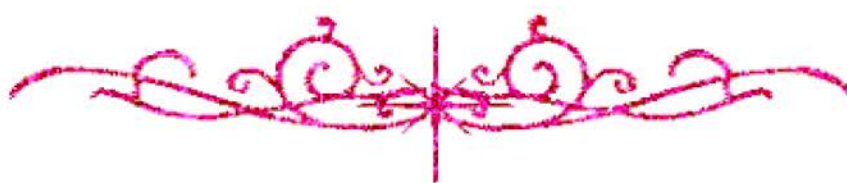


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شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم



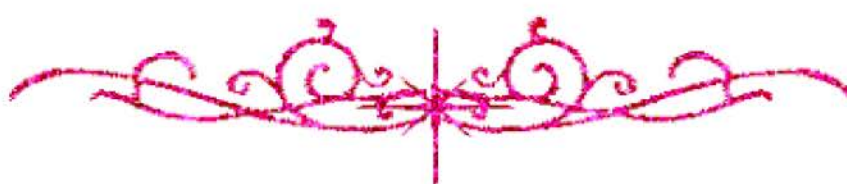
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شبكة المعلومات الجامعية



شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



سامية محمد مصطفى



شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

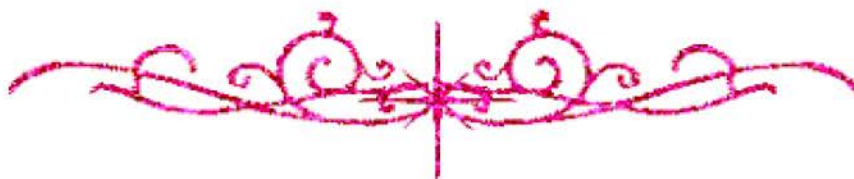
قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



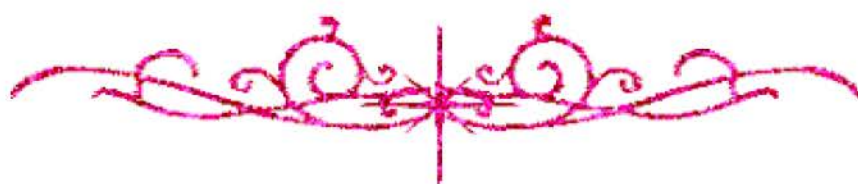
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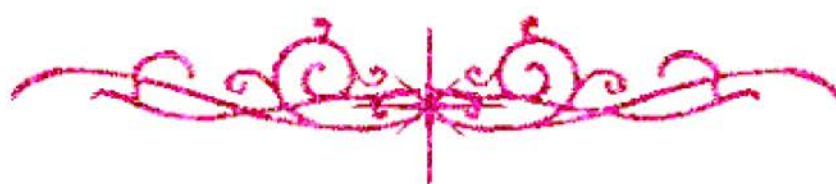
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شبكة المعلومات الجامعية



بالرسالة صفحات
لم ترد بالأصل



MASSIVE PRODUCTION OF SOME ECONOMICALLY IMPORTANT METABOLIC COMPOUNDS IN *DUNALIELLA SALINA*

Thesis

Submitted to Faculty of Science
Alexandria University

For

The Degree of Master of Science

"Botany"

By

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B.Sc. (Botany) 1988

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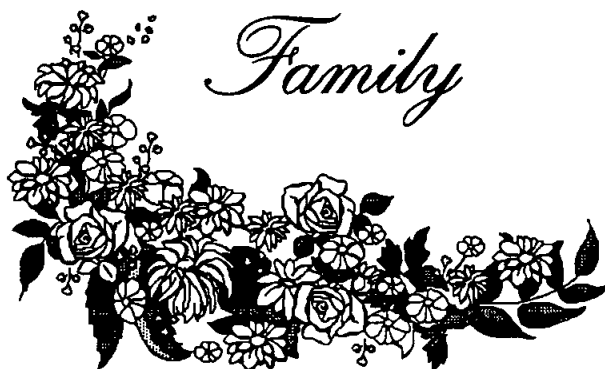
وما توفيقى إلا بالله

صدق الله العظيم

Dedicated To

My

Family



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A word of thanks is given to **ALLAH**, the source of all knowledge, by whose abundant grace this work came to fruition.

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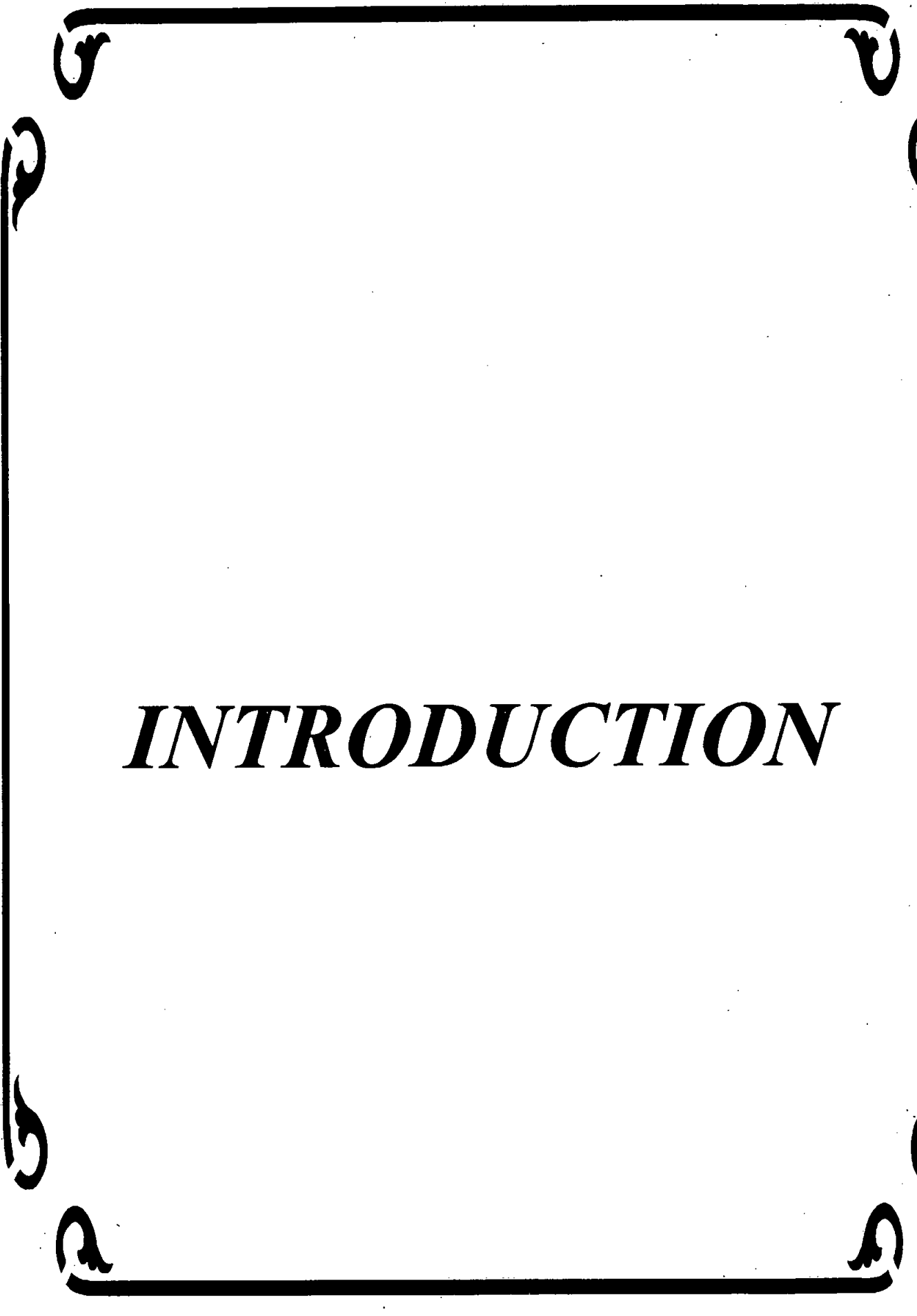
Sencere thanks are also extended to all my colleagues of the laboratory of phycology and to the friends of Botany Department, for their kind help and encouragement.

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INTRODUCTION

INTRODUCTION

Photosynthesis is the most abundant energy-storing and life-supporting process on earth. It is not surprising, therefore, that utilization of the photosynthetic machinery for the production of energy, chemicals and food by mass-culturing of microalgae has had particular appeal. The early trials of algal biomass production were concentrated on the fresh-water green alga *Chlorella* as a potential source of single cell protein (Burlew, 1953 and Tamiya, 1957). Since then, many other potential applications for large-scale cultures have been advanced, including the production of food, feed, extractable chemicals, waste-water treatment aquaculture, and health promoting algal preparations. Several reviews have been reported on the progress of outdoor mass cultivation of microalgae (Soeder and Binsack, 1978; Goldman, 1979 a,b; Shelef and Soeder, 1980; Becker, 1985; Barclay and McIntosh, 1986; Oswald, 1986; Richmond, 1986 a,b; Benemann et al., 1987). Most of these literatures deal with fresh water microalgae that grow autotrophically or heterotrophically.

Serious attempts to utilize mass culture systems for marine microalgae were initiated in the last few years, prompted by requirements in the mari-culture food chain biotechnology, the search for lipid producing microalgae as a means for large scale biological energy storing system (S.E.R.I., 1985) and the investigation of specific algae which accumulate industrially interesting products (Parkinson, 1987).

Several drawbacks limit the large-scale expansion and utilization of mass-cultured algae:-

- a) Very few products which economically justify commercial production have been identified in micro-algae.
- b) Only limited biological knowledge is available on techniques to control the chemical composition of algae for enhancement of a selected product or products.
- c) The technology for mass-cultivation of algae is still under development.
- d) Growing a particular algal species in an outdoor pond is greatly hampered by contamination with other organisms creating conditions under which a desired algal species predominates is not trivial and is essential for successful commercial cultivation

The halotolerant green alga *Dunaliella* is probably one of the most successful microalga for outdoor cultivation. This alga has several features which made it favourite for mass-cultivation (Ben-Amotz and Avron, 1983a). Mass-cultivation of algae in open ponds requires considerable areas of land where solar light is plentiful and temperatures are moderate throughout the year. Such conditions exist essentially in arid areas, where fresh water is normally scarce but saline waters, including sea water, is often available. *Dunaliella* thrives well under such conditions since it requires media containing about 6-12% sodium chloride for optimal growth (Ben-Amotz and Avron, 1989). *Dunaliella* is one of the very few microorganisms that can thrive in media containing such high salt concentrations. This provides a great selective advantage which allows the cultivation of this alga in a relatively pure culture (unialgal culture). The high salt concentration also minimizes the number of predatory species which need

special treatments to be eliminated. Since *Dunaliella* thrives in simple inorganic media, growth of non-photosynthetic organisms (heterotrophic organisms), such as bacteria and fungi which can digest the alga themselves, is severely limited. Under appropriate growth conditions *Dunaliella* accumulates massive amounts of a highly priced product, β carotene over 10%, in addition to glycerol, around 20% - 40% of the algal organic weight and the remaining algal meal. Lacking a cell wall, dried *Dunaliella* cells are easily and fully digestible by humans and animals.

The genus *Dunaliella* belongs to class Chlorophyceae, order Volvocales. There are several ill-defined species all are unicellular, ovoid in shape, 8.25 μm long, 5-15 μm wide, and motile with two equal long flagella inserted anteriorly (Butcher, 1959). The alga contains one large cup-shaped chloroplast with a single pyrenoid embedded in the basal portion. The pyrenoid is surrounded by polysaccharide granules. Like most green algae, *Dunaliella* contains typical organelles characteristic to eukaryotic organisms. The chief morphological characteristic of *Dunaliella*, in contrast to other algae, is the lack of a rigid polysaccharide cell wall. The cell is enclosed by a thin elastic plasma membrane covered by a mucus surface coat. The cell shape and volume are, therefore respond rapidly to osmotic changes. The lack of a rigid cell wall increases the sensitivity of *Dunaliella* to tension force by different mechanical means and imposes some limitations on the treatment of cultures (Ben-Amotz and Avron, 1989). The halophilic algae that have been subjected to the closest salinity are species of *Chlamydomonas*, but ecological evidence (Brock, 1975) suggests that the genus is much less halotolerant than *Dunaliella*. The best known halophilic species of *Dunaliella* are