COGITATIONES

Physiological Effects of the Meteorologically Abnormal Year 1974 Observed in Healthy Males in the Netherlands and Southern Norway[1]

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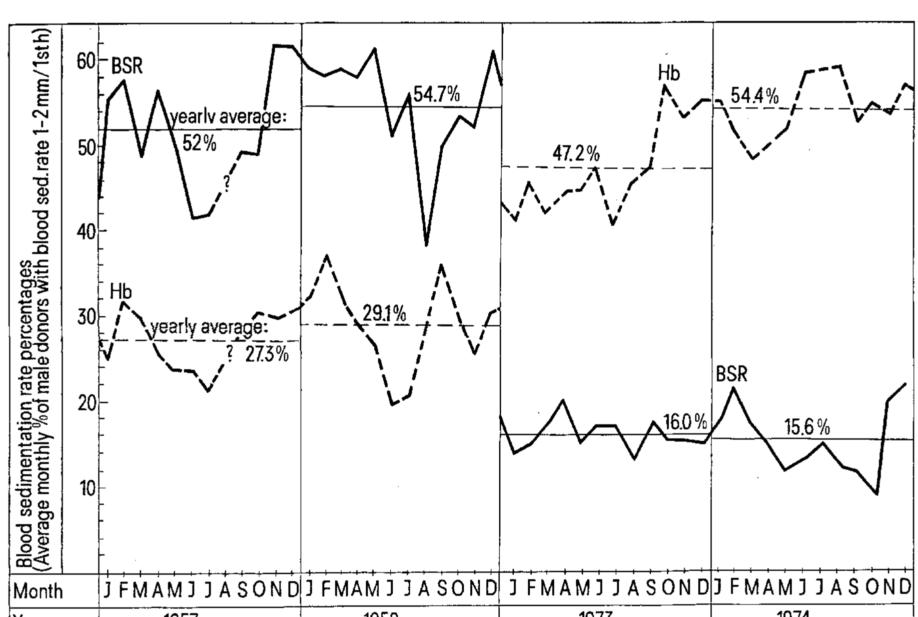
Summary. Convincing evidence of biological effects during long-term abnormal weather conditions is very rare because usually no continuous series of physiological data from the same animals or humans (either eingle or in groups) have been collected over many years during the period preceding the meteorological event. Since 1955, at the Biometeorological Research centre, Leiden, about 220,000 blood data were collected from healthy male blood donors at Leiden, The Netherlands, and about 110,000 data at Oslo, Norway, since 1966. It was found that during the meteorologically abnormal year of 1974, which was abnormal in many parts of the world, both in Leiden and Oslo abnormal biological patterns occurred in blood sedimentation rate, haemoglobin, diastolic blood pressure, γ-globulin levels, Piccardi p-test percentages and a few other biological parameters. A more complete monograph will be published at a later date.

Biometeorological studies which were able to provide convincing evidence of biological effects during abnormal weather conditions (storms, tornados, etc.) are extremely rare. Usually no physiological data of animals or human subjects are known during the period preceding the meteorological event, and therefore an accurate evaluation of the observed physiological changes is usually not possible. The Biometeorological Research Centre, Leiden, has been studying since 1955, on a daily basis, a number of physiological parameters of large groups of healthy male blood donors in Leiden, The Netherlands, and since 1966 in 17 other blood banks in the world, the longest series of data being available from Oslo (Norway). Thus physiological changes observed during very abnormal meteorological events, or series of events, can be compared with similar data during a long period preceding and following the event. Such an abnormal period was the year 1974 and the beginning of 1975 in The Netherlands, which period actually started in 1972 and continued during 1973. These abnormal weather conditions during 1974 were observed in many parts of the world, in particular in the Northern Hemisphere (see W.M.O. Bulletin April 1975, pp. 92–104). For example in the USA, a record-breaking number of tornadoes occurred, particularly around 3 April 1974 (abt 140), causing 315 deaths, 45,000 injuries and 500 million dollar property damage, the worst spell of tornadoes known in the history of the USA. The surface pressure distribution over the Northern Hemisphere in 1974 as a whole was considerably different from that in 1973. For example Icelandic low was more pronounced. The intense cyclonic activity over the North Atlantic facilitated the advection of mild air over Western Europe. Blocking high pressure areas over North Europe in spring produced sunny and dry weather over other areas in Europe. The lower than normal pressures from

[1] Apart from the references given and the Monograph vol. 7, April 1965 of the Monograph Series Biometeorological Research Centre, Leiden, also a new, more extensive publication on the topic of this paper is in preparation.



A comparison of blood sedimentation rate and haemoglobin patterns in healthy male population groups at Leiden (The Netherlands) during the years 1957, 1958 and 1973, 1974, based on monthly averages of daily observations. Since 1955, the curves show short and long-term (3 and 6 years) fluctuations which reached the lowest point at the end of 1974.

September to December 1974 caused the abnormally high amounts of precipitation in Western Europe. In order to analyze the biological significance of these abnormal weather conditions, let us consider in more detail the weather conditions in The Netherlands and in Southern Norway during 1973 and 1974.

Some characteristics of the abnormal weather conditions at Leiden and Oslo during 1974. Weather conditions at Leiden. The abnormal weather conditions in The Netherlands during 1974 started already in 1973 with a very warm January. On 2 April 1973, the heaviest strom since 1900 took place; on 30 June the longest sun eclipse occurred since 1433, followed by heat waves in July and August, and again very heavy storms in November and December 1973. However, 1974 was even more abnormal. January was again very warm and heavy storms occurred; April was extremely dry; June 1974 was the coldest June of the last 100 years. From 22 September, a series of deep depressions passed over the country, followed by heavy continuous rainfall during October, November, December (3 times more rain than normal) such as was not observed during the last 125 years. During November and December 1974 again heavy storms occurred, the temperature was far above normal (highest during the last 270 years). This continued through January 1975 with average temperatures of $+5.3\,°C$ ($+2.2\,°C$ normal) and a maximum of $+14\,°C$. Such very warm conditions in January were not recorded since 1763. In the period September 1974–January 1975, the amount of rain which was recorded near Leiden was 555 mm (against 344 mm normal) and only 315 h of sunshine against 395 (normal).

Weather conditions at Oslo. According to the information received from Mr. Th. W. JOHANNESSEN of the Norwegian Meteorological Institute at Blindern (Oslo), 1974 was a very unusual meteorological year in Norway.

The winter temperatures were extremely high. This happened only once (in 1934) since 1837. Also spring was very warm, whereas the summer was below normal. In spring there was a long dry spell (end of March till the middle of May) which has never been observed as long as observations were made in Oslo. September and November 1974 were very wet and had the lowest number of sunshine hours since 1953.

Physiological changes observed at Leiden and Oslo during 1974. Physiological changes at Leiden. Since 1955, four important physiological parameters have been studied in Leiden, 3 days per week, in large groups of healthy male blood donors. The blood sedimentation rate 1st h (Westergren method), the haemoglobin content of the blood, the diastolic blood pressure and the γ-globulin level of the blood. For details see publications mentioned in the list of references.

During 1974 (and particularly during the last 4 months) the following physiological observations were made at Leiden which differed considerably from previous periods since our observations started in 1955.

1. Studies of several thousands of healthy male blood donors at Leiden have shown that the most common blood sedimentation rate (BSR) value/1st h (determined with the Westergren method) is 1–2 mm. The percentage of donors per donor day with BSR 1–2 mm varies considerably. On certain days it may be 80%, on other days only 15%. Both the statistical analysis of BSR data with respect to different meteorological parameters and physiological experiments in climatic chambers have shown beyond any doubt that the only systematic correlation between BSR and different interrelated meteorological parameters is the correlation BSR and thermal stress. The BSR is reduced by increased cooling (combination of temperature, windspeed and humidity) and increases with reduced cooling. This explains the low BSR values in winter and high values in summer. They were very high during the recent heat wave experienced in Western Europe. The actual measurements took place in the same locality in the blood transfusion laboratory with rather constant temperature ($24 \pm 0.1\,°C$).

The actual cause of BSR changes is the change in fibrinogen content of the blood which is produced in the liver. The fibrinogen content of the blood changes under thermal stress, as can be shown empirically or under controlled conditions in climatic chambers. The percentage of male blood donors at Leiden with BSR 1–2 mm/1st h reached the lowest figure (i.e., highest BSR) in October 1974: 9.2% (in October 1971: 25%)[2]. The yearly average in 1974 of 15.6% was the lowest observed value since the observations started in 1955[3,4]. The highest percentage (54.7%) was observed during the maximum sun spot year 1958 (see Figure).

2. The most common haemoglobin (Hb) value at Leiden is 14.5 g/100 ml. Values above 15.0 and below 14.0 g/100 ml are considered to be respectively high and low values. For each donor day (i.e., days when blood donors come to the bloodbank in Leiden) always the percentage of donors is calculated with Hb values of 15.0–16.5 g/100 ml, in other words the percentage of donors on the total donor population with relatively high Hb values. The number of donors with such relatively high Hb values jumped from 42.9% in 1972 to 47.2% in 1973 and 54.4% in 1974, particularly after June 1974[5].

3. As the diastolic blood pressure (DBP) values are less sensitive to emotional stresses than the systolic values, only the diastolic values have been analyzed in Leiden from thousands of healthy male blood donors. The frequency distribution of DBP values shows a clear maximum at 80 mm Hg, at least with an age group distribution of donors existing in Leiden. The observed DBP values 85–105 mm Hg were considered to be high, 75 mm Hg and less were considered to be low. The number of healthy male blood donors at Leiden with diastolic blood pressure $>$ 80 mm Hg dropped from 1973 to 1974 from 60% (Dec. 1973–Febr. 1974) to 59% (March–May 1974), 55% (June–Aug.) and 49% (Sept.–Nov. 1974). The yearly average dropped from 61% in 1973 to 55% in 1974[6].

4. In late 1974, the population had low γ-globulin levels[7], high albumin levels and low 17-ketosteroid levels, low mortality rate from myocardial infarction, increased complaints of rheumatics and of depressive persons.

5. Other changes observed at Leiden in the physical environment during 1974 are: High Piccardi *P*-test[9] percentages in 1974 (aver. 62.6%) against 53% in 1972 and 1973, with the lowest values in September 1974 (beginning of the very rainy autumn of 1974).

[2] A new BSR cycle started at Leiden in November 1974 (see point 6). Former studies (TROMP[8]) have shown that infrared radiation accelerates BSR, UV, γ- and X-ray radiation reduces sedimentation rate.

[3] S. W. TROMP, Int. J. Biometeor. *11*, 105 (1967).

[4] S. W. TROMP, J. interdiscipl. Cycle Res. *4*, 207 (1973).

[5] S. W. TROMP, Rep. biometeor. Res. Centre, Leiden (1967), no. 6.

[6] S. W. TROMP, Rep. biometeor. Res. Centre, Leiden (1969), no. 13.

[7] S. W. TROMP, Rep. biometeor. Res. Centre, Leiden (1967), no. 8.

[8] S. W. TROMP, J. interdiscipl. Cycle Res. *6*, 9 (1975).

[9] This test is based on differences in precipitation speed of BiCl3 precipitated with double distilled water outside and under a copper screen, a phenomenon probably due to continuously fluctuating, still unknown electromagnetic waves in our environment[8].

6. On November 15th 1974, a new cycle of solar activity started with a high latitude sunspot. Also a sudden rise in the average monthly BSR percentage was observed since November 1974 (20% against 9% in October 1974), which continued during 1975 (in April 30%). This indicates a sudden drastic change in the physico-chemical state of the blood of healthy population groups in Leiden at the end of 1974.

Physiological changes at Oslo. 1. The BSR values changed rather suddenly during 1974. They became much lower (i.e., BSR percentages 1–2 mm much higher). The yearly averages of percentages of donors with BSR 1–2 mm/1st h fluctuated from 1966 to 1973 between 25 and 33%. In 1971, 1972 and 1973 these values were about 30, 32 and 31%, whereas in 1974 it suddenly increased to 41%, a value never before observed since the beginning of the observations in 1966. This could be due to the fact that the number of sunshine hours (i.e., infrared radiation) in Oslo at the end of the year was the lowest since 1953. It has not been possible to establish whether the total UV and X-ray radiation at Oslo was considerably higher than in other years, which could also have had a reducing effect on BSR values in Oslo.

2. The haemoglobin (Hb) values increased in 1974, as happened at Leiden. The number of male donors with relatively high Hb (15.0–16.9) increased from 66.6% (in 1973) to 69.6% (in 1974). The increase was even more in the Hb group 15.8–17.5%.

3. Unfortunately no blood pressure data are available in Oslo, so no comparison could be made between 1973 and 1974.

These various observations in Leiden and Oslo support the assumption that the meteorologically abnormal year 1974 had a considerable effect on a number of objectively measurable basic physiological functions in man. Undoubtedly many other, not continuously recorded, physiological parameters in the population in The Netherlands and Norway must have been affected by these weather conditions, and this may be true also for other parts in the world which experienced abnormal meteorological conditions during 1974.

PRO EXPERIMENTIS

Vereinfachte Chromosomenbänderungsmethode bei landwirtschaftlichen Nutztieren

Simple Chromosome Banding Technique for Farm Animal Investigations

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Summary. For routine cytogenetic investigations, a simple banding technique on chromosomes is described. Used on different cell material, a visible banding appearance is produced which makes the typing of chromosomes precise and fast. On 2 examples of cattle and rabbit chromosomes, the identification of a centric fusion and a trisomic is shown.

Obwohl seit dem Erscheinen der ersten Veröffentlichung über die Fluoreszenzmethode von CASPERSSON et al.[1] eine Flut von Arbeiten über dieses Thema erschienen sind, soll hier dennoch nochmals eine Methode beschrieben werden, die sich in den Händen des Verfassers seit über drei Jahren bewährt hat und von den verschiedensten Veröffentlichungen (M. SEABRIGHT[2], DRETS und SHAW[3], SCHNEDL[4]) die günstigsten Bedingungen zu eigen machte. Die Bänderungsmethoden werden nach den ersten euphorischen Anfängen nunmehr realistisch in die zytogenetischen Untersuchungen eingebaut und haben ihren Platz innerhalb der Zytogenetik gefunden. (SELLES et al.[5]; STRANZINGER und FÖRSTER[6]). Es soll hier aber nicht verschwiegen werden, dass eine direkte Übernahme dieser Methode in einzelnen Labors häufig deshalb nicht gelingt, weil meist sehr unscheinbare aber wichtige Einzelheiten nicht beachtet werden. In dieser Arbeit sollen deshalb für routinierte Zytogenetiker unwichtige Details besprochen werden, um eine Anwendung für neue Interessenten zu erleichtern.

Material und Methoden. Die Kultur und Aufarbeitung der Zellen oder Gewebepräparate bis zum Objektträger erfolgt nach den üblichen Methoden. Als hypotone Lösung setzt sich überall die 0,075 *M* KCl-Lösung durch. Damit wird auch eine weitgehende Standardisierung der Behandlung möglich, da die Zeiteinwirkung ebenfalls nur geringe Abweichungen erlaubt, ca. 7 Min. Einwirkungszeit und 7 Min. Zentrifugationszeit sind als optimal anzusehen. Kleinere Variationen sind möglich und manchmal auch nötig, da das Zellmaterial und das Alter der KCl-Lösung, die Temperatur der Lösung (37 °C) und die Temperatur im Labor sich in der Wirkung gegenseitig beeinflussen. Von entscheidender Bedeutung ist die Anfertigung von Tropfpräparaten. In unserem Labor hat sich folgende Methode sehr bewährt, da sie ebenfalls leicht zu standardisieren ist: Nur trockene, saubere und exakt vorgereinigte Objektträger werden für die Präparation verwendet. Nach der 3. Fixierung mit 3 Teilen Methanol und 1 Teil Eisessig (tiefgekühlt im Gefrierfach bei −20 °C) wird die optimale Zellkonzentration eingestellt. Drei Tropfen Zellflüssigkeit werden aus ca. 10 cm Höhe (in kleinerem Abstand) auf den trockenen Objektträger aufgetropft. Sofort anschliessend wird einmal leicht im rechten Winkel auf den Objektträger geblasen, die überstehende Flüssigkeit einmal längs und einmal an der schmalen oberen Seite des Objektträgers auf ein Filterpapier abgetropft.

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[2] M. SEABRIGHT, Chromosoma *36*, 204 (1972).
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[5] W. D. SELLES, K. M. MARIMUTHU und P. W. NEURATH, Humangenetik *22*, 1 (1974).
[6] G. STRANZINGER und M. FÖRSTER, Experientia *32*, 24 (1976).