All About Enzymes Cell

The functional analysis of macromolecular structures in tissues and cells has been greatly enhanced by advances in histochemistry and cytochemistry. Enzyme histochemistry is becoming particularly important as new methods succeed in demonstrating and quantifying the activity of key regulatory enzymes. The specificity, precision, and reproducibility of enzyme histochemical methods are constantly improving. This practical laboratory handbook contains a selection of the most important enzyme histochemical techniques currently available for light microscopy. The methods included here were chosen because of their reliability and specificity, and all are clearly detailed in easy-to-follow protocols. The introductory chapter provides a good theoretical background to enzyme histochemistry, and the book will be of interest to all researchers in cell biology, pathology, biochemistry, and cell physiology.

Enzymes are always considered as great gifts from nature since they are holding brilliant properties, including high activity, selectivity and specificity. Nowadays, a variety of enzymes have been applied to many industry processes. However, challenges are still needed to be addressed while applying enzymes. It is worth to point out that enzymes are sensitive to the change of ambient conditions. Most of enzymes are unstable and work under certain sort of temperature and pH conditions. Since enzymes could be denatured when subject to unnatural conditions, their work environment has to be controlled. Researchers have been developed a variety of methods to improve the stability of bio-catalysts under various non-biological conditions. However, the immobilization process might harm the activity of enzymes. Therefore, even though immobilization approach has stabilized the stability of bio-catalysts, alternative strategies are still necessary to maintain the enzymes' activity during the encapsulation process. In my research, two novel strategies were successfully developed to maintain enzymes' activity during encapsulation processes. Enzyme-based microgels and nanogels were successfully synthesized at cellular and enzymatic level for various applications, which are briefly outlined below: Cellular level: An approach was envisioned in this section to improve biocatalyst stability, while maintaining their activities at the maximum during the encapsulation process. The new technology employs materials self-assembly to form a protective layer coating on cells surface. Enzymes are restricted within the cell all the time, without disturbing the structure during the encapsulation process. Therefore, this strategy maintains enzymes' activity at maximum. What's more, the protective polymer coating significantly increases biocatalyst viability in harsh thermal environment, different pH conditions, while allowing rapid transport of substrates into the biocatalyst without significant activity compromise. Compared with the conventional enzymes' encapsulation method, such robust microgels exhibit significantly improved activity and catalytic stability. Meanwhile, such robust single cells make the immobilized whole cells much cheaper to use than an immobilized enzyme. Enzymatic level: In this section, surface coating with zwitterionic polymers was studied at the single enzymatic level without disturbing the enzyme structure during the encapsulation process in order to maintain enzymes' activity. The protective polymer coating can significantly increase biocatalyst viability while allowing rapid transport of substrates into the biocatalyst without significant activity compromise. Zwitterionic polymer shells have an efficient antibiofouling property which reduce the protein or cell adsorption, reduce immune response and prolong the circulation time of nanogels in blood circulation system. Overall, my researches focus on maintaining enzymes' activity during the encapsulation process. Protective layers stabilize enzymes and create new surface functions. The encapsulation process is without disturbing enzymes' 3D structure. The resulted enzyme microgels or nanogels gain high activity and various new functionalities. With these technologies, we can envision a promising prospect in environmental, therapeutic and analytical applications of enzymes.

Enzyme Technology is one the most promising disciplines in modern biotechnology. In this book, the applications of a wide variety of enzymes are highlighted. Current studies in enzyme technology are focused towards the discovery of novel enzymes (termed “bio-discovery” or “bio-prospecting”) and the identification and elucidation of novel pathways of these novel enzymes with emphasis on their industrial relevance. With the development of molecular techniques and other bioinformatics tools, the time to integrate this subject with other fields in the life sciences has arrived. A rapid expansion of the knowledge base in the field of enzyme biotechnology has occurred over the past few years. Much of this expansion has been driven by the bio-discovery of many new enzymes from a wide range of environments, some extreme in nature, followed by subsequent protein (enzyme) engineering. These enzymes have found a wide range of applications, ranging from bioremediation, bio-monitoring, biosensor development, bioconversion to biofuels and other biotechnologically important value-added products. Hydrolases constitute a major component of the global annual revenue generated by industrial enzymes and the emphasis has therefore been placed on these enzymes and their applications. With the immense interest of researchers active in this area, this book will serve to provide information on current aspects in this field of study. In the current edition, the contributions of many diversified topics towards establishing new directions of research in the area of enzyme biotechnology are described. This book serves to provide a unique source of information to undergraduates, post graduates and doctoral courses in microbiology and biotechnology along with allied life sciences. The present edition of the book covers all important areas of enzyme biotechnology i.e. the wide variety of enzymes in the field of enzyme biotechnology and their industrial applications, new methods and state-of-the-art information on modern methods of enzyme discovery. This book will act as good resource on most of the current facets of enzyme technology for all students engaged in bioengineering and biotechnology.

The continuing rapid progress in work designed to improve the functional properties of enzymes and cells as industrial catalysts has led to this revised, updated, and expanded new edition of the warmly received initial edition of Immobilization of Enzymes and Cells. This long-awaited second edition contains new and simplified protocols useful for industrial applications, novel techniques that will prove useful now or in the near future, and protocols for the preparation of immobilized derivatives suitable for a wide variety of nonconventional reaction media. The authors also offer tools for the development of new immobilization techniques, methods for preparing immobilized derivatives for therapeutic and industrial use, and new chemical reactors designed to overcome the limitations of immobilized derivatives. The emphasis is on improving enzyme and cell properties via very simple immobilization protocols, along with the development of new and better methods. The protocols follow the successful Methods in BiotechnologyTM series format, each offering step-by-step laboratory instructions, an introduction outlining the principles behind the technique, lists of the necessary equipment and reagents, and tips on troubleshooting and avoiding known pitfalls. Innovative and highly practical, Immobilization of Enzymes and Cells, Second Edition, affords biochemists, biotechnologists, and biochemical engineers a practical review of all the latest methods and tools-as well as optimized conventional techniques-needed to carry out successful research involving immobilizing enzymes and cells.

What is life? Fifty years after physicist Erwin Schrodinger posed this question in his celebrated and inspiring book, the answer remains elusive. In The Way of the Cell, one of the world's most respected microbiologists draws on his wide knowledge of contemporary science to provide fresh insight into this intriguing and all-important question. What is the relationship of living things to the inanimate realm of chemistry and physics? How do lifeless but special chemicals come together to form those intricate dynamic ensembles that we recognize as life? To shed light on these questions, Franklin Harold focuses here on microorganisms--in particular, the supremely well-researched bacterium E. coli--because the cell is the simplest level of organization that manifests all the features of the phenomenon of life. Harold shows that as simple as they appear when compared to ourselves, every cell displays a dynamic pattern in space and time, orders of magnitude richer than its elements. It integrates the writhings and couplings of billions of molecules into a coherent whole, draws matter and energy into itself, constructs and reproduces its own order, and persists in this manner for numberless generations while continuously adapting to a changing world. A cell constitutes a unitary whole, a unit of life, and in this volume one of the leading authorities on the cell gives us a vivid picture of

what goes on within this minute precinct. The result is a richly detailed, meticulously crafted account of what modern science can tell us about life as well as one scientist's personal attempt to wring understanding from the tide of knowledge.

The critically acclaimed laboratory standard, Methods in Enzymology, is one of the most highly respected publications in the field of biochemistry. Since 1955, each volume has been eagerly awaited, frequently consulted, and praised by researchers and reviewers alike. The series contains much material still relevant today - truly an essential publication for researchers in all fields of life sciences.

The use of High Performance Liquid Chromatography (HPLC) techniques in the study of enzymatic reactions has grown significantly since the publication of the first edition of this highly successful book: the role of enzymes in biological research has expanded; the application of HPLC and enzymes has extended to more disciplines; advances in separation techniques and instrumentation have increased the capability of HPLC; and the discovery of new enzymes has spawned new methods of analysis. High Performance Liquid Chromatography in Enzymatic Analysis, Second Edition addresses these developments in its coverage of the refinements of HPLC methods and their use in a wide range of laboratory applications. It offers the same practical approach found in the first edition, incorporates a wealth of new information into existing chapters, and adds new chapters to deal with new applications, including capillary electrophoresis, forensic chemistry, microdialysis, and the polymerase chain reaction. Topics include: * Application of HPLC to the assay of enzymatic activities * Concepts and principles of HPLC, including the latest technological advances * Concepts and principles of capillary electrophoresis (CE) * Strategy for design of an HPLC/CE system for assay of enzyme activity * Preparation of enzymatic activities from tissues and single cells * Analysis of enzymatic activities in body fluids, including chromatobiosis * HPLC for the identification of new enzymatic activities * Fundamentals of the polymerase chain reaction * HPLC in forensics * Survey of enzymatic activities assayed by the HPLC method, including many new categories * Multienzyme systems, including many new examples * HPLC in the analysis of contaminated food "It is the ability of HPLC to accomplish separations completely and rapidly that led to its original application to problems in the life sciences, particularly those related to purification. An analysis of the literature revealed that this technique was used primarily for the purification of small molecules, macromolecules such as peptides and proteins, and more recently, antibodies. This application to purification has all but dominated the use of the method, and there has been a plethora of books, symposia, and conferences on the use of HPLC for these purposes. However, it was only a matter of time before others began to look beyond and to explore the possibilities that result from the capacity to make separations quickly and efficiently." --from the preface to the First Edition Easy to read and full of practical advice and hundreds of diagrams and examples, High Performance Liquid Chromatography in Enzymatic Analysis, Second Edition is an invaluable resource for students, researchers, and laboratory workers in analytical chemistry and biochemistry, molecular biology and cell biology, and for anyone interested in keeping up with this fast-growing field.

Summarizes research encompassing all of the aspects required to understand, fabricate and integrate enzymatic fuel cells Contributions span the fields of bio-electrochemistry and biological fuel cell research Teaches the reader to optimize fuel cell performance to achieve long-term operation and realize commercial applicability Introduces the reader to the scientific aspects of bioelectrochemistry including electrical wiring of enzymes and charge transfer in enzyme fuel cell electrodes Covers unique engineering problems of enzyme fuel cells such as design and optimization

Our group has demonstrated that all the enzymes required for the biosynthesis of farnesyl diphosphate (FPP) from mevalonate are localized to peroxisomes. FPP is the precursor of critical isoprenoids, thus, its regulation and metabolism are crucial. In rat liver, an allyl pyrophosphatase (FPPase) converts FPP to free farnesol. Farnesol is then oxidized to prenyl aldehyde by alcohol dehydrogenase (ADH) or it is converted to FPP by phosphorylation reactions. In this study, we identified a specific FPP kinase activity in rat liver. We also determined the subcellular localization of the FPPase, ADK and FPP kinase activities in whole liver homogenates. Regulation studies demonstrated that FPP kinase activity but not FPPase responded to modulation in FPP levels. The rate-limiting enzyme in isoprenoid biosynthesis, 3-Hydroxy-3-methylglutaryl (HMG)-CoA reductase has been localized to peroxisomes and endoplasmic reticulum (ER). No information is available regarding the regulation or function of the peroxisomal reductase in isoprenoid metabolism. To facilitate the regulation studies of the peroxisomal reductase, we utilized a mammalian cell line (UT2*) that expresses only one reductase protein of 90 kDa that is localized exclusively in peroxisomes. Comparison of the regulation of the two reductases revealed major differences between the two proteins. The peroxisomal reductase is not the rate-limiting enzyme for cholesterol biosynthesis. The peroxisomal protein is not phosphorylated and its activity is not altered in the presence of cellular phosphatases. Its rate of degradation is not accelerated by mevalonate. Moreover, the degradation process is not blocked by the cysteine protease/proteosome inhibitor, N-acetyl-Leu-Leu-norleucinal (ALLN). Finally, the peroxisomal protein is more resistant to statin inhibition. These data suggest that the peroxisomal protein is functionally and structurally different from the ER reductase. We also showed that peroxisomal-deficient PEX2- Chinese hamster ovary (CHO) cells display reduced levels of peroxisomal. isoprenoid enzymes and show reduced rates of isoprenoid biosynthesis. We showed that the deficiency in the peroxisomal enzymes was due to acceleration in the rate of degradation of the proteins, and a decrease in the mRNA levels and rate of synthesis of these proteins. Taken together, the data presented in this study emphasize the indispensable role of peroxisomes in isoprenoid biosynthesis.

In this book, an ensemble of examples is provided to illustrate the diversity of approaches and applications to which the multi-enzyme catalysis is currently applied. Enzymes act in living beings as extremely complex, network mixtures that are supportive of all the biochemical transformations on which the life is based. In the biotechnological context, many of the enzymatic processes performed in vitro at both small and industrial scales lie on the enzymatic transformation of a single molecular species for the generation of a product and as catalyzed by a single enzyme. However, the number of technological applications for which cell-free enzyme mixtures are required is increasing and the science of how to combine individual reactions in complex processes is under speedy development. Obviously, any of the current in-progress multi-enzyme processes is fully mimicking the complexity of a living cell or cell community. However, the refined combination of selected enzymes and substrates is offering a new technological approach that is supporting the development of new or improved products in many fields such as food, leather and pharmaceutical industries. This book is unique and presents selective examples of each of these processes have been incorporated in this book by experts in their respective areas.

Enzyme technology continues to maintain a high degree of interest both in the academic and industrial communities. Since the last Enzyme Engineering Conference held in Bad Neuenahr, Federal Republic of Germany, two years ago, an increasing emphasis has been placed on the study and application of immobilized whole cells and organelles. This new emphasis has been reflected in the number of presentations directed to this area. The Fifth International Enzyme Engineering Conference was held in Henniker, New Hampshire, July 29 to August 3, 1979. The organizers of this conference are especially grateful for the generous support received from a number of industrial organizations. The conference was attended by 183 participants representing over 22 countries making this truly an international conference. During this conference, emphasis was placed on a wide variety of areas including: enzyme production, energy transduction, co factor modification, biomass conversion, immobilized enzymes, cells and organelles, and enzymatic synthesis of chemicals and pharma ceuticals. This volume contains most of the presentations and posters presented at the Fifth Conference. The names of the session co chairmen, workshop chairmen, committee members and sponsoring organizations are included as an appreciation of their efforts in making this a successful conference. The preparation of this volume was carried out by the editors including editing and proofing of the individual manuscripts and the final copy of this volume. The editors are indebted to Ms. S.

As newer members of the transglutaminase family are being discovered and new functions for existing members are being described, it

becomes imperative to collect all the findings in a book. This volume provides the most comprehensive single source of information and will appeal to both new investigators just entering the field and established researchers aiming to elucidate the biological relevance of these enzymes in cancer, inflammation, autoimmune diseases and related areas of research.

In the first series of experiments eCG was administered to mares during pregnancy, diestrus, pseudopregnancy and persistent luteal phase. Equine CG stimulated luteal estrogen production during all reproductive states except diestrus, indicating that luteal steroidogenesis is regulated by eCG, and that luteal responsiveness to eCG is age-dependent.

Tour of the Cell: Proteins and Enzyme Function Proteins are one of the most abundant organic molecules in living systems and have the most diverse range of functions of all macromolecules. That diversity of function is due to a tremendous diversity of "uniquely defined" structures. Proteins may be structural, regulatory, contractile, or protective; they may serve in transport, storage, or membranes; or they may be toxins or enzymes. Each cell in a living system may contain thousands of proteins, each with a unique function. Their structures, like their functions, vary greatly. They are all, however, polymers of amino acids, arranged in a linear sequence. But that simple linear sequence is just the beginning of the story. Chapter Outline: Proteins Enzymes Buffers and Enzymes The Open Courses Library introduces you to the best Open Source Courses.

This book covers the most recent developments in the analysis of allosteric enzymes and provides a logical introduction to the limits for enzyme function as dictated by the factors that are limits for life. The book presents a complete description of all the mechanisms used for changing enzyme activity. It is extensively illustrated to clarify kinetic and regulatory properties. Eight enzymes are used as model systems after extensive study of their mechanisms. Wherever possible, the human form of the enzyme is used to illustrate the regulatory features.

Some enzymes of the citric acid cycle and glycolytic pathway in cell-free extracts of Vibrio marinus MP-1 were compared for thermal lability. After one hour of moderate temperature exposure, enzymes of both pathways rapidly lost catalytic activity. For all but one enzyme, 50 percent remaining activity occurred near an averaged temperature of 27 C. Succinic dehydrogenase was remarkably unstable, being 50 percent inactivated at 16 C. Complete loss of enzymatic activity for the TCA and glycolytic enzymes took place at an averaged temperature of 32 C. Lactic dehydrogenase was the most thermostable as evidenced by activity up to 39 C. Several of the "psychrophilic" enzymes (hexokinase, aldolase, and lactic dehydrogenase) produced greater activity in the presence of sodium chloride as opposed to tris-HC1. Suspending the enzyme preparations in sodium chloride resulted in an increased thermal stability. The 50 percent remaining activity took place at 1 C to 15 C higher with an average of 32 C. Complete loss of catalytic function averaged 2 C higher for the sodium chloride suspended enzyme. There was noticeably less difference in thermal protection by sodium chloride at temperatures above the region of 50 percent remaining activity. The effects of salt are explained on the basis of increased activity coefficients in solution. The behavior of lactic dehydrogenase on moderate temperature exposure suggested the existence of isozymes, or that denaturation occurred in three major steps, each with a different rate. The low temperature requirement of all the enzymes under investigation, together with the ionic requirement of hexokinase and the relatively high level of phosphoglucose isomerase were suggested as possible factors controlling the obligate psychrophile's activities. Furthermore, the diverse influence of moderate temperature exposure on each enzyme (whether in buffer of sodium chloride) could alter differentially the cell's catalytic processes so that they could no longer operate in synchrony. Comparison with enzymes from other sources indicated the tricarboxylic acid cycle and glycolytic enzymes of Vibrio marinus MP-1 to be conspicuously thermal labile.

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Deals with topics in Mendelian genetics, cytology, biochemical genetics, mutagenesis, extranuclear and extrachromosomal inheritance, molecular genetics, developmental genetics, human genetics, population genetics, evolutionary genetics and biostatistics.

This book covers important advances in enzymology, explaining the behavior of enzymes and how they can be utilized to develop novel drugs, synthesize known and novel compounds, and understand evolutionary processes.

Industrial biotechnology is the practice of using cells to generate industrially useful products. An enzyme is a protein that catalyzes, or speeds up, a chemical reaction. Enzymes are the focal point of biotechnological processes, without them biotechnology as a subject would not exist. The main advantage of enzymes compared to most other catalysts is their stereo, region and chemo selectivity and specificity. Enzymes are responsible for many essential biochemical reactions in micro organisms, plants, animals, and human beings. Biotechnology processes may have potential in energy production, specifically in the substitution of renewable plant biomass for fossil feedstock. This will depend on the development of enzymes able to degrade cellulose in plant biomass and designing methods to recycle or dispose of spent biomass. With time, research, and improved protein engineering methods, many enzymes have been genetically modified to be more effective at the desired temperatures, pH, or under other manufacturing conditions typically inhibitory to enzyme activity (e.g. harsh chemicals), making them more suitable and efficient for industrial or home applications. Enzymes are used in the extraction of natural products, as catalysts in organic chemistry, in clinical analysis, in industrial processes, and so on. The application of enzymes is found in many different fields and it is one of the good sectors to venture. In coming few years it is estimated that world enzyme demand will average annual increases of 6.3 percent. This book basically deals with principles of industrial enzymology, basis of utilization of soluble and immobilized, enzymes in industrial processes, principles of immobilization of enzymes, enzymes in clinical analysis principles, practical aspects of large-scale protein purification, the applications of enzymes in industry, use of enzymes in the extraction of natural products, data on techniques of enzyme immobilization and bio affinity procedures etc. In this book you can find all the basic information required on the fundamental aspects of the enzymes, their chemistry, bio chemistry as well as detailed information of their applications a wide variety of industrial processes etc. The book is very useful for research scholars, technocrats, institutional libraries and entrepreneurs who want to enter into the field of manufacturing of enzymes.

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Almost all metabolic processes in the cell need enzymes in order to occur at rates fast enough to sustain life. The set of enzymes made in a cell determines which metabolic pathways occur in that cell. The study of enzymes is called enzymology. Enzymes are known to catalyze more than 5,000 biochemical reaction types. Most enzymes are proteins, although a few are catalytic RNA molecules. Enzymes' specificity comes from their unique three-dimensional structures.Like all catalysts, enzymes increase the rate of a reaction by lowering its activation energy. Some enzymes can make their conversion of substrate to product occur many millions of times faster. An extreme example is orotidine 5'-phosphate decarboxylase, which allows a reaction that would otherwise take millions of years to occur in milliseconds. Chemically, enzymes are like any catalyst and are not consumed in chemical reactions, nor do they alter the equilibrium of a reaction. Enzymes differ from most other catalysts by being much more specific.

"Rapid advances in nanoscale science and engineering are fueling the development of a new area in biotechnology, nanoscale enzymatic biocatalysis. Carbon nanotubes (CNT) are fascinating supports for enzyme immobilization because their specific surface area is extremely high; in addition, their high conductivity also makes them greatly useful for electrochemical applications. The overall objective of this study is to examine the use of CNT for construction of enzyme-based electrodes for electro-biochemical applications. Special focus is on the effect of CNT on reaction kinetics and mass and electron transfer processes on the enzyme electrodes. Glucose oxidase (GOx) was employed as a model enzyme for immobilization on multi-wall carbon nanotubes (MWCNT). Three difference immobilization methods were exploited to incorporate GOx onto MWCNT, including Covalent Attachment (CA), Enzyme Coating (EC) and Cross-Linked Enzyme Aggregate (CLEA). GOx-MWCNT electrodes were constructed by coating the GOx/CNT complex suspending in solution containing Nafion on carbon electrodes, including carbon felt and carbon papers. The resulted composite electrodes were and investigated for applications including biosensors and biofuel cells with respect to apparent enzyme activity, stability, and overall electrode performance. A self-made glucose biosensor system was prepared using GOx-CNT composite electrode along with 1, 4-Benzoquione (BQ) was as a mediator. The mediator was deployed to speed up the electron transfer between the reaction active sites of GOx and the surface of electrode. The sensor responses in form of electrical current with respect to changes in glucose concentration in sample solutions were monitored for electrodes prepared by using different enzyme immobilization methods, i.e., CA, EC and CLEA. That reveals the activity of GOx-CNT electrodes. Moreover, the thermal stability of the biosensor was probed under elevated temperatures, up to 50oC. It was found that CLEA provided the highest activity that gave a sensor sensitivity of 13.3 mA/M-cm2. Although all the three methods of enzyme immobilization improved significantly the stability of the enzyme, CLEA again gives the best stabilization effect. Biofuel cells were also constructed by using GOx-CNT composite electrodes. IN addition to regular lab-size biofuel cells, miniature biofuel cells of sizes (1x1 and 2x2 cm) were also prepared for potential applications in micro-scale devices. In this part of study, we examined the performance of biofuel cells in terms of output power density and potential-current (V-I) relation. The kinetics of reactions were also examined and correlated to cell performance in order to understand governing factors of the cells. The kinetics of native, CNT-immobilized and electrode-mounted GOx were examined by following changes in substrate concentration via UV spectrometry. Electrodes constructed with different support materials such as Toray carbon paper, carbon cloth and carbon felt were investigated. Both the storage and operational stability of GOx-CNT electrodes in biofuel cells were investigated. Compare to native enzymes, although all the three methods of enzyme immobilization improved the stability significantly, CLEA again gives the best stabilization effect. This study showed that mass transfer processes on the surface of the composite electrodes is the key limiting factor determining the overall electrode performance. Enzyme immobilized on CNT gave an enzyme activity that was compatible of native enzyme in solution; however, compared to electrodes With/without CNT, CNT electrodes demonstrated higher electron transfer rate was about 6 times higher. Studies on biofuel cell performance revealed that the electrode performance in terms of measured electrical current density represent only 0.6% of the reactivity the enzyme mounted on the electrodes, indicating that electric transfer and other in-cell electrical resistance is the determining factor of the fuel cells. This demonstrated that the further improvement the of biofuel cells performance could be achieved through optimal design of the cells. Of the three methods of enzyme immobilization, CLEA provided the best performance in almost all the aspects examined. It might be attributed to the micro-environment surround enzyme was enhanced by a form of multilayer coatings on the high-surface area CNT. It is expected that combined with better cell design with more efficient electrical transfer, the use of nanotubes can eventually afford highly efficient biochemical electrode for biosensing, biofuel cell or electrobiocatalytic applications."--Abstract.

Allosteric Regulatory EnzymesSpringer Science & Business Media

Two types of mutants of Clostridium acetobutylicum were isolated. The amylolytic enzyme synthesis in C. acetobutylicum BA 101 and BA 105 was amplified and catabolite de-repressed, respectively, as compared to the parental ATCC 824 strain. There was an 8.3-fold increase in total amylolytic activity when C. acetobutylicum ATCC 824 was grown in P2 medium containing starch. When this strain was grown on starch in the presence of glucose, total amylolytic activity decreased with increasing glucose concentration. Amylolytic enzyme production by C. acetobutylicum BA 101 was 1.8- and 2.5-fold higher than that of the ATCC 824 strain grown on starch or glucose, respectively. While there was no change in amylolytic activity of C. acetobutylicum BA 105 when grown on starch, this strain produced 6.5-fold more amylolytic activity on glucose relative to the wild type strain. Amylolytic activity was primarily cell-associated (cell-bound and intracellular) when C. acetobutylicum ATCC 824 was grown on glucose or maltose and primarily extracellular when it was grown on dextrin or starch. The cell-associated amylolytic enzymes of this strain were intracellular (up to 71% of total activity). When grown in starch-based P2 medium, the intracellular amylolytic activity was 90% membrane-bound and 10% cytoplasmic. The amylolytic enzymes of C. acetobutylicum BA 101 and BA 105 were primarily extracellular on all carbohydrates tested. Amylolytic enzymes purified from the culture supernatant of C. acetobutylicum ATCC 824 displayed only $alpha$-amylase activity. The molecular weight of the purified $alpha$-amylase (160-fold) was determined by SDS-PAGE to be 61 Kda. HPLC analysis of end-products of enzyme activity on various substrates indicated that the enzyme acted specifically in an endo-fashion on the $alpha$-1,4-glucosidic linkages. Enzyme activity was optimal over a pH-range of 4.5-5.0 and temperature of 55$spcirc$C, but was rapidly inactivated at higher temperatures. Addition of calcium chloride (2-5 mM) increased $alpha$-amylase activity by ca. 20%, while the addition of 19 mug/ml acarbose (a differential inhibitor of amylases) resulted in 50% inhibition. C. acetobutylicum BA 101 and BA 105 produced up to 1.8-fold higher levels of butanol than the ATCC 824 strain when grown in starch-based (60 g/1) P2 medium containing yeast extract. (Abstract shortened with permission of author.)

This volume is concerned with the enzymes of the nervous system. Cerebral enzymes form the basis of the functional brain. They are needed for the control of the energetics of the nervous system, whether it be their release or their direction; for the elaboration of transmitters and for their destruction; for the synthesis, transport, and breakdown of all metabolites of the nervous system. They are indispensable for the control of the multitude of factors that govern our thinking and our behavior. They make it possible for us to comprehend what is taking place around us and perhaps to understand what may be in store for us. Enzymes are the stuff of life, and no living cell can be without them. They are the results of many millions of years of evolution, from the time when biological membranes first came into being and were folded to produce the first cells within which the earliest enzymes were wrought. Countless changes have taken place within them, so that, now, only those enzymes exist that play specific roles in the functions of the living cells of today. Those in the nervous system possess a mUltiple role: in the creation, maintenance, and ultimate breakdown of the component cells and in enabling consciousness, perception, memory, and thought to become possible. But though life may go on forever, the enzymes that make life possible will undergo the many changes involved in the

evolutionary process.