It may be too early to indulge in sweeping generalizations, but we venture to predict that similar structural differentiations will be found in all ciliated epithelia. The facts of comparative morphology justify such a prediction. Function is so universally found to be associated with, and to depend upon, definite structural organization of living substance that in a tissue so specialized in function as that of a ciliated epithelium we may expect *a priori* to find in it a corresponding structural differentiation that is neither indefinite in form nor of temporary duration.

The results of our investigation of various types of ciliated cells, which rest upon experimental as well as morphological evidence, will be fully reported and discussed in a paper to be published in the *Journal of Morphology and Physiology.*

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## PRELIMINARY NOTE CONCERNING PHYSIOLOGICAL SPECIALIZATION IN FOMES PINICOLA FR.

THE idea of physiological specialization in the fungi has undergone extensive development during recent years. In fact, a considerable amount of literature on this subject has arisen since about 1890, and it has been demonstrated beyond all reasonable doubt that physiological specialization exists in a great number of fungi belonging to widely separated families. The rusts have received particular attention in regard to this point and many interesting as well as important facts have been brought to light by the work of Eriksson, Dietel, Stakman, Hungerford and others.

Other genera of fungi, as, for example, *Erysiphe, Glomerella, Sphaeropsis, Rhyzoctonia, Septoria* and many others, have also been investigated, but, as far as the writer is able to ascertain, little has been done along the line of physiological specialization in the case of the wood-destroying fungi. It is true that some work has been done on these forms, but the emphasis has been on the morphological rather than on the physiological aspects of the question.

In regard to their general life history, many of the wood-destroying fungi differ from most other fungi in that they may, as a result of a single infection, inhabit a single host plant for a great number of years. For example, it is not impossible, nor even improbable, that *Echinodontium tinctorium, Fomes pinicola, Trametes pini,* etc., may grow in a tree as a result of a single infection for twenty-five, fifty or even a greater number of years. If, then, the character and general properties of the host plant exert any influence on the fungi infecting it, tending to produce physiological specialization, strains or varieties, it would not seem unreasonable to suppose that the chances for the production of such specialized forms or varieties among the wood-destroying Basidiomycetes would be very good.

There is also a very important practical aspect to this question. It is usually considered, in addition to other reasons, very poor practice from the standpoint of forest sanitation to allow infected trees to remain standing on an area upon which it is expected to raise future forest crops, even though these infected trees are of a different genus than those to be grown eventually. A concrete case will serve to elucidate this point. The white pine stands of the Inland Empire contain a considerable number of inferior species, such as white fir and hemlock. These latter species are often heavily infected with heartrot and many of such infected trees remain standing on the area after logging operations are completed. This is particularly true if broadcast burning does not follow the logging operations. These infected trees remain on the area at least during the early growth of the second crop. Very often the same species of fungi which cause the heartrot in these remaining trees also cause heartrots in the trees with which it is hoped to restock the area, as, for example, white pine. Thus *Trametes pini* causes more or less similar heartrots in fir, spruce, larch and pine. *Fomes pinicola* causes a red brown sapwood rot in spruce, larch, fir, pine and hemlock. *Echinodontium tinctorium* causes a heartrot in practically all the western true firs, Engelmann spruce, Douglas fir and western hemlock. Many other examples might be given, but the above are sufficient to illustrate the point. It is generally assumed, therefore, that these infected trees remaining on the area after logging constitute a menace to the future forest crop, even though it may be of a different genus. If, on the other hand, physiological specialization has developed to the extent that the strain common to white fir is limited to white fir, the Douglas fir strain to Douglas fir, etc., it is evident that the expense of falling and destroying these infected remaining trees might be eliminated when the forest sanitation is the only factor necessary to consider. The writer volunteers no expression of opinion on this point at this time, but merely calls attention to the situation.

It must be obvious that artificial infection experiments with the heartrot fungi are especially difficult and that it would take many years before any reliable data could be obtained. However, studies can be made on the physiological characteristics of these forms which may at least indicate the desirability of undertaking such artificial infection experiments, no matter how difficult or time-consuming the work may be.

The present note reports the results obtained from a physiological study of four cultures of *Fomes pinicola* Fr. obtained from four different hosts, namely, Douglas fir (*Pseudotsuga taxifolia*), white fir (*Abies grandis*), western hemlock (*Tsuga heterophylla*) and western white pine (*Pinus monticola*).

The results obtained show that these four strains of *Fomes pinicola* differ very markedly in (1) the characteristics of growth, (2) the rate of growth, (3) the extra-cellular enzyme activity, (4) the intra-cellular enzyme activity, (5) the effects produced in mixed cultures, (6) the growth on liquid media and (7) the nitrogen relations.

The wood-destroying properties are now under observation, but since these experiments require long incubation periods, the results will not be available for some time. A detailed discussion of the question of physiological specialization in *Fomes pinicola* will be published later.

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## SERIES REGULARITIES IN THE SPARK SPECTRUM OF NITROGEN[1]

During the past decade the spectroscopy laboratory of the Bureau of Standards has been investigating the arc spectra of the elements as far into the infra-red as modern photographic methods will permit. This work has revealed the fact that certain lines appear on practically all the spectrograms regardless of what elements have been employed as electrodes in the arc. These lines were correctly attributed to the gases of the atmosphere in which the arc operated; and subsequent investigations of the spectra emitted by tubes containing oxygen, nitrogen, and argon have established the chemical origin of all the atmospheric lines which have been observed in the red and near infra-red regions. Preliminary wave lengths have already been published for these lines. (*Publ. Amer. Astron. Soc.*, 4, pp. 170 and 363; also, Merrill, *Astroph. Jl.*, 51, p. 236).

It is the purpose of this note to direct attention to the fact that the nitrogen lines which are observed most frequently and belong apparently to the category of sensitive lines, result from combinations of a triple $p$ term with an $s$ term, another triple $p$ term, and with a five-fold $d$ term. According to the alternation law of Kossel and Sommerfeld the spectrum of non-ionized nitrogen should exhibit series regularities of even structure, while the spectrum of ionized nitrogen, conforming to the displacement law, should exhibit structures of odd multiplicity. The series regularities given in the accompanying table are of odd multiplicity (quintet system), and therefore belong to the spark spectrum of nitrogen. In the table, the first column gives the combining terms of which the inner quantum numbers are designated by subscripts, the second column gives the wave lengths and intensities of the lines, the third gives the vacuum wave numbers, and the fourth gives the wave-number separations of the common triple $p$ term. The separations of all the polyfold terms involved follow approximately Landé's interval rule. Details of a more complete analysis of the spectrum will appear in a subsequent paper.

| Term combination | λ I. A. | ν | Δν |
|---|---|---|---|
| $S_2P_3$ | 7468.74 (5) | 13385.5 | |
| | | | 47.1 |
| $S_2P_2$ | 7442.56 (4) | 13432.6 | |
| | | | 33.7 |
| $S_2P_1$ | 7423.88 (3) | 13466.3 | |
| $P_3P_3$ | 8216.46 (5) | 12167.4 | |
| | | | 46.7 |
| $P_3P_2$ | 8185.05 (3) | 12214.1 | |
| $P_2P_3$ | 8242.47 (3) | 12129.0 | |
| | | | 46.5 |
| $P_2P_2$ | 8210.94 (2) | 12175.5 | |
| | | | 33.9 |
| $P_2P_1$ | 8188.16 (3) | 12209.4 | |
| $P_1P_2$ | 8223.28 (3) | 12157.3 | |
| | | | 33.6 |
| $P_1P_1$ | 8200.59 (1) | 12190.9 | |
| $P_3D_4$ | 8680.35 (2) | 11517.1 | |
| $P_3D_3$ | 8718.99 (1) | 11466.1 | |
| | | | 46.7 |
| $P_2D_3$ | 8683.61 (2) | 11512.8 | |
| $P_3D_2$ | —— | (11428.7) | |
| | | | 46.7 |
| $P_2D_2$ | 8711.87 (1) | 11475.4 | |
| | | | 33.7 |
| $P_1D_2$ | 8686.38 (1) | 11509.1 | |
| $P_2D_1$ | 8729.07 (½) | 11452.8 | |
| | | | 33.8 |
| $P_1D_1$ | 8703.42 (1) | 11486.6 | |
| $P_1D_0$ | —— | —— | |

C. C. KIESS

BUREAU OF STANDARDS
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[1] Published by permission of the Director of the Bureau of Standards of the U. S. Department of Commerce.