tented ignorance we can maintain until our friends, the psychologists, finally settle upon some one theory after this is fortified with evidence of such a character as to exclude its competitors. Their authority will then be accepted as readily as they now accept the authority of the physicists about the polarization of light or the mechanical equivalent of heat.

So far, therefore, as physicists accept the Young and Helmholtz hypothesis their acceptance must be based, not on any physiological grounds, but upon its convenience of application to the phenomena of color mixture and color analysis. Practically, one hypothesis may, perhaps, be no better than any other for this purpose, If we abandon the term 'primary color,' and substitute 'prominent color' for it, our selection may be determined avowedly by convenience. In the performance of the extended work of color analysis, which was undertaken a few years ago under the direction of Professor Rood for a well-known firm of publishers, the composition of all compounds was expressed in terms of black, white and five 'standard colors,' red, orange, yellow, green and blue. The standard pigments selected were English vermilion, mineral orange, chrome yellow, emerald green and artificial ultramarine, all of which give enduring and reliable hues. Violet was left out because no sufficiently reliable pigment was obtainable; but by mixture of appropriate proportions of standard red, blue and black a good violet was included in a selected series of types. There is no danger of practical inconvenience to the physicist because of the present unsatisfactory conditions relating to color theory.

To give the outlines of the competing views is hardly necessary. The Hering hypothesis is well known, and probably universally rejected among physicists. Wundt's hypothesis has a good following among psychologists, but is still very little known among physicists. Without pretending to be a psychologist, I am much more favorably impressed with this hypothesis than with that of Hering. Mrs. Franklin's views need not be outlined, as they are readily accessible, in either the English or German language. With the hypotheses of Ebbinghaus and Nicati I have not yet become acquainted. Physicists will, perhaps, not be surprised at this frank confession.

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THE EPARTERIAL BRONCHIAL SYSTEM OF THE MAMMALIA.

The paper deals with the structure of the bronchial system and pulmonary vascular supply of the mammalia as exhibited by corrosion in an extensive series comprising representative types of all orders and many families. The conclusions reached are, in the main points, at variance with the views expressed by Professor Aeby and generally accepted in the current text-books of Human and Comparative Anatomy. For reasons given in detail in the paper, the primitive form of the mammalian bronchial distribution appears to be Aeby's 'bilateral hyparterial type.' The arrangement of the primary bronchial trunks and of the pulmonary artery exhibited in this type is of considerable morphological importance in reference to the evolution of the typical mammalian bronchial tree, and is discussed at length in the paper. Aeby's researches revealed but a single form possessing this distribution, viz.: *Hystrix cristata*, the European Porcupine. Subsequently, M. Weber described the same type in the lungs of *Balæna mysticetus* and *B. antipodum*. The present investigations have added a fourth form to the list, *Taxidea americana*, the American Badger.

In examining the lungs of the remaining

mammalia which were investigated, a distinct and progressive series can be established in accordance with which the various conditions of bronchial distribution and vascular supply may be derived from the primitive type found in *Hystrix* and *Taxidea*. This series is illustrated in the paper by a selection of the following seven forms: *Canis familiaris, Dicotyles torquatus, Myrmecophaga jubata, Auchenia glama-pacos, Cebus capucinus, Cebus niger, Phoca vitulina.*

Aeby's 'stem bronchus' and its monopodic system of lateral branches, characteristic of the majority of mammalian lungs, appears to be derived from the tracheal bulla or lacuna with dichotomous division of the primary branches found in *Hystrix* and *Taxidea* by further development and relative rearrangement. The typical 'stem bronchus' develops from three segments of the primitive bronchial tree.

1. Proximal portion, between the bifurcation and the origin of the primary cephalic trunk, is derived by further segmentation and division of the tracheal bulla.

2. The second segment of the stem bronchus is formed by the primary caudal trunk of the primitive lung.

3. The third segment is continued caudad as the representative of the medial secondary caudal branch of *Hystrix* and *axidea.*

The general conclusions reached in the paper may be summed up as follows:

1. The right and left lung agree morphologically in the type of their bronchial distribution.

2. The asymmetry, when observed, is apparent, not real, depending usually upon complete separation of the right primary cephalic trunk into two components, the proximal one of which changes its original relation to the bronchial stem and pulmonary artery by migration cephalad. More rarely the asymmetry depends upon the complete migration cephalad of the entire cephalic trunk carrying both secondary branches (*Myrmecophaga*).

3. Aeby's hypothesis of the morphological equivalence of the middle right and upper left lobe of the human lung is therefore untenable.

The proposition should read:

RIGHT LUNG.	LEFT LUNG.
Upper + middle lobe	= upper lobe.
Lower + cardiac lobe	= lower lobe.

4. The active agent in changing and modifying the architecture of the lung is *not* the pulmonary artery (Aeby), but the *migration* of the cephalic primary trunk, or of its proximal secondary derivative, usually only on the right side, producing apparent asymmetry. This migration affords an opportunity for more complete development of the resulting terminal bronchial system and for consequent increase in respiratory area.

5. In the majority of mammals this greater development of respiratory surface is confined to the right side, resulting in the formation of the so-called 'Eparterial Bronchus,' and also indicated by the development of a special accessary cardiac bronchus of the right side.

6. Except, therefore, for purposes of topography, the distinction of Eparterial and Hyparterial bronchi should be abandoned, at least to the extent of clearly recognizing the fact that in asymmetrical lungs, every right 'eparterial' bronchus finds its morphological equivalent among the 'hyparterial' bronchi of the left side.

7. The impropriety of ascribing any morphological significance to the number of pulmonary lobes is apparent. The division of the lung into lobes is an entirely secondary character, not dependent upon the type of bronchial distribution, but probably connected with the unequal mobility and rate of expansion in different segments of the thoracic walls.

8. For reasons detailed, the primitive type of the mammalian lung is the symmetrical 'bilateral hyparterial' form, the symmetrical 'bilateral eparterial' form representing the *end-stage* in the process of evolution, not the *primary type* (Aeby, Wiedersheim).

9. The primitive type of division is practically dichotomous (*Hystrix*, *Taxidea*).

We can recognize two main trunks on each side, one cephalic, the other caudal. The cephalic trunk supplies the anterior and middle portions of the lung, the main migratory modifications in the different types taking place within its region of distribution. The caudal branch supplies the posterior and larger portion of the lung.

In the subsequent development of the stem-bronchus and its monopodic type of branching, characteristic of the majority of mammalian lungs, the following factors are active:

a. Complete segmentation of the primitive tracheal bulla, producing the usual bifurcation. This establishes the proximal portion of the stem-bronchus, and gives to the primary cephalic trunk the position of a lateral branch derived from the same.

b. The caudal continuation of the stem-bronchus is composed of the representative elements of the primary caudal trunk and its medial secondary branch, the lateral secondary branch and additional lateral accessory branches developed subsequently appearing as the 'ventral branches of the stem-bronchus' (Aeby).

c. The cardiac bronchus usually appears as a special accessory branch derived from the stem-bronchus of the right side only (Exception *Auchenia*).

10. In the majority of forms examined, the pulmonary artery is not dorsal to the stem-bronchus, except in the terminal portion. The position, as Narath has pointed out, is lateral or dorso-lateral.

11. Hence the distinction into 'dorsal' and 'ventral' branches, separated by the pulmonary artery in Aeby's sense, should be abandoned.

12. The results above outlined agree with the conclusions reached by Narath in regard to the equivalence of the anterior or cephalic branches of right and left side in asymmetrical lungs. They differ in the interpretation of the derivation of the 'Apical bronchus,' which he regards as the dorsal branch of the first ventral bronchus, and in the above outlined phylogenetic development of the stem-bronchus and its monopodic system of branching.

The conclusion of the paper deals with the probable causes which lead to the migratory changes in the relative position of the cephalic branches.

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SINGULAR STRESS-STRAIN RELATIONS OF RUBBER.

Since the stress-strain diagrams from rubber were published in this Journal of date of February 19th, last, the investigation has been somewhat extended. In all cases the same curious behavior was noted and the same peculiar differences compared with other materials. In all cases the substance behaved under load precisely as do other materials in the early part of its strain; then a reversed curve is described and the test-piece stiffens greatly and offers continually increasing resistance until, at last, rupture takes place, without yielding by inelastic deformation at any point in its course. Toward the end of its test the substance yields proportionately to the applied load. The fracture is sharp and without warning and the break clean and smooth and at right angles to the line of pull. No permanent reduction of section is observable after fracture. The reduced section immediately before breaking was