Preface

This Dissertation gives an account of some of the theoretical and experimental work carried out during a period when I was a member of the Medical Research Council Unit for the Study of the Molecular Structure of Biological Systems, at the Cavendish Laboratory. It falls broadly into two parts: theoretical studies on the d-helix and on combinations of d-helices, and experimental work on two species of haemoglobin. These two fields are not separate, but are two aspects of the same problem — the structure of proteins and polypeptides, approached by way of x-ray techniques and stereochemical considerations. They are linked here by theoretical studies of certain aspects of Penz' haemoglobin data.

The work in collaboration on the Fourier transform of a helical structure and on its application to synthetic polypeptides was done in collaboration with Dr. W. Cochran, and, in part, with Dr. V. Vand. The somewhat adventitious nature of this collaboration, and the contribution of the respective authors, is indicated in the text. The substance of this work has already been published and (Cochran & Crick, 1952: Cochran, Crick and Vand, 1952). The minor developments of the theory in Chapter IV and Appendix I are all my own work.
The work on poly-
-methyl-L-glutamate was done in a
loose collaboration with Mr. I.F. Trotter and Dr. L. Brown, of
Messrs. Courtaulds, Coventry. I did none of the experimental work.
The theoretical work recorded in Chapter V is my own, except where
specifically indicated, though I had the advantage of being able to
discuss the work with my collaborators.

The theoretical work in the four chapters on coiled-coils (Chapters
VI to IX) is my own, though I benefitted from discussions with Mr. G. Kreisel
and from reading the article by Pauling and Corey putting forward
a similar idea. A short note has already been published in
Nature (Crick, 1952 b) and two further papers have been
accepted for publication by Acta Crystallographica.

The theoretical treatment in Chapters VIII and IX on
horse haemoglobin is my own. I did none of the experimental
work, which had been carried out by Perutz and his co-workers.

The substance of Chapter VIII has already been published (Crick, 1952 a)
that of Chapter IX has been accepted by Acta Crystallographica.

The experimental work in Chapters XII and XIII on horse and
ox haemoglobin is all my own, with the exception that the


ox haemoglobin crystals were grown by Mr. G.S. Adair, and
that some horse haemoglobin crystals, in phosphate (the result on
which are only briefly reported) were grown by Dr. M.F. Perutz. At
points in these two chapters the work of others is referred to, but
this is always clearly indicated. I collaborated with Mr. E.R. Harell
on the interpretation of some of the ox haemoglobin results, but
as mentioned in the text this work is not reported here. Otherwise the
interpretation is my own.

Thus, with the exception of the work with Dr. W. Cochran,
the work is substantially my own, allowing for the fact that
the theoretical results part are often applied to the experimental
results of others.

Five additional papers are attached, covering work which
is not described in this dissertation. The first two - The
physical properties of cytoplasm; a study by the magnetio-
particle method. Part I: experimental. Part II: Theoretical -
describe work done at the Strangeways Laboratory, Cambridge, in
collaboration with Dr. A.F.W. Hughes. The original idea was
suggested by Dr. Thomas S. Fell. Dr. Hughes carried out the
initial experiments, and built the initial apparatus. I carried out
Most of the patterns were calculated for me by the computers of the **Mathematics Laboratory**, using a Hollerith machine. One or two were done by EDSAC, with the help of Dr. J.C. Kendrew. I should like to thank for both these forms of assistance I am very grateful.
all the later experiments, and made some of the later apparatus. All
the theoretical work not attributed to others.

The short communication on the unit cells of four proteins,
described work done by me while I was at the Cavendish, at a
period when I was attempting to find a new small protein.

It has been omitted from the body of the
dissertation because in full somewhat to one side of the subject,
and because the results were rather negative.

The two remaining papers, 'A structure for DNA'
and 'General Implications of the Structure of DNA' were
done recently in collaboration with Dr. J.D. Watson. It would
have been possible to incorporate them in this dissertation,
but on reflection I decided against it, for two reasons.
Firstly, it would have meant recasting the whole plan of the
dissertation, and this would not have been easy at such a
late stage. Secondly, the work was carried out in very

None of this work, either in the dissertation or in the
attached papers has been submitted for a degree at any other University.

My thanks are due in particular to my two senior colleagues, Dr. M.F. Penry and Dr. J.C. Kendrew, who guided all my early effort, both in crystallography and biochemistry. I am particularly indebted to Dr. Penry, as many of my ideas have been formed while studying his work on haemoglobin.

On the theoretical side I have greatly benefited from conversations with Dr. W. Cochran, Mr. E.R. Havelock and Mr. G. Kreisel, and more recently with Dr. Jerry Dench. It has been a pleasure to collaborate with Mr. J.F. Trotter and Mr. L. Brown, and I should like to thank them for making their experimental results available to me. I should also like to thank Mr. G.S. Adair for supplying me with ox haemoglobin crystals.

The views of Dr. J.D. Water and myself are often similar, but our backgrounds are so different that I have found our many discussions together most stimulating and informative.

There is one general type of influence I should like to acknowledge. In crystallography it is often the manner
of attack their matters, and I am conscious of having too learnt much from observing the way in which Professor Sir Lawrence Bragg and Professor Linus Pauling have approached crystallographic problems.

Finally I should like to thank Miss Berry, who almost all the figures, and who always helps so willingly.