Bibliography of Publications by John R. Womersley: Pioneer of Modern Computing and Applied Mathematician

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This bibliography was compiled in connection with a biographical article about John Ronald Womersley (1907-1958) [1]. He was an applied mathematician, then a manager of mathematicians and statisticians, in war and in peacetime. Then he was in at the beginning of electronic computers. Finally he made a difficult career transition in the mid 1950s from second-level management back to very successful applied mathematics research, before his early death.

(Engraving from Donald A. McDonald, Blood flow in Arteries, second edition, Edward Arnold, 1974.)

This list of Womersley's publications is the most extensive we could assemble, but the authors would be glad to hear of missing items. We have used publicly available indexes and bibliographies, as well as three partial and rather careless lists that Womersley included in his US job applications. In a few cases, Womersley gave slightly different titles. Here, the titles used in the formal publications are given. A short commentary is given on some of the items, and the reader is referred to the biographical article [1] for further details.

J. R. Womersley, Two nomograms for calculating the fluidity of cellulose solutions, Memoirs of the Shirley Institute, XIII, 95-100 (1934)

Reprinted in: Journal of the Textile Institute, XXVI (5), T165-T170 (1935)

J. R. Womersley, The application of differential geometry to the study of the deformation of cloth under stress, Memoirs of the Shirley Institute, XVI, 1-16 (1937)

Reprinted in: Journal of the Textile Institute, XXVIII(3), T97-T112 (1937)


These two papers were written while Womersley was in his first job as an applied mathematician at the British Cotton Industry Research Association’s Shirley Institute in Manchester, England. It was standard practice for Shirley Institute papers to be reprinted in the Journal of the Textile Institute. However, it is noteworthy that the second one was important enough to be reprinted again forty years later.

This – a collaboration with Professor Douglas Hartree on the use of Britain’s first differential analyzer – was leading edge work at the time.


During World War II, Womersley became the manager of a statistics research team for the Ministry of Supply in London, and his team’s advice on quality control was vital for the supply of reliable munitions.


*Reprinted in: Journal of the Textile Institute, XXXVI* (10), T253-T266 (1945)


*Reprinted in: Journal of the Textile Institute, XXXVI* (12), T311-T323 (1945)

These two papers were delayed publications of pre-war work.


M. R. Hopkins published several papers, including this one, on the surface finish of metals in 1944-1948. Hopkins worked for the Taylor, Taylor and Hobson Company in Leicester, England, experts in precision metrology. We assume that Womersley’s involvement was due to his wartime work on quality control.

J. R. Womersley, *Scientific computing in Great Britain*, Mathematical Tables and Other Aids to Computation, **2**, 110-117 (1946)

This was Womersley’s only publication from his time as the founding head of the Mathematics Division of the National Physical Laboratory at Teddington, England. This was the period when, among many others, he hired Alan Turing to design the ACE computer, and Donald Davies, who later invented packet switching.


From late 1950 until mid 1954 Womersley managed electronic computer development for British Tabulating Machines in Letchworth, England. This patent, and the following paper, show that he was fully involved in the technical work.

On 16 September 1951, Womersley was due to speak on The use of high speed computers in statistics and econometrics at the Conference of the Association of Incorporated Statisticians at Balliol College, Oxford, 1951 (as announced in *The Incorporated Statistician*, 2(2)1-1, 1951.) However, that contribution was not included in the proceedings printed in *The Incorporated Statistician*, 2(3) (1951) and 3(1) (1952). It seems likely that this paper is in fact his delayed conference contribution.


In 1954-1955, Womersley spent an extraordinarily productive year as a researcher at St. Barthomolew’s Hospital, London, where he essentially created the mathematical theory of blood flow in the above six papers.


From mid-1955 until his death early in 1958, Womersley held a senior research position at the Wright Air Development Center, Dayton, Ohio, USA. This report contains a compilation of Womersley’s writings and results on blood flow, amounting to a book of 254 typed pages, including hundreds of equations, the results of calculations from “the 1103 computer” (presumably WADC’s UNIVAC 1103), and more than 100 pages tabulating numerical results from 40 hours work by “the [Harvard] Mark IV Calculator”. It neatly illustrates the arc of Womersley’s life from applied mathematics to numerical analysis and electronic computers. The draft title *The mathematical analysis of the arterial circulation in a state of oscillatory motion* is sometimes cited. The report was formally declassified and made public only in July 2015, thanks to the efforts of Aric Ahrens of the Paul V. Galvin Library at the Illinois Institute of Technology. It can be obtained as a file of 129 MB at [http://contrails.iit.edu/DigitalCollection/1956/WADCTR56-614.html](http://contrails.iit.edu/DigitalCollection/1956/WADCTR56-614.html).


**Untraced writings**

In his job applications for WADC, Womersley listed two pending publications whose text we have been unable to trace:


Probably this was in fact the above paper in J. Physiol. 128.

There are published references to two talks that Womersley gave about his wartime activities, whose text also appears to be lost:

*Group Control Charts* given to the Manchester Statistical Society on 11 March 1944 (while he was still at the Ministry of Supply). This is mentioned in the *Journal of the Royal Statistical Society* 107(1)72-73,1944 and in *The Engineer* dated 3 March 1944. It was apparently postponed from 18 December 1943: see *The Engineer* dated 10 December 1943.

*Some applications of statistics in the war effort* (with E.D. van Rest, his colleague in Department SR17 at the Ministry of Supply) given to the London Group of the Royal Statistical Society on 1 March 1946. This is mentioned in the *Journal of the Royal Statistical Society* 109(4)476-489,1946.

We are very grateful to Aric Ahrens for help in tracing some of the more obscure references above.