Selektive insektizide Wirkung des Butazolidins

Ein Laborant, der seit mehr als 10 Jahren einen Laboratoriumsstamm von *Pediculus humanus v. corporis* unterhält, stellte eines Tages fest, dass sämtliche Läuse (etwa 600) aller Stadien, die er sich vormittags zum Füttern angesetzt hatte, abends tot waren. Dieses Phänomen wiederholte sich am nächsten Tag mit 50 frischen Läusen, die er sich ansetzte. Es ergab sich, dass diese Person in ärztlicher Behandlung stand. Sie hatte an diesen zwei Tagen sowie an den zwei denselben unmittelbar vorangegangenen Tagen je eine intramuskuläre Einspritzung von 600 mg Butazolidin (B.) erhalten.

Das folgende Experiment mit reinem B. ergab, dass die insektizide Wirkung nicht auf dem Lokalanästhetikum beruhte, welches das zu therapeutischen Zwecken benützte Präparat enthält.

Ein Kaninchen von 3 kg Gewicht erhielt intravenös 2 cm^3 einer 1prozentigen Lösung des Natriumsalzes des B.[1] sowie 0,2 cm^3 Liquemin (Hoffmann-La Roche). 5 min später wurde dem Tier Blut entnommen und damit 50 Läusen mit einer Mikropipette ein Klystier verabreicht. Die durchschnittliche Menge Blut, die je Laus verabreicht wurde, betrug 1,32 mg. Nach 3 h waren 49 der 50 Läuse tot. Blut, das diesem Kaninchen 24 h später entnommen wurde, hatte keinen Einfluss auf die 50 Läuse, welche damit rektal inokuliert wurden. Zur Verhinderung der Gerinnung des Blutes waren wieder 0,2 cm^3 Liquemin verabreicht worden.

Beobachtungen an grösseren Serien von Läusen, die rektal mit steigenden Verdünnungen von B. in menschlichem Zitratblut inokuliert wurden, ergab, dass die DL_{50} zwischen 0,02 und 0,04 γ je Laus lag.

Überraschender als die Toxizität des B. für *Pediculus* war die Beobachtung seiner selektiven Wirkung. Auf einem Kaninchen, das unmittelbar vorher intravenös 70 mg B./kg erhalten hatte, wurden Imagines und Nymphen des ersten und zweiten Stadiums von *Ornithodorus moubata* gefüttert. Die Imagines von *O. moubata* waren nach 3 Wochen noch munter, einige Weibchen legten Eier. Hingegen fiel auf, dass die Nymphen, welche sich während der ersten Tage nach der Blutmahlzeit normal verhielten, sich in der Folge nicht häuteten und innerhalb von drei Wochen eingingen. Bei einigen Exemplaren war es zwar zur Bildung einer Exuvie gekommen, doch starben auch diese Exemplare, ohne die Exuvie abgeworfen zu haben.

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Summary

Butazolidin proved to be insecticidal by ingestion for *Pediculus humanus* and for the first and second instars of *Ornithodorus moubata*. Adult specimens of *O. moubata* were not affected.

[1] Wir verdanken diese Lösung dem Entgegenkommen der Firma J. R. Geigy AG., Basel.

Multiple Hemoglobins in Birds[1]

Multiple hemoglobins have been demonstrated in certain cattle[2], in man under normal[3] and pathological conditions[4], and in the domestic fowl[5]. Subsequent to the initiation of our investigation RODNAN and EBAUGH[6] have reported the occurrence of multiple hemoglobins in a variety of vertebrate species. Most of the mammals studied had only a single hemoglobin component, although the horse was an exception. Among the birds studied, it was reported that chicken, duck, and robin had multiple components as contrasted to the single-component hemoglobin of the pigeon and penguin (species not given). The results of this investigation, together with those reported herein, indicate that the occurrence of more than one hemoglobin component is a common, although not general, phenomenon among adult birds.

In the course of our investigations, analyses were made of the blood of 21 species of birds. The wild birds were collected in Whitman County, Washington, during the period April 1955 to April 1956. Samples of blood were drawn directly from the heart into a syringe wetted with a 1:10000 solution of heparin. Cells were separated from the plasma by centrifugation at 3000 rpm for 15 min and then washed thrice with 0·85% NaCl solution. The hemoglobin was released by the addition of an equal volume of distilled water to the packed cells. Cellular debris was then removed by centrifugation at 15000 rpm for 30 min. The hemoglobin solutions were frozen and stored at −10° C until analyzed.

Electrophoretic patterns were obtained by applying 10 microliters of the hemoglobin solution to filter paper strips (Whatman 3 MM). The strips were moistened with veronal buffer (pH 8·7, ionic strength 0·075). A constant current of 0·092 mA/mm width was applied for 6 h. After drying, and without staining, the strips were scanned and integrated using a Spinco Analytrol. Percentages of the hemoglobin components were estimated by planimetry. In accordance with the terminology of JOHNSON and DUNLAP[5] the anionic migrant is designated as α and the cationic migrant as β.

Among those species examined, all except the domestic pigeon were found to have 2 hemoglobin components. Although the pigeon pattern was skewed there was no definite separation. This conforms with the analysis of RODNAN and EBAUGH[6]. There were rather marked differences in the distinctness of separation among the hemoglobins of the various species (see Figure and Table). In the galliform birds and ducks the separation was relatively slight (+), whereas the two woodpeckers exhibited fair to good separation (++ to +++). Among the passeriform birds the separation was good to excellent (+++ to ++++), with the exception of the American Magpie (*Pica pica americana*) in which the separation was only fair (++). The relative percentages of α- and β-hemoglobin in the species studied are presented in the Table. The relative percentages of the two

[1] Approved by the Washington Agricultural Experiment Stations for publication. The investigation reported herein was supported, in part, from funds provided for biological and medical research by the State of Washington Initiative Measure No. 171.

[2] R. CABANNES *et al.*, C. r. Soc. Biol. *149*, 7 (1955).

[3] H. G. KUNKEL and G. WALLENIUS, Science *122*, 288 (1955).

[4] A. I. CHERNOFF *et al.*, Science *120*, 605 (1954).– T. H. J. HUISMAN *et al.*, Nature *175*, 902 (1955).– H. A. ITANO, Science *117*, 89 (1953); Arch. int. Med. *96*, 287 (1955).

[5] V. L. JOHNSON and J. S. DUNLAP, Science *122*, 1186 (1955).

[6] G. P. RODNAN and F. G. EBAUGH, Fed. Proc. *15*, 155 (1956).

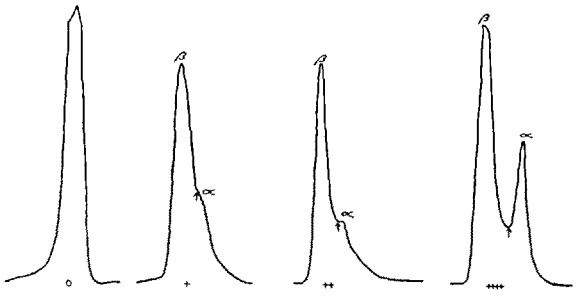
The relative distributions of α-hemoglobin and β-hemoglobin in 21 species of birds, Expressed as percentage of total hemoglobin

	Number of Specimens	α-hemoglobin			β-hemoglobin			Degree of Separation*
		maximum	minimum	mean	maximum	minimum	mean	
Passeriformes								
Zonotrichia leucophrys gambelii	26	39·9	23·5	30·4	76·5	60·2	69·6	+ + + +
Melospiza lincolnii	6	33·7	17·8	26·5	82·2	66·3	73·5	+ + + +
Melospiza melodia	17	41·5	25·0	32·1	75·0	58·5	67·9	+ + + +
Spizella passerina arizonae	3	32·5	26·9	28·8	73·1	67·5	71·2	+ + +
Spizella arboracea ochracea	1	–	–	26·3	–	–	73·7	+ + + +
Spinus tristis	3	35·8	26·6	31·0	73·4	64·2	69·0	+ + + +
Junco oreganus	14	37·3	24·9	31·1	75·1	62·7	68·9	+ + + +
Hesperiphona vespertina	1	–	–	23·0	–	–	67·0	+ + + +
Sternus neglectus	1	–	–	27·2	–	–	72·8	+ + +
Passer domesticus	3	25·6	17·8	22·5	82·3	74·4	77·5	+ + + +
Parus gambeli	3	33·2	27·6	30·3	72·4	66·8	69·7	+ + + +
Pica pica hudsonia	2	35·4	27·2	31·3	72·8	64·6	68·7	+ +
Turdus migratorius	1	–	–	25·4	–	–	74·6	+ + + +
Empidonax hammondii	1	–	–	29·2	–	–	70·8	+ + + +
Piciformes								
Colaptes auratus borealis	1	–	–	29·1	–	–	70·9	+ + +
Colaptes cafer collaris	1	–	–	20·8	–	–	79·2	+ +
Anseriformes								
*Anas platyrhynchos***	2	28·0	23·8	25·9	76·2	72·0	74·1	+
Galliformes								
Domestic Fowl (White Olympian–New Hampshire hybrid)	5	34·7	19·6	25·8	80·4	65·3	74·2	+
*Meleagris gallopavo****	4	52·2	44·8	49·3	55·3	47·8	50·7	+
Phasianus colchicus	1	–	–	19·6	–	–	80·4	+
Columbiformes								
Columba livia	5	?	?	?	?	?	?	0

* See the Figure. ** One domestic and one wild. *** Domestic.

components in the White-crowned Sparrow (*Zonotrichia leucophrys gambelii*) were analyzed statistically with respect to differences between the sexes; no sex differences were demonstrable. Similarly no differences could be demonstrated between first-year (4–8 months

Electrophoretic Patterns of Hemoglobin



Columba livia *Domestic Fowl* *Colaptes cafer collaris* *Zonotrichia leucophrys gambelii*

old) and adult (more than 1 year old) birds. It should be noted that RODNAN and EBAUGH[6] found 3 components in the hemoglobin of the domestic fowl. It is possible that this separation, in contrast to the 2 components found in our analyses, may be explained by the lower hydrogen-ion concentration (pH 9·2) used in their investigations. However, the two investigations apparently produced similar results for the American Robin (*Turdus migratorius*).

From a systematic aspect, it is of interest to note that marked differences exist among the orders examined and that the differences among families within an order, and genera within a family, are successively less striking. It is of interest also to note the single-component hemoglobin of the pigeon, a member of the Columbifomes, an order of several anatomic and physiologic peculiarities. These observations, together with the report of a single hemoglobin in a penguin species[6], indicate that an extensive study of the hemoglobin components among the orders of birds might produce information of considerable usefulness in understanding systematic relationships among the orders of birds.

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Zusammenfassung

Papierelektrophorese des Hämoglobins von zwanzig Vogelarten aus vier verschiedenen Ordnungen ergab zweiteilige Diagramme. Nur bei der Taube ist das Hämoglobin einheitlich, während sonst ziemlich allgemein in der Klasse der Aves zwei Komponenten nachweisbar sind.