The world of nature abounds in organic compounds of nearly every conceivable structural class, the study of which constitutes a fascinating and fruitful area of scientific investigation. Our present understanding of biochemistry allows a remarkably detailed view of the substances and reactions which make up the chemical machinery of life, the metabolic pathways which utilize food, convert energy, manufacture tissue and eliminate waste. In the course of this primary chemical activity, however, the metabolic laboratory also creates a number of secondary substances (secondary metabolites), the biological purpose of which for the most part is obscure. These compounds very commonly possess wonderfully complex structures, however, and thus have long been a source of challenge and stimulation to the organic chemists. The cells of living organisms - plants, fungi, bacteria, lichens, insects and higher animals - are the sites of intricate and complex synthetic activities that result in the formation of a remarkable array of organic compounds, many of them of great practical importance to mankind.

By the early of the present century many basic tools had been assembled, in the form of reagents and synthetic and diagnostic methods, for the investigation of structure; and in the last two decades these have been augmented by the development of powerful physical methods that are widely used today. Ultraviolet and infrared spectroscopy, nuclear magnetic resonance, mass spectrometry and X-ray crystallography, which are now capable of providing complete information regarding structure and stereochemistry of organic molecules. Pioneering work continues, for the immense
area of the chemistry of alkaloids, coumarins, terpenoids and steroids, which continue to provide limitless opportunities for important advances in organic chemistry.

Recent years have witnessed a tremendous surge of interest in the plant principles like alkaloids, steroids and coumarins not only as problems of chemistry, but also as medicinally potent agents. Of the various plant families, Rutaceae, Apocynaceae, Magnoliaceae and Compositae are much reputed for producing medicinally evaluated extremely diversified series of extractives, offering great encouragement to chemists for chemical exploration of the plants belonging to these families, and to physiologists and biochemists for intensifying their researches in their own fields on the active components isolated and characterized by the chemists. From a purely chemical point of view the family Rutaceae is a fascinating group of plants in respect of polycyclic compounds, viz., alkaloids, coumarins, terpenoids and flavonoids it produces and is surely one of the most versatile of all the families of higher plants.

It was thus of interest to carry out systematic chemical investigation on Rutaceae plants, with a view to isolating and characterizing their chemical constituents and elucidating the structure of the new chemically as well as biologically interesting compounds. With this object in view, two Rutaceae plants, viz., Glycosmis cyanocarpa Spreng and Feronia elephantum Correa were subjected to systematic chemical investigation, the outcome of which has culminated into the present dissertation.

This thesis entitled "Chemistry of Natural Polycyclic Compounds" embodies the results of a series of investigations on the chemical constituents of some Indian medicinal plants, carried out by the author in the Department of Chemistry, University
College of Science, Calcutta 700009, under the supervision and guidance of Dr. S. X. Talapatra, M.Sc., Ph.D., F.R.S., F.R.I.C., Reader-in-Chemistry, Calcutta University, during the period January 1970 to October 1974. The thesis is set up as follows:


Part-II: Studies on the Coumarin Constituents of *Glycosmis cyanocarpa* Spreng and *Feronia eleohantum* Correa.

The Part-I of the thesis consists of a brief introductory resume on the recent development in the chemistry of 2-quinolone alkaloids (Section-A). Section-B of this part presents an introduction on *Glycosmis* species and a list of naturally occurring compounds isolated from the different species of the genus *Glycosmis*, followed by the isolation and structure elucidation of glycocarpine, a novel 2-quinolone alkaloid from *Glycosmis cyanocarpa*.

The Part-II begins with a survey of coumarins reported in recent years (Section-A). The Section-B presents the isolation, characterization and some reactions of coumarins obtained from *Glycosmis cyanocarpa*. This is followed by Section-C which deals with the isolation, characterization and a few reactions of coumarins obtained from *Feronia eleohantum*.

A brief summary of the work incorporated in the present dissertation follows the preface.

The numbers given to the literature references, structures, tables, schemes and figures have been made continuous independently for each part of the dissertation. For the sake of convenience the references have been cited in the footnote of the respective page (or the next page) where they first appear.
Petroleum ether (light petrol) used had boiling point 60-80°. Extracts of products in organic solvents were generally washed with saturated sodium chloride solution and dried over anhydrous sodium sulphate in each case.

All the thin layer chromatography (TLC) experiments were performed on microplates prepared by dipping the plate in a slurry of silica gel G (manufactured by Messrs. Gouri Chemical Works, Calcutta) in chloroform; the spots were detected by staining with iodine vapour. Silica gel (mesh 100-200; Gouri Chemical Works) was employed for column chromatography. The column chromatographic experiments were monitored by micro TLC.

The melting points reported were determined in air bath using Toshniwal melting point apparatus and are uncorrected. The analytical samples were routinely dried in vacuo over P₂O₅ at 80° for 8 hours.

The UV spectra were measured in aldehyde free ethanol solution with a Carl Zeiss Universal Spectrophotometer, Model VSU-1 or a Beckman Spectrophotometer, Model DK2. The IR spectra were taken in KBr phase or in nujol with a Perkin-Elmer Infracord 137 or Perkin Elmer 221-1607 instrument. The PMR spectra were measured either with a Varian A 60D or a Varian HA-100 or a Varian HA-100D instrument using tetramethyl silane as internal standard and the chemical shifts were measured in δ (ppm) units. The rotations were measured with a Hilger-Watts M-511 microoptic polarimeter. The mass spectra were run in a Hitachi-Perkin Elmer RMU6 spectrometer operating at 70 e.V. and using direct insertion probe.

The author takes this opportunity to express his sincere gratitude and deep appreciation to Dr. S. K. Talapatra, M.Sc., Ph.D., P.R.S., F.R.I.C., Reader-in-Chemistry, Calcutta University, for stimulating discussion, constructive ideas, expert criticism and valuable guidance throughout the course of this investigation and for providing laboratory facilities.

The author is greatly indebted to Dr. (Mrs.) B. Talapatra, D.Sc., P.R.S., Lecturer-in-Chemistry, Calcutta University, for her keen interest and helpful discussions and to Prof. (Mrs.) A. Chatterjee, D.Sc., P.R.S., F.N.A., Head of the Department of Chemistry and Dean of the Faculty of Science of this University, for her constant encouragement.

The author is deeply grateful to Prof. A. Chakravarty, IIT, Kanpur; Dr. S. C. Pakrashi, IIEW, Calcutta; Dr. R. S. Kapil, CDRI, Lucknow; Dr. Balsubramanyam, IISI, Bangalore; Dr. B. S. Joshi, CIBA Research Center, Bombay; Dr. B. C. Maity, U.K. and
to Mr. Aditi Acharya, Science College, Calcutta for the spectral and rotational measurements. Thanks are also due to Prof. P. K. Larsen, Copenhagen, for supplying an authentic sample of 6-methoxy-7-geranyl oxy coumarin and to Dr. A. K. Dasgupta, EIPW Ltd., Behala, Calcutta for supplying the authentic samples of dihydroxanthyletin and tetrahydroxanthyletin.

It is a great pleasure to acknowledge the enthusiastic co-operation of my colleagues of which special mention should be made of Durga S. Bhar, Swapan K. Mukhopadhyay, Dilip K. Pradhan, Debabrata Banerjee and Tapan Roy in the preparation of the dissertation and to record sincere appreciation of the efforts they have given throughout the progress of this work.

Lastly, I express my profound regards to my mother and deep appreciation to my wife Manusree for their constant inspiration, sacrifice and encouragement during the progress of this work.

Department of Chemistry,
University College of Science,
Calcutta 700009

MANAS KUMAR CHAUDHURI

November, 1974.