**The Second Family Case of Pelger's Familial Nuclear
Anomaly of Leucocytes Reported in Japan and a
Further Blood Investigation of Cases
belonging to the First Family Case.**

30th Hematological Paper.

By

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Introduction.

In a preceding paper¹⁾ I have reported of the first family case of Pelger's Familial Nuclear Anomaly of Leucocytes in this country—of the first family with 6 persons showing the anomaly. In the present paper I desire to report of the second case, or the second family with the anomaly in this country. At the same time 2 further cases belonging to the first family case will be related of in the present paper.

The hitherto reported cases of this nuclear anomaly are, within my knowledge, 22 family cases, as will be shown in Table 1.

Besides the cases shown in Table 1, a case of a rhinopharyngeal disease examined by Schmidt²⁾ may, as Undritz³⁾ states, be a case of the anomaly with 30% leucocytes with the rod-shaped nucleus in spite of the probable absence of a clinical symptom corresponding to that shift. And I am of the same opinion. According to Undritz³⁾ there are cases of the anomaly which have been seen by Schilling, Hirschfeld, Naegeli and Schleip. If the number of the cases reported since 1930 are taken into consideration, then Pelger's

1) Y. Kokubo, Tohoku J. Exp. Med., 1936, **29**, 519.

2) R. Schmidt, Med. Klin., 1934, 77.

3) E. Undritz, Fol. Haematol., 1937, **56**, 416.

anomaly may not be a very rare anomaly. I myself met with two families of the anomaly among about 400 mothers during my investigation of milk and blood.

TABLE 1.
*Cases with Pelger's anomaly that has been reported
by different authors.*

Year	Authors	Reported cases	Country	Remarks	Literature
1930	Pelger	2 families (2 cases)	Holland		Pelger, K. cited from Huët's report (Cf. G. J. Huët, Klin., Wschr., 1932, 11, 1624).
1932	Huët	3 (23 ")	"	One case was already reported by Pelger.	Huët, G. J. Klin. Wschr., 1932, 11, 1264.
"	Burger	2 (7 ")	"		Burger, G. C. E. cited from Schilling's report (Cf. V. Schilling, Dtsch. med. Wschr., 1933, 59, 724).
"	Jordans	1 case	"		Jordans, G. H. W., cited from Undritz's report (Cf. E. Undritz, Fol. Haematol., 1937, 56, 416).
1933	Undritz	1 family (8 cases)	Switzerland		Undritz, E. Schweiz. med. Wschr., 1933, 14, 286; 1934, 15, 10.
"	Schilling	4 families	Holland Switzerland Germany Tschecho-slovakia	1 family in Holland, 1 family in Switzerland and 1 family (3 cases) in Germany were found by Burger, Undritz and Weigelt-Fürth respectively. And only one case in Tschecho-slovakia was discovered by Schilling.	Schilling, V. Dtsch. med. Wschr., 1933, 59, 724.

TABLE 1. Continued.

Year	Authors	Reported cases	Country	Remarks	Literature
1933	Huët	1 case	Holland	Huët wrote to Undritz.	Huët, G. J. cited from Undritz's report (Cf. E. Undritz, <i>Fol. Haematol.</i> , 1937, 56 , 416).
1934	Naegeli	1 "	Switzerland		Naegeli, O. cited from Undritz's report (Cf. E. Undritz, <i>Fol. Haematol.</i> , 1937, 56 , 416).
1935	Leitner and Van Leeuwen	1 "	Holland		Leitner J. and J.J. Van Deeuwen, <i>Klin. Wschr.</i> , 1935, 14 , 17.
"	Dietzel	2 families	Germany	These families were discovered by Weigeldt-Fürth and reported by Dietzel. One family was also reported by Schilling and Weigeldt.	Dietzel, K. cited from Undritz's report (Cf. E. Undritz, <i>Fol. Haematol.</i> , 1937, 56 , 416).
"	Zündel	1 family (7 cases)	"		Zündel, W. <i>Fol. Haematol.</i> , 1935, 54 , 1.
1936	Schilling	1 case	Java	The blood specimens were sent by E. W. Den Hartog-Jager in Java (1927).	Schilling, V. <i>Med. Welt</i> , 1936, 10 , 993.
"	Stahel	1 "	Switzerland		Stahel, R. cited from Undritz's report (Cf. E. Undritz, <i>Fol. Haematol.</i> , 1937, 56 , 416).
"	Alieff and Reekers	1 family (13 cases)	Germany		Alieff M. and R. Reekers, <i>Klin. Wschr.</i> , 1936, 15 , 1522.
"	Chevallier and Ely	1 case	France	At the Société Française d'Hématologie, February 5th 1936.	Chevallier M. P. and M. Z. Ely (cited in <i>Presse Médicale</i> , 1936, No. 20, 386)
"	Zündel	2 families (12 cases)	Germany		Zündel, W. <i>Dtsch. Arch. Klin. Med.</i> , 1936, 179 , 151.

TABLE 1. Continued.

Year	Authors	Reported cases	Country	Remarks	Literature
1936	Kokubo	1 family (typical 8 cases and "Half Typical" 4 cases)	Japan		Kokubo, Y. Tohoku J. Exp. Med., 1936, 29, 519.
1937	Undritz	"Teilträger" 1 case	Switzerland		Undritz, E. Fol. Haematol., 1937, 56, 416.
"	Ludtmann	1 case	?	At the International Hematological Meeting in Münster i. W., May 10th, 1937.	Ludtmann (cited in Schweiz. med. Wschr., 1937, 67, 1932).
Unknown	Hadorn	1 "	Switzerland	Without publication	Hadorn, W. cited from Undritz's report (Cf. Undritz, Fol. Haematol., 1937, 56, 416).

Further Cases of the Anomaly.

First I shall describe two further cases belonging to Yamas.... Yamag.... Families already reported in the previous paper¹⁾.

Of the family—Yamas... Yamag... Families—I have already reported. This time I have found 2 further cases—a grandmother and a cousin of the child already reported of. The grandmother has generally been healthy up to the day of this writing, and the cousin has been so since the birth. Their blood specimens were

Fig. 1. Family tree of Yamas---Yamag---Families with Familiar Nuclear Anomaly.

TABLE 2.

*Blood picture of Yamag.....Yamas.....Families with
Pelger's Familial Nuclear Anomaly.*

Blood relation			Grand-mother	Cousin	Mother	Son	Son	
Age y=years m=months			65 y	1 y 6 m	39 y	13y 11 m	9y 1 m	
Red blood cell count per cmm. (thousands)			5,210	5,270	5,940	5,470	4,910	
Hemoglobin (Sahli's value)					95	95	95	
White blood cell count per cmm.			4,300	13,600	6,300	13,500	8,800	
Varieties of leucocytes	Basophiles	%	0.2	0	1.1	0.1	0.4	
		Absolute count per cmm.	8	—	7.0	10	40	
	Eosinophiles	%	5.6	5.0	8.2	3.5	4.7	
		Absolute count per cmm.	240	680	520	470	400	
	Neutrophiles	%	65.7	42.0	57.4	67.7	45.2	
		Absolute count per cmm.	2,820	5,710	3,610	9,140	3,980	
	Monocytes	%	9.1	7.4	5.5	6.1	6.1	
		Absolute count per cmm.	390	1010	350	820	540	
	Lymphocytes	%	29.4	45.4	27.8	22.7	43.2	
		Absolute count per cmm.	1,260	6,170	1,750	2,460	3,800	
	Plasma cells	%	0	0.2	0	0.1	0.4	
		Absolute count per cmm.	—	30	—	10	40	
Arneth's nuclear shift	Neutrophiles	I	Pseudo-myelocytes*	0.4	0	0.6	0.3	0.3
			Pseudo-metamyelocytes**	2.7	0.7	1.2	1.3	1.7
		T ⁺⁺⁺	peculiar	92% 60.5	97% 75.9	97% 69.5	96% 75.6	92% 76.5
			non-peculiar	8% 36.4	3% 23.4	3% 28.7	4% 22.8	8% 21.5
		II	peculiar	92% 36.4	76% 23.4	87% 28.7	87% 22.8	81% 21.5
			non-peculiar	8% 36.4	24% 23.4	13% 28.7	13% 22.8	19% 21.5
		III		0	0	0	0	0
		IV		0	0	0	0	0
		V		0	0	0	0	0

TABLE 2. Continued.

Blood relation		Grand-mother	Cousin	Mother	Son	Son	
Armeth's nuclear shift	Eosinophiles	I	64	64	44	78	20
		II	36	36	56	22	30
		III	0	0	0	0	50
	Basophiles	I	64 (4) [†]		67 (4)	50 (2)	34 (1)
		II	33 (2)		33 (2)	50 (2)	66 (2)
		III	0		0	0	0
	Monocytes	R [§]	66	53	47	38	46
		W ^{§§}	30	40	50	51	37
		T ^{§§§}	4	7	3	11	17
		S ^{§§§§}	0	0	0	0	0
Sedimentation rate (mm) of erythrocytes (Yoshida's micro method)		15'	2.0	1.0	1.5	1.0	1.5
		30'	6.0	1.5	4.0	2.5	4.0
		45'	7.0	3.0	6.5	4.0	7.0
		60'	9.0	6.0	9.0	5.5	9.0
Remark		Healthy	Healthy	Healthy; the third examination 186 days later	Adenoid; Re-examination 184 days later	Healthy; Re-examination 183 days later	

* As to their real nature, Cf. Y. Kokubo, Tohoku J. Exp. Med., 1936, 29, 519.

*** T cells=metamyelocytes with deeply indented nucleus.

§ R cells=cells with round-formed nucleus.

§§ W cells=cells with slightly indented nucleus.

§§§ T cells= " deeply "

§§§§ S cells=cells with polymorpho-or segmented nucleus.

† A number in brackets shows the actual number counted.

stained with the Tohoku Pediatric Method,⁴⁾ a modification of Sato and Sekiya's⁵⁾ copper peroxidase reaction.

4) A. Sato, T. Suzuki and Ry. Shibata, Tohoku J. Exp. Med., 1934, 24, 195.

5) A. Sato and S. Sekiya, Tohoku Igaku-Zasshi, 1920, 6, 543; Tohoku J. Exp. Med., 1926, 7, 111.

The most striking blood feature of these two cases was a very severe nuclear shift to the left. This was seen not only of the neutrophils, but also of eosinophiles, basophiles and monocytes. Not only was there thus a severe shift of the nucleus, but also the nuclear form was highly characteristic of the anomaly. And "Pseudo-myelocyte (Undritz)" and "Pseudo-metamyelocyte (Undritz-Kokubo)" were found among the neutrophils. It was indubitable that these two cases belonged to the anomaly, and I myself was able to trace a heredity of the anomaly through three generations during my investigation.

*A New Family (Kishim . . . Family)
with Pelger's Anomaly.*

I have recently* found another family with the anomaly, though I was able to examine only mother and son. Her only son had been healthy since birth, but was attacked by fever and cough and visited our Pediatric Department. The diagnosis was tracheobronchitis and blood was examined. It was clear from the accompanying Table 3 that these two cases presented Pelger's nuclear anomaly. As has been shown in Table 3, the most striking blood feature in the blood picture of the mother was, in spite of her being healthy, a very severe nuclear shift to the left, and in that of her son a more severe nuclear shift to the left was seen in undue proportion to a condition of his disease. Though first a few cells of Class III were seen in the mother's blood specimen, cells of Class I included, nevertheless, over almost half of all neutrophils: "Pseudo-myelocyte (Undritz)" and "Pseudo-metamyelocyte (Undritz-Kokubo)" occurred in both cases. As to eosinophiles in the mother, only 4 cells were seen among 600 leucocytes, and the nucleus of each 2 cells with a rod-shaped or two-segmented nucleus showed the peculiar form. Regarding basophiles, only one cell with two-segmented nucleus showing no peculiar form was seen among almost 600 leucocytes. As to eosinophiles and basophiles of the case of her son, each one cell with the peculiar formed nucleus was counted among 1200 leucocytes. Concerning monocytes, it was clear that both cases showed the nuclear shift to the left in contrast to Arneth's normal nuclear shift of monocytes, but not any nuclear peculiarity of these cells was found. An acceleration of micro hemosedimentation and a leucocytosis mainly resulting from a neutrophilia in the case of her son are

* January 1937.

TABLE 3.
*Blood picture of Kishima.....Family with Pelger's
 Familiar Nuclear Anomaly.*

Blood relation				Mother	Son	
Age y=year or years				24 y	1 y	
Hemoglobin (Sahli's value)					70	
Red blood cell count per cmm. (thousands)				6,950	5,470	
Platelets (Fonio) per cmm. (thousands)				468	469	
White blood cell count per cmm.				8,100	15,000	
Varieties of leucytes	Basophiles	%		0.2	0.1	
		Absolute count per cmm.		20	20	
	Eosinophiles	%		0.7	0.1	
		Absolute count per cmm.		60	20	
	Neutrophiles	%		75.7	56.8	
		Absolute count per cmm.		6,130	8,520	
	Monocytes	%		7.1	3.5	
		Absolute count per cmm.		580	530	
	Lymphocytes	%		16.1	38.4	
		Absolute count per cmm.		1,300	5,760	
	Plasma cells	%		0.2	1.1	
		Absolute count per cmm.		20	170	
Arneeth's nuclear shift	Neutrophiles	I	Pseudo-myelocytes*		0.2	0.6
			Pseudo-metamyelocytes**		0.2	1.2
			T*** peculiar		67.4	81% 77.0 90%
		II	non-peculiar		19% 31.1	10% 21.2 74%
			peculiar		35% 31.1	74% 21.2
			non-peculiar		65%	26%
			III		1.1	0
		IV		0	0	
		V		0	0	
		Mono-cytes	R§		50	50
	W§§		40	28		
	T§§§		10	20		
	S§§§§		0	2		
	Sedimentation rate (mm) of erythrocytes (Yoshida's micro method)			15'	0.5	3.0
				30'	2.0	15.0
				45'	4.0	22.0
60'				6.0	25.0	
Remarks				Healthy	Tracheobronchitis	

*, **, ***, §, §§, §§§, §§§§ Cf. Foot-note to Table 2.

due probably to tracheobronchitis. Further, a high blood platelet count was seen in the mother, but this is very probably due to her B-avitaminotic state, because her milk was only weakly positive (or clinically negative) to Arakawa's reaction.

*Opinions of Different Authors Concerning Neutrophiles,
Eosinophiles, Basophiles, Monocytes and
Lymphocytes in Pelger's Anomaly.*

1. Neutrophiles:—It is a recognized fact that Arneth's nuclear shift to the left in a high grade is the specific feature of the anomaly. As to the cytoplasm of "Pelger-cells"*, however, Undritz⁶⁾ and Schilling⁷⁾ described that it is intensely granulated, and the former stated that it contains vacuoles in nucleus and cytoplasm. In my own blood specimens I have not seen these vacuoles. Zündel⁸⁾ states that Pelger's anomaly can be diagnosticated by the peculiar nuclear form alone. I think that the differentiation between cases of typical Pelger's anomaly and of "Teilträger" (of this Undritz³⁾ saw only one case) can not be made on the basis of the nuclear form alone, and that the examination of the nuclear shift is necessary for it, because "Teilträger" shows a slight nuclear shift to the left. As to the chromatin structure of the nucleus, Undritz³⁾ states that the nucleus with central pyknotic nucleoles show the structure of a ripe nucleus. I myself was able to characterize the neutrophiles in Pelger's anomaly by use of the copper peroxidase reaction. That is, I demonstrated that these neutrophiles were already ripe cells (Cf. Fig. 2 in my preceding paper¹⁾) as regards the cytoplasm as well as the nucleus. In my previous paper¹⁾ Prof. Sato suggested the names "Pseudo-myelocyte(Undritz)" and "Pseudo-metamyelocyte(Undritz-Kokubo)." Recently Undritz³⁾ gave the names "Pelger-cells" to the peculiar cells of the anomaly, or "Pelger's neutrophilic myelocytes, meta-myelocytes, rod-shaped nuclear and two-segmented cells."

2. Eosinophiles:—Pelger¹⁰⁾ and Huët¹¹⁾ recognized the peculiar

* As to "Pelger-cells" it will be described later.

6) E. Undritz, Schweiz. med. Wschr., 1933, 286; 1934, 10.

7) V. Schilling, Dtsch. med. Wschr., 1933, 724.

8) W. Zündel, Fol. Haematol., 1935, 54, 1.

9) M. Alieff and R. Reekers, Klin. Wschr., 1936, 1522.

10) Pelger, cited from Huët's report (Cf. G. J. Huët, Kl. Wschr., 1932, 1264).

11) G. J. Huët, Kl. Wschr., 1932, 1264.

nuclear feature of the nucleus in eosinophiles too. Schilling⁷⁾ who first introduced the name Pelger's anomaly did not touch upon the cells at all. Undritz^{3) 6)}, Zündel⁸⁾, Alieff and Reekers⁹⁾ saw the peculiar nuclear shift as well as the peculiar nuclear form in eosinophiles. Undritz³⁾ went so far as to describe the nuclear shift in eosinophiles as more severe than in neutrophiles. Zündel⁸⁾ also states that a left shift of eosinophiles is a characteristic feature for determining Pelger's anomaly. In my own cases I was able to recognize the peculiar nuclear form in eosinophiles and also a severe nuclear shift, though a percentage was not taken.

3. Basophiles:—Pelger¹⁰⁾ and Huët¹¹⁾ recognized the peculiar nuclear feature of the nucleus in basophiles. Schilling did not state the cells at all. Undritz³⁾ mentioned that it was difficult to determine Pelger's anomaly on the basis of the nuclear form of basophiles alone, but, as any one may think, it is difficult to say anything definite on the basis of such cells as basophiles which occur in only a small percentage. Zündel⁸⁾ saw the nuclear shift to the left as well as the peculiar form of nucleus in basophiles. Alieff and Reekers⁹⁾ saw the normal nuclear shift, but not any nuclear peculiarity. In my own cases, I was able to recognize the peculiar nuclear form, but as to a nuclear shift, I recognized, within all the cells counted, the left nuclear shift, though the occurrence of basophiles was too rare to say anything definite.

4. Monocyte:—Pelger,¹⁰⁾ Huët,¹¹⁾ Zündel,⁸⁾ Alieff and Reekers⁹⁾ did not touch upon monocytes at all. Undritz³⁾ stated that no characteristic was seen in monocytes besides rich granulation and "Reticulumzeichnung" in some cells. In my own cases, I was able to recognize the nuclear shift to the left, but of the nuclear form of the cells, I did not see the specific features.

5. Lymphocytes and plasma cells:—Undritz³⁾ stated that lymphocytes did not deviate from the normal, but recently he constantly recognized "lymphocytäre Plasmazellen" in a small percentage that characterized Pelger's anomaly according to him. Zündel⁸⁾ saw lymphocytosis, and Alieff⁹⁾ also lymphocytosis and a large number of lymphocytes with nucleus having oval form remarkably. In my own cases I was unable to see any specific features in lymphocytes, though in some cases lymphocytosis was seen. As to hemoglobin, red cells, blood platelets, and blood sedimentation, almost all the authors stated that they did not show any specific feature. I am of the same opinion.

Half Typical Pelger's Anomaly.

In my preceding paper¹⁾ I spoke of "Half Typical Pelger's Anomaly"*. Recently Undritz³⁾ has published a case of "Teilträger."** "Teilträger" was according to his definition a woman who, in spite of being clinically healthy, showed in a slight grade a nuclear shift to the left and typical "Pelger-cells" (Pelger's neutrophilic myelocytes, metamyelocytes, rod-shaped nuclear, and two-segmented cells) among blood cells, or constantly almost 10% Pelger-cells among leucocytes. He emphasized further that in a case of "Teilträger", a slight nuclear shift to the left of neutrophiles and an occurrence of "Pelger-cells" will be seen in a constant rate if the case is examined under the same condition. And the picture of the "Teilträger" is, he means, a mosaic picture of ordinary blood leucocytes and Pelger-cells, but he states that no cell-bastards will appear. It remains unknown whether he made a further blood investigation of the relatives of his case, so it may be imagined, or at any rate it cannot be excluded, that there may be a case of typical Pelger's anomaly among the relatives.

Now as to my "Half Typical Pelger's Anomaly". The anomaly was seen in children from a mother with the Typical Pelger's Anomaly. These cases of "Half Typical Pelger's Anomaly" showed a fairly severe nuclear shift to the left, though the grade was not so severe as in the cases of "Typical Anomaly", and that in eosinophiles and monocytes as well as in neutrophiles. But there was no occurrence of "Pseudo-myelocyte (Undritz)" and "Pseudo-metamyelocyte (Undritz-Kokubo)" in any of the cases. Further, it was interesting to me that I was able to observe such forms as may be called bastard forms of nucleus—bastard forms of normal formed and peculiar formed nucleus, besides the occurrence of the cells with the characteristic nucleus in a few numbers. When I investigated blood picture of cases with "Half Typical Pelger's anomaly, I counted these bastard forms in addition to the peculiar forms of nucleus. From the fact that "Teilträger" and "Half Typical Anomaly" include constantly "Pelger-cells" in a certain percentage, it will be natural to think that both are probably the same anomaly. Last year Arneth¹²⁾ examined blood

* "Half Typical Pelger's Anomaly" was suggested by myself in May 15th, 1936, at the 96th monthly meeting of the Tohoku Medical Society, Sendai; the paper was printed in October, 1936 (Cf. Y. Kokubo, Tohoku J. Exp. Med., 1936, 29, 519.).

** "Teilträger" was reported by Undritz in Folia Haematologica, in January, 1937 (Cf. E. Undritz, Fol. Haematol., 1937, 56, 416.).

12) J. Arneth, Fol. Haematol., 1937, 57, 353.

specimens of Pelger's anomaly sent from many authors and published his own opinion of it. He recognized, in accordance with the other authors, the existence of the Pelger anomaly with abnormal different blood elements, but observed no features of anomaly in monocytes and basophiles, contrary to the opinion of some of the authors.

Heredity of Pelger's Anomaly.

From the literature it is clear that inheritance can occur from a male as well as a female case. In my own cases the anomaly was transmitted from father and mother, and occurred in male and female children, beside a heredity through three generations was observed. Zündel¹³⁾ reported 2 persons (Family H), father and only child, showing Pelger's anomaly, while among 32 relatives including grandfather and grandmother he did not see a single case with the characteristic blood features. Stahel¹⁴⁾ also reported only one female patient (Family K), who had no children, with Pelger's anomaly, and observed that not any of 27 relatives of the family showed the Pelger's anomaly. Zündel¹³⁾ mentioned three possibilities: 1. Illegitimacy, 2. an irregular dominance or an indeterminable heredity, and 3. a new development of Pelger's anomaly. Stahel¹⁴⁾ considered three items as possible explanations: 1. Recessive inheritance, 2. a spontaneous occurrence in the sense of mutation, and 3. manifestation of a form of reaction produced in a body under the influence of one of an exogenous factor of stimulus. Stahel takes into consideration tuberculosis as one stimulant factor.

Genesis of Pelger's Anomaly.

The very first author who saw the anomaly—Pelger—considered it as a *signum mali ominis* of tuberculosis. Huët¹¹⁾ thought it was a constitutional anomaly, though his cases showed a strong hereditary tendency of tuberculosis in the family history. Burger,¹⁵⁾ Alieff,⁹⁾ and Undritz⁶⁾ recognized a hereditary tendency of tuberculosis. Naegeli¹⁶⁾ is of the opinion that, as a hypersegmentation of the nucleus of neutrophils can occur in pernicious anemia, so nuclei with

13) W. Zündel, Dtsch. Arch. klin. Med., 1936, **179**, 151.

14) R. Stahel, Schweiz. med. Wschr., 1937, 308.

15) Burger, Cited from Schilling's report (Cf. V. Schilling, Dtsch. med. Wschr., 1933, **59**, 724).

16) O. Naegeli, Med. Welt, 1934, 465.

17) Hirschtel, cited from Undritz's report (Cf. E. Undritz, Fol. Haematol., 1937, **56**, 416.).

few segments may occur in Pelger's anomaly. Hirschfeld⁹⁾ states that such abnormal cells can occur in cases of infectious diseases. Zündel⁸⁾¹³⁾ mentioned cases with hereditary tendency of tuberculosis. Recently Stahel¹⁴⁾ also thought of the hereditary tendency of tuberculosis after a number of studies concerning the problem. Though Stodtmeister¹⁸⁾ was the first who investigated the result of bone-puncture in a case of Pelger's anomaly, Stahel¹⁴⁾ tried a sternal puncture in a case of the anomaly and made a precise report. According to him, there were half-ripe myelocytes, myelocytes, metamyelocytes, cells with rod-shaped nucleus in a large percentage, while ripe neutrophils showed, as he states, a reduction in number. As to lymphocytes, he says a deviation of the number might be present, though still within physiological limits. And typical coarse nuclear structure was seen in the stage of transition to such metamyelocytes as will be seen in the blood of Pelger's anomaly. His explanation concerning this is: First, such a change in the bone-marrow may be the result of an exogenous agent in the sense of a chronic infection, (but this hypothesis is, as I also believe, insufficient for the explanation of special nuclear formation). His further explanation is: The anomaly is due to a failing of the proper development of the bone-marrow; the original production of the marrow cells may be normal, but in the stage of myelocytes a stoppage of proper development of them due to a hereditary anomaly may occur, the nuclei becoming ripe in this stage of retardation, and ripe leucocytes with ripe nuclear structure and with unripe nuclear form will occur, thus precipitating young and "presenile" cells. He wanted to experiment on this and tried to inject pyrifur. In a normal person the remedy caused, he states, a remarkable increase of cells with rod-shaped nucleus and a severe nuclear shift to the left. And in a case of Pelger's anomaly, though a large number of cells with rod-shaped nucleus were already seen in the peripheral blood, metamyelocytes and some myelocytes were mobilized, showing us, he explains, that metamyelocytes in Pelger's anomaly correspond to cells with rod-shaped nucleus in a normal case. He further states that as to the number of the other kinds of cells mobilized by the injection of pyrifur there was no difference between a normal case and Pelger's anomaly. This experiment of his will show that the bone-marrow in Pelger's anomaly will react normally just as in a normal case. Stahel states the above shown functional attitude of the bone-marrow and the above

18) R. Stodtmeister, Dtsch. Arch. klin. Med., 1936, 179, 159.

mentioned theory of production of metamyelocytes instead of "stabkernig" cells indicate a "geschädigte Infektionsabwehr". He further mentions as to heredity of the anomaly that he imagines a kind of specific reaction of bone-marrow, and that a predisposition to such reaction will be inherited. According to him, this specific reaction will, under the influence of an infection, be produced, and as a result of a failing of development of bone-marrow "Pelger-cells" will be sent into the peripheral blood. Now, I think that hypothesis can not be applied to a case of an entirely healthy body with Pelger's anomaly, because no hereditary tendency of tuberculosis was seen in my own cases, nor was there a single case of tuberculosis in the cases examined. Quite healthy persons in the family showed the blood anomaly. As has already been described in my previous paper, I used the copper peroxidase reaction (the Tohoku Pediatric Method) for the investigation, and showed that the apparently "young" leucocytes are ripe enough, not only in the nucleus, but also in the cytoplasm, so that the use of the prefix "Pseudo" is, as I believe still, quite right. I think it more rational to consider the anomaly as a constitutional anomaly.

Fig. 2. Picture of 100 neutrophils, 2 basophiles and 16 eosinophiles.

One neutrophile "pseudo-myelocyte (Undritz)"; 8 "pseudo-metamyelocytes (Undritz-Kokubo)"; 53 neutrophiles with peculiar rod-shaped nucleus; 13 neutrophiles with non-peculiar rod-shaped nucleus; 25 neutrophiles with peculiar two-segmented nuclei. 2 basophiles with non-segmented nucleus, 15 eosinophiles with non-segmented nucleus; one eosinophile with segmented nucleus.

But it is not to be excluded that such cells may occur in pathological (or even normal) cases, because I have already seen "Half Typical Pelger's Anomaly."

When I investigated the blood of the first mother with typical Pelger's anomaly, I asked Dr. T. Suzuki to draw a picture showing the contour of peculiar formed nuclei in 100 neutrophiles, 2 basophiles, and 16 eosinophiles for comprehension of peculiar form of nuclei (Cf. Fig. 2).

By way of appendix, I tabulated the results of the third investigation of the mother belonging to the first family with Pelger's anomaly, and that of the second blood investigation of her two sons. As had been shown in Table 2, all of these 3 persons showed the typical Pelger's anomaly (Cf. Table 2).

Remarks.

Those who reported more than several individual cases with Pelger's anomaly are Huët (23 cases in 3 families), Burger (7 cases in 2 families), Undritz (8 cases in one family), Zündel (7 cases in one family, and Alieff and Reekers (13 cases in one family). Mine are 10 cases in 2 families.

Summary.

(1) In the present paper I demonstrated Kishim... Family as the second family of Pelger's Familial Nuclear Anomaly of Leucocytes in this country.

(2) The result of the blood investigation of 2 further cases (grandmother and cousin) belonging to the first family of Pelger's anomaly

Fig. 3. Blood of Pelger's anomaly

(ca. 600×)

In Fig. 2 in my preceding paper¹⁾, 7 cells in a case of Pelger's anomaly were represented (Cf. a-e, g and h in Fig. 2). The cell f is not a "Pelger-cell", but was illustrated here only for the purpose of comparison: it is a usual neutrophile with rod-shaped nucleus to be seen in the daily routine hematological work.

in Japan was reported, which taught me that the anomaly in the first family was inherited through three generations.

(3) The opinions of different authors concerning the varieties of leucocytes and genesis of Pelger's anomaly were introduced, and my own opinion was also published.