

# STUDIES ON THE GEOGRAPHICAL DISTRIBUTION OF AUSTRALIA ANTIGEN \*

SWADESH SETH

Department of Anthropology, University of Delhi, India

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*The world distribution of the Australia antigen, the agent responsible for hepatitis in man, is reviewed on the basis of the available literature, with the addition of a personal research on a sample of German donors.*

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Australia antigen, an infectious agent, is a genetically controlled isoantigen (Blumberg et al. 1966). In 1969, Edwards described the segregation of Au(+) children in a family in conformity with the hypothesis of monofactorial autosomal recessive inheritance.

Australia antigen causes hepatitis in man and possesses many properties of a serum polymorphism (Blumberg et al. 1972) as shown by population genetic, clinical and immunological studies.

Since 1966, many populations have been examined and it is now possible to see an overall pattern of world distribution of the hepatitis-associated antigen, and possibly of its selection.

As a contribution to such a study, sera from 1270 healthy German blood donors have been analysed for the detection of Au/SH antigen by the electrophoretic immuno-precipitation technique (Pesendorfer et al. 1970).

The world distribution of Au(+), as derived by the various reports available in the literature, is shown in the Table.

Though in some of the reports the number tested is not very large, it is however quite evident that the incidence of this autosomal recessive allele does not show any geographical variation. In the present study, only 8, out of the 1270 donors, were found to possess this antigen. In another study on Germans (Cossart 1970), 0.8% of the donors were found to possess the Au/SH antigen. The highest percentage of Australia antigen is found in patients with acute virus hepatitis (64%) (Sonwald et al. 1970).

Most of the Caucasians have quite a low frequency of Au(+), i.e., 0.1-0.8% (Blumberg 1965), while some of the tropical populations possess quite high frequency, e.g., 20.2% in Indians of Peru (Blumberg et al. 1970). Recent data on the Italian population (Blumberg et al. 1970), show that the frequency of Au(+) individuals is 0.5 to 1%. This is in contrast to the study by Carbonara et al. (1970) wherein the frequency of Au(+) among the Italians of Sardinian ancestry is much higher (6 to 12.9%). Similarly, very high frequency can be observed in some of the Asian populations, e.g., Taiwanese (13.0%), Vietnamese (6.3%),

\* This study was conducted during the author's tenure at the various laboratories in Bonn and Lübeck in 1972-73 on leave of absence from University of Delhi.

TABLE  
WORLD DISTRIBUTION OF AU (+) ANTIGEN

Reference	Population	Geographical location	N	Incidence (%) of Au(+)	Gene frequency	
					Au	au
EUROPE						
Blumberg et al. 1970	Lapps and Finnlapps	Finland	127	0.00	—	1.000
	Italians	Italy	212	0.00	—	1.000
	Finns	Finland	924	0.10	0.030	0.970
Swanepoel & Crnickshank 1972	Salisbury Europeans	Rhodesia	1,275	0.20	0.042	0.958
Blumberg et al. 1970	—	Great Britain	2,048	0.19	0.043	0.957
Soulier et al. 1970	French	Paris	77,086	0.28	0.052	0.948
	French	Paris	7,846	0.39	0.062	0.938
	French	Paris	10,200	0.43	0.065	0.935
Carbonara et al. 1970	—	Hertfordshire	3,108	0.61	0.078	0.922
<i>Present study</i>	<i>Germans</i>	<i>North Germany</i>	1,270	0.63	0.079	0.831
Cossart 1970	Germans	Heidelberg	2,053	0.82	0.090	0.910
Blumberg et al. 1970	Greeks	Greece	857	1.80	0.134	0.866
	Portuguese	Hawaii	44	2.20	0.148	0.852
Ananthakrishnan et al. 1972a	Bulgarians	Bulgaria	138	2.20	0.148	0.852
Blumberg et al. 1972	Italians	Cagliari	150	6.00	0.252	0.748
	Italians	Torino	90	10.00	0.313	0.687
	Italians	Sardinia	504	12.90	0.360	0.640
ASIA						
Blumberg et al. 1970	Chinese	Taiwan	100	0.00	—	1.000
	Jordanians	Jordan	40	0.00	—	1.000
Ananthakrishnan et al. 1972a	Iranians	Iran	102	0.00	—	1.000
Blumberg et al. 1970	Japanese	Japan	1,034	0.50	0.070	0.930
	Israelis	Israel	340	1.20	0.110	0.890
Ananthakrishnan et al. 1972a	Kumaonis	North India	452	1.31	0.114	0.886
Lee 1972	Chinese	Hong Kong	280	1.50	0.122	0.878
Ananthakrishnan et al. 1972b	Bengalis	West Bengal (India)	353	1.70	0.130	0.870
	Indians	South India	127	2.40	0.154	0.846
Blumberg et al. 1970	Filipinos	Manila	197	4.60	0.217	0.783
	Filipinos	Cebu	764	4.80	0.219	0.781
	Vietnamese	Vietnam	128	6.30	0.250	0.750
	Taiwanese	Taiwan	23	13.00	0.342	0.658
AFRICA						
Blumberg et al. 1970	'Coloured'	South Africa	100	0.00	—	1.000
	—	Tristan da Cunha	42	0.00	—	1.000
Swanepoel & Crnickshank 1972	Pare	Tanzania	120	0.80	0.089	0.911
	Rural Africans	Zambia Valley and Invanga	1,036	2.50	0.154	0.846
	—	Nigeria	159	2.51	0.159	0.841
Ananthakrishnan et al. 1972a	—	—	—	—	—	—
Blumberg et al. 1970	Bantu	South Africa	72	2.80	0.167	0.833
Ananthakrishnan et al. 1972a	—	West Africa	237	2.95	0.171	0.829

Table — *continued*

Swanepoel & Crnickshank 1972	Salisbury Africans	Rhodesia	4,011	3.60	0.189	0.811
	Bulawayo Africans	Rhodesia	228	4.40	0.209	0.791
Ananthakrishnan et al. 1972 <i>b</i>	Angola	Africa	413	5.08	0.225	0.775
Blumberg et al. 1970	Ghanians	Ghana	95	9.50	0.308	0.692
AMERICA						
Blumberg et al. 1970	Indians Haida	Canada	338	0.00	—	1.000
	Indians					
	Alhabaskan	Alaska	204	0.00	—	1.000
	Navajo Indians	U.S.A.	95	0.00	—	1.000
	Quechua Indians	Peru	102	0.00	—	1.000
	Sioux Indians	South Dakota	130	0.00	—	1.000
	Negroes	Georgia	607	0.00	—	1.000
	Whites	Georgia	896	0.00	—	1.000
	Whites	Brazil	100	0.00	—	1.000
	Maya Indians	Yucatan	1,417	0.07	0.026	0.974
	Eskimos	Alaska	394	0.03	0.054	0.946
Gutierrez et al. 1972	—	Costa Rica	850	0.12	0.034	0.966
Blumberg et al. 1970	Indians	Mexico	340	0.30	0.054	0.946
Gutierrez et al. 1972	—	Costa Rica	2,867	0.80	0.089	0.901
Blumberg et al. 1970	Indians	Brazil	119	2.50	0.158	0.842
	Cashinahua					
	Indians	Peru	89	20.20	0.449	0.551
OCEANIA						
Blumberg et al. 1970	Australian					
	Aborigines	Australia	1,807	2.10	0.147	0.853
	Maoris	New Zealand	4	0.00	—	1.000
	Polynesians	Hawaii	43	2.30	0.152	0.848
	Polynesians	Bora Bora	119	2.50	0.158	0.842
	Melanesians	New Guinea	166	3.60	0.189	0.811
	Micronesians	Marshall Islands	474	7.20	0.268	0.732

as well as among the African population of Angola (5.95%) and Ghanians (9.5%). This antigen is all together absent in many populations.

It is well known that, for each infectious condition, environmental factors play a great role. Actually, a high frequency of Au(+) is found either in populations in which the sanitary conditions are poor or in individuals in whom the probability of infection is higher than average i.e., subjects living in crowded localities, polytransfused patients, laboratory staff, etc. (Carbonara et al. 1970). But the selective disadvantages of Au(+) by hepatitis are almost negligible beyond any controversy, and the immunity to it is not confined to any particular population or race.

Hence, with such a restricted distribution and low frequency of this gene, hepatitis cannot act as a selective factor due to its non-severity. As the mortality rate is very low, it rules out the possibility of natural selection acting on this particular antigen as far as its association with hepatitis is concerned.

Also, this antigen, does not occur in a series of variant forms in man and hence may not serve as an additional tool or a 'genetical marker' for anthropological studies, as previously done by some investigators.

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#### RIASSUNTO

##### *Distribuzione Geografica dell'Antigene Australia*

Viene passata in rassegna, sulla base della letteratura disponibile, la distribuzione mondiale dell'antigene Australia, l'agente responsabile dell'epatite nell'uomo. Viene aggiunto il contributo personale di una ricerca effettuata su di un campione di donatori tedeschi.

#### RÉSUMÉ

##### *Distribution Géographique de l'Antigène Australie*

La distribution mondiale de l'antigène Australie, l'agent responsable de l'hépatite chez l'homme, est passée en revue sur la base de la littérature disponible. La contribution personnelle d'une recherche effectuée sur un échantillon de donneurs allemands est ajoutée.

#### ZUSAMMENFASSUNG

##### *Geographische Verteilung des Antigens Australia*

Aufgrund des verfügbaren Schrifttums gibt Verf. eine Uebersicht über die Verteilung des für die Hepatitis beim Menschen verantwortlichen Antigens Australia, und fügt noch einen eigenen Beitrag hinzu über eine Untersuchung an einer Reihe deutscher Blutspender.

Dr. S. Seth, P.O. Box 1423, Delhi 110006, India.