganization of the planet: the splitting apart of Laurasia, South America and Africa, movement of Australia and India and the separation of North America from Europe; 2) the massive proliferation of mammals. These two factors imposed a radical re-organization of the embryonic development of the nose, influencing the sneezing. These are some types of noses developed in the most fertile period of the mammalian era (Figure 5).

According to paleonthologists, dog noses appeared 75 million years ago, of the horses later - 50 million years ago, while the nose of the cat is supposed to have appeared only 18 million years ago (Figure 6).

Figure 5 Types of noses

Figure 6 Noses development

The growing oceans gave birth to flying and marine mammals (whales and dolphins). The two nostrils transformed into one blowhole covered by muscular flaps, being able to close when the whales submerge (Figure 7). At the water's surface, they exhale air explosively, followed immediately by inspiration. Their trachea and esophagus are completely separated; unlike humans, they have no pharyngeal reflex and do not sneeze.

Figure 7 The first photograph shows the expirium of a whale; this is not a sneeze. On the right, one can see the blowhole of a dolphin open (up) and its closing at the moment of submerging (down).

The nose/sneezing interrelationship in the snub-nosed monkey" (*Rhinopithecus roxellana*) (Figure 8) is threatening with the extinction of the species. In the snub-nosed monkeys, the nose cartilages degenerated and disappeared. This monkey with uncovered nose, sneezes loudly during rain, allowing hunters to catch it easily, which may soon cause its extinction (they are today only 8000). To survive, the monkey hides during the raining season and adapted itself to live at the top of mountains in the snow, despite the fact that they are herbivorous and eat lichens, leaves, fruits, seeds and grass.

In humans, sneezing can be triggered by photic, gastric, sexual, ideational, electrical stimulation, tactile stimulus applied to the nose or ankle, dilation of blood vessels, and exposing the neck or head to low temperatures. All these are an irrefutable proof of the complexity of the human neuronal and biochemical network that transforms sneezing in a sophisticated automatism.

Throughout 338 million years, the simple reflex of sneezing of the reptiles has become a sophisticated automatism in human beings. It is up to you to decide the fate of geo-rhinology – to survive or not!

Figure 8 Rhinopithecus roxellana ("snub-nose monkey")

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