injected into the animal body, 3.5 mg being lethal per kilogram of body weight.[7] Recently, two contributions appeared dealing with the isolation and crystallization of clavacin from two kinds of fungi, *Penicillium patulum*[8] and *A. clavatus*;[9] both preparations proved to be identical chemically. A comparison of the respective antibacterial spectra, as announced for the crude clavacin[10] and for patulin[8] (the name given to the substance isolated from *P. patulum*), and as found for crystalline clavacin[11] further established the fact that the two substances are identical. The crystalline clavacin was found to be less toxic to animals than crude clavacin,[11] its activity being in this respect, as well, identical with that reported for patulin.[8]

As this note was being written, an article appeared[12] dealing with the identity not only of clavacin and patulin, but also of claviformin, a substance produced by *P. claviforme*;[13] the authors,[12] believing that they were the first to crystallize clavacin, proposed a new name for this substance, namely, clavatin. It may be of interest to record here that clavacin, as first announced,[1] possessed quantitatively all the antibacterial properties of the crystalline preparation, thus pointing to the fact that it was in a nearly pure, even though non-crystalline, state. The isolation of claviformin was announced simultaneously with that of clavacin. Furthermore, the claviformin preparation contained a small amount of sulfur, and the wrong chemical formula was suggested for it ($C_9H_8O_5$). Comparative data for the various preparations are brought out in Table 1.

TABLE 1

Name of preparation	When announced	Empirical formula	Melting point °C	Antibacterial activities	
				E. coli units	*S. aureus* units
Clavacin, non-crystalline	Aug. 20, 1942[1]	......	......	165,000–230,000[10]	100,000–200,000[10]
Claviformin	Aug. 1942[13]	$C_7H_6O_4$	110	80,000	160,000
Patulin	1943[8]	$C_7H_6O_4$	111	33,000–50,000	33,000–50,000
Clavacin, crystalline	Jan. 7, 1944[9]	$C_7H_6O_4$	109–110	200,000–250,000[11]	200,000[11]
Clavatin	Dec. 25, 1943[12]	$C_7H_6O_4$	109.5–110.5	......	64,000–128,000

These results definitely indicate that the five preparations are identical in their chemical nature and antibacterial activities (slight quantitative differences in activity may be due to the use of different strains of test organisms). Whatever may be the final decision concerning the proper designation of this substance, the fact remains that three different organisms, *A. clavatus, P. claviforme* and *P. patulum,* produce the same antibiotic substance.

It is thus important to record here that considerable confusion has arisen from the fact that various microorganisms are capable of producing the same type of antibiotic substance. This has already been demonstrated for the following: citrinin is formed by *P. citrinum* and *A. candidus;* penicillic acid, by *P. puberulum* and *P. cyclopium;* penicillin, by *P. notatum, P. chrysogenum* and *A. flavus;* gliotoxin, by *Trichoderma, Gliocladium* and *A. fumigatus;* spinulosin, by *P. spinulosum* and *A. fumigatus;* and clavacin by *P. claviforme, A. clavatus* and *P. patulum.*

For the sake of completeness, it should also be mentioned that much confusion in the study of antibiotic substances has arisen from the fact that many organisms are capable of producing more than one type of substance. It is sufficient to call attention to the confusion that has arisen from the designation of the second antibacterial factor produced by *P. notatum,* namely, the glucose-oxidase, which has been designated as *E. coli* factor, penatin, notatin and penicillin B, and which has often been confused with the true penicillin. *A. fumigatus,* however, apparently tops the list, since it has the capacity of forming four different antibacterial compounds, spinulosin, fumigatin, fumigacin and gliotoxin, the first two of which are closely related.

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[7] H. Robinson, Some toxicological, bacteriological and pharmacological properties of antimicrobial agents produced by soil microorganisms. Thesis. Rutgers Univ., 1943.

[8] H. Raistrick, J. H. Birkinshaw, S. E. Michael, A. Bracken, W. E. Gye and W. A. Hopkins, *Lancet*, 245: 625–635, 1943.

[9] I. R. Hooper, H. W. Anderson, P. Skell and H. E. Carter, SCIENCE, 99: 16, 1944.

[10] S. A. Waksman and A. Schatz, *Proc. Nat. Acad. Sci.*, 29: 74–79, 1943.

[11] Unpublished data.

[12] F. Bergel, A. L. Morrison, A. R. Moss, R. Klein, H. Rinderknecht and J. L. Ward, *Nature*, 152: 750, 1943.

[13] E. Chain, H. W. Florey and M. A. Jennings, *Brit. Jour. Exp. Path.*, 23: 202–205, 1942; see also recent note in *Lancet*, 246: 112–114, 1944.

A LAST WORD ON "STARRING"

I HAVE read with interest Dr. F. C. Whitmore's remarks in SCIENCE for November 26, 1943, on "starring," but was somewhat surprised to note how far he has strayed from the original meaning of this distinguishing mark for certain men of science. According to Dr. J. McKeen Cattell in the preface of the first edition of "American Men of Science" (January, 1906), "the star means that the subject of the biographical sketch is probably among the leading thousand students of science of the United States." This meaning has been followed in succeeding editions of "American Men of Science" and it is specifically stated in the caption of the last voting list, which reads: "Chemists nominated for inclusion among the one hundred and seventy-five leading chemists in the United States."

Dr. Whitmore, however, interprets starring somewhat differently. He speaks of the large loss of leading chemists by some institutions which has caused them "to encourage the younger members of the chemistry staff and to add to that staff young men of promise" and then refers later to "a chance of the accidental omission of the name of a deserving young scientist by the group which makes the preliminary nominations." Now this emphasis placed by Dr. Whitmore on youth is lacking in the caption of the voting list which does not read "one hundred and seventy-five deserving young chemists of promise" but "one hundred and seventy-five leading chemists." Youth, of course, must be served, but it is a far leap from the status of a "young chemist of promise" to that of a "leading chemist." The young chemists of promise may eventually become leading chemists, and it is hoped that they will, but until they are so recognized their names should not be placed on a ballot intended solely for leading chemists. The inclusion of their names on such a list means the exclusion of the names of older, better known chemists with greater records of accomplishments.

We should feel indebted, however, to Dr. Whitmore for having disclosed what seems to have been the guiding motive of some institutions in making up the list of their nominees. The insertion of the names of young men by an institution on a voting list along with the names of older scientists involves a lowering of the average production rating of its entire group of nominees; the young men, however promising, haven't had the time to produce. An easily determined, although not wholly satisfactory, index of productivity is the number of papers published during a certain period of time. It is open to several objections but is free from bias and vastly better than basing one's judgment on mere acquaintance, or hearsay evidence, or solicitation, or preference for the members of a particular college. It is useful as a rough, convenient measuring stick and was so applied to the nominees of the two institutions with the highest number of candidates on the last voting list, as summarized in my paper in SCIENCE for September 24, 1943.

For the institution with 8 nominees the following number of papers, of which a candidate was author or co-author, according to the last Decennial Index of Chemical Abstracts, was found to be, respectively: 82, 25, 24, 21, 21, 12, 9, 3—a total of 197, or an average of 24.6 per man. Five of the nominees had published more than 20 papers, which speaks well for the chemical productivity of this institution. The average age of these five candidates, according to "American Men of Science," was 48 years; the average age of the nominees who had published less than 20 papers was 38 years. This institution seems to have placed a little greater stress on men of productivity. The other institution with 7 nominees on the voting list showed the following records. Number of papers published per individual for the same decennial period: 59, 14, 12, 3, 2, 2, 1—a total of 93, or an average of 13.3 per man. The age of the nominee with 59 papers was 53 years; the average age of the remaining candidates who had published less than 20 papers was 36 years. This institution, in making up its list, seems to have placed stress almost entirely on young men of promise. A number of institutions, represented on the voting list with only a few nominees, seem to have concentrated almost wholly on men of productivity. One university with only 3 candidates had a total productivity of 112 papers, or an average of 37 papers per man. As to how far older chemists of high productivity may possibly be exposed to "a chance of the accidental omission," referred to by Dr. Whitmore, the single example is cited of a prominent institution that has 8 excellent "unstarred" chemists of an average age of 55 years who for the same decennial period published 279 papers or an average of 35 per man. Not one of their names appears on the last list of chemists nominated for "starring."

The future of the practice of "starring" men of science would seem, therefore, to depend on whether candidates are to be nominated on the basis of accomplishment, or on that of youthful promise. If it is to be a designation for accomplishment the list of nominees to be voted upon should be made up accordingly, with a short statement as to age, past experience, honors, attainments, etc., of each candidate. That only two institutions on the last voting list of chemists should be represented by over 18 per cent. of the nominees indicates a very unsatisfactory distribution. The conditions responsible for this unsatisfactory distribution seem to be (1) a growing tendency on the part of certain strong, influential institutions to exceed their quota of candidates by nominating so-called "young men of promise" and (2) the failure of many directors of research in other institutions to sponsor better known chemists of established scientific attainment.

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