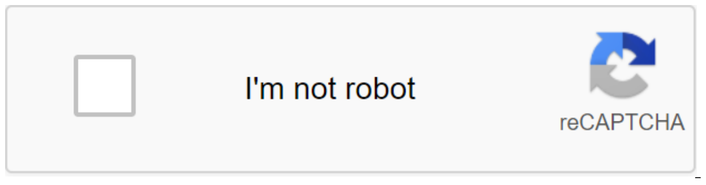
La celula libro



Continue

1. to CELL Jeffrey M. Cooper Robert E. HdUSITian fifth edition m 2. Cooper and Hausman edition OF CLULAquinta ? No. 9 Jeffrey M. Cooper and Robert E. Hausman of Boston University 3. The authors Jeffrey M. Cooper is a professor and head of the Faculty of Biology at Boston University. In 1973, he received his phD in biochemistry from the University of Miami, completed his doctoral thesis with Howard Temine at the University of Wisconsin, where he developed genetic transmission tests to detect the proviral DNA of the Sarcoma Rus virus and related retroviruses. In 1975, he enrolled in the Faculty of the Dana-Farber Cancer Institute and Harvard Medical SchooL to expand these studies to identify oncogenes in human tumors. Since arriving at Boston University in 1998, Dr. Cooper has used La Celula for his cell biology classes, also continued his research and participated in a significant expansion of biocyclion. Dr. Cooper's research focuses on understanding the protein functions of oncogenes in signaling pathways that regulate cell proliferation and planned cell death. He has published two books on cancer and more than 100 scientific articles on cell signaling and cancer. Robert E. Hausman is a professor and director (a graduate) of the Department of Biology at Boston University. He received his PhD in Biological Sciences from Northwestern University in 1971, doing a doctoral thesis with Aron Moscona at the University of Chicago, where he researched cellular interactions in the early stages of embryonic development and discovered one of the molecules of cellular adhesion. In 1978, he expanded his research on cell surface interaction in muscle development and regulation of genetic expression in the development of the nervous system through cell contact. He taught cell biology and taught special courses at Boston University. Professors Cooper and Hausman are currently teaching cell biology. His work focuses on understanding how cellular and cellular interactions, as well as between the cell and extracellular matrix, affect differentiation and morphogenesis. Cover Cover illustrates cell surface receptors, the formation of a pit with a katrina coating, cytoskelet structures, ribosomes and other components of cyto-plasma. Artist David S. Goodsell is an associate professor of molecular biology at the Scripps Research Institute. His illusory-trado books, the machines of life and our molecular nature, explore the biological molecules and the various roles they play in living cells. His new work: Bionanotechnology: Lessons represents a growing link between biology and nanotechnology. More information can be found on Spanish edition: Cell: Molecular Approach, 5th edition of Jeffrey M. Cooper and Robert E. Hausman Original Edition ISBN: 978-84-7101-811-3 (MARBEN, S.L. - Spanish edition) ISBN: 978-0-87893-300-6-2009 (ASM Press) M-31575-LII Printed in Spain. Printed in Spain 4. Content Global Cell Vision and Cell Research 3 2ngen and Cell Evolution 4 x First Cell 4 Metabolism vclution 6 Current Prokaryotes 8 Eukaryotic laules 8 1 Origin Eukaryotes 10 Itesarrollo from Multicellular Organisms 12 Cells as Experimental 1 6 Noli 16 vaduras 17 dc'iorh'b'tls degans 17 'ophile melanogaster 18 rabidopsis taliana 19 vertebrate 19 Cell Biology Tools 21 Optical Non-Cryoscopy 2 1 ' Lcroscopy 27 Cell ftraration 30 Animal Cell Growth in Culture 33 Plant Cell Cultures 34 Virus 38 KEY EXPERIMENT: Animal Cell Code 35 MOLECULAR MEDICINE: Virus and Cancer 37 Summary and Keywords 39 Issues 41 Bibliography 42 yu-rv-thru lt;7 m3 SECTION i INTRODUCTION Cellular Composition 43 Cell Molecules 43 Carbohydrates 44 Lipids 46 Nucleic Acids 50 Proteins 52 Cell Membranes 58 Membrane Lipids 60 Membrane Proteins 61 Transport through Cell Membranes 63 Proteomics : Large-scale analysis of cell proteins 65 Cell Protein Identification 66 Global Protein Arrangement Analysis 68 Protein Interactions 69 KEY EXPERIMENT: Folding Polypep Circuits 54 KEY EXPERIMENT: Cell Membrane Structure 59 Summary and Keywords 70 Issues 71 Bibliography 72 Central Role of Enzymes as Biological Catalysts 73 Enzymes Activity Catalyst 7 3 Enzyme Catalysis Mechanisms 74 Coenzymes 78 Regulation of Enzymatic Activity 79 Metabolic Energy 80 Free Energy and ATP 81 Generation ATP from Glucose 84 Energy Production from Other Organic Molecules 89 Photosynthesis 90 Biosynthesis Cellular Components 91 Carbohydrates 92 Lipids 93 Protein 94 Nucleic 97 MOLECULAR MEDICINE: FenHcetonuria 96 KEY EXPERIMENT: Antimetabolites and Chemotherapy 98 Summary and Keywords 100 Questions 101 Bibliography 101 5. 4 Basics of Molecular Biology 103 Inheritance, Genes and DNA 103 Genes and Chromosomes 104 Genes and Enzymes 105 DNA Identification as Genetic Material 107 DNA Structure 108 REPLICATion OF DNA 110 Expression of Genetic Information 111 Colinality Genes and Proteins 111 Messenger RNA Paper 112 Genetic Code 113 RNA Virus and Reverse Transcription 115 Recombinant DNA 118 Restriction Endonukles 118 Generation Recombinant RNA Molecules 120 Vectors for Recombinant DNA 121 DNA Sequencing 124 Expression of Cloned Genes 125 Detection of Nucleic Acids and Proteins 128 DNA enhancement with polymerase chain reaction 128 Nucleic acid hybridization 130 Protein Antibodies Probe 133 Eukar Gene Gene Function 136 Genetic Analysis of Yeast 136 Gene Transfer in Plants and Animals 138 Cloned Mutagenesis DNA141 Introduction of Mutations in Cell Genes 142 Intervention in Cell Gene Expression 144 KEY EXPERIMENT : DNA Provirus Hypothesis 116 KEY EXPERIMENT: RNA interference 147 Summary and keywords 148 Issues 150 Bibliography 150 ECTIONII FLOW OF GENETIC INFORMATION i- Organization and No.1 cell genome sequencing ?55 Complexity of eukaryotic genomes 155 Introns and exons 157 Repetitive DNA sequences 161 Gene duplication and pseudogenes 164 Genome composition in upper eukaryotes 165 chromosomes and chromatin 166 chromatin 166 Centromers 170 Telomeres 174 Complete Genome Sequence 175 Prokaryotic Genomes 177 Yeast Genome 178 Genomes of Cuenorhabdit Elegans, Drosophila melanogaster and other invertebrates 179 plant genomes 182 Human Genomes 184 Genomes of other vertebrates 18 bioinformatics and biology systems 191 Systematic analysis of gene function 191 Gene Expression Regulation 192 Variation between individuals and genomic Medicine 194 KEY EXPERIMENT: Discovery of Introns 158 KEY EXPERIMENT : Human Genome 186 Summary and Keywords 196 Issues 198 Bibliography 199 Replication, Maintaining and reorganizing the genomic DNA replication of DNA 201 DNA polymerase 202 Replication fork 202 Replication of Fidelity 210 Origin and the beginning of replication of 211 Telomeres and telomerase: Maintaining the chromosome ends 214 DNA repair 216 reversal of direct damaged DNA 216 Exciusion repair 219 DNA synthesis of trans trauma 226 Repair double thread 22766 66. between the approved sequences of ADD 228 4odelos recombination approved 228 ersims involved in the recombination of approved 230 'organization DNA 233' specific combination and site 234 Transposition through intermediaries go DNA240'r;rj.position through _RNA 242 Gene ventilated 245 f:; KEY: rsanization of genes :e-unoglobulins 236 ME)Molecular ICISIA: colon inoir and DNA repair insumen and keywords 247 Neuritas 249 biography 249 Synthesissynthesis and RNA. 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I'll go totipotencial 719 STO KEY: Determining the necessary for the death of Mada 696 O KEY: Cultivation : embryonic 715 - .r v key oalabras 720 22 . -Aria 722 Development and Causes of Cancer 719 Cancer Types 725 Cancer Development 727 Cancer Causes 728 Cancer Cell Properties 729 Cell Conversion 734 Tumor Viruses 735 Hepatitis B Virus and C 736 SV40 and Poliovirus 736 Papillomavirus 737 Adenovirus 738 Herpesvirus 73 8 Retro Virus 738 Oncogenes 739 Retrovirus Oncogenes 739 Proto-Oncogenes 740 Oncogenes in Human Cancer 743 Features oncogenic Products 747 Genes Their Tumor Suppressors 752 Identification of Tumor Suppressive Genes 752 Products Function Tumor Suppressor Genes 756 Rolecogens and Genes, Rolecogens and Genes suppressive tumor Tumor 759 Molecular Approaches to Cancer Treatment 761 Prevention and Early Detection 761 Molecular Diagnostics 761 Treatment 763 KEY EXPERIMENT: Discovery of Proto-Oncogenes 742 MOLECULAR MEDICINE: Imatin The cancer treatment is directed against oncogene bcr/abl 766 Summary and keywords 767 questions 770 bibliography 770 Answers to questions 773 Glossary 783 index 799 11. - This fifth edition of La Celula, retains the focus and goals that characterized previous editions, seeking to make students understand the exciting research and the basics of progress in this field of science in constant motion. In this low tra-1, the important and numerous achievements that emerged after the publication of the previous edition in 2008 were included. Progress in genomics has been particularly appealing, with new technologies that have allowed rapid sequencing of individual genomes? - including James Watson and Craig Venter - as well as identifying the genes he admits - are once again susceptible to various common diseases. In fact, we believe that these constant advances will soon lead us to the point where sequencing of the personal genome becomes viable, with a great impact on personalized medicine. Large-scale genomic analyses provide new insights into the choice of responsible genetic changes in many cancers, which may have implications for the development of new target stages and more improvements in treatments. In addition to advances in genomics, advances have emerged in epigenetics, such as figuring out epigenetic succession of centurions in higher eukaryotes, understanding the completeness of histton modification in genetic regulation, and advances in understanding the inactivation of the X chromosome of unsoded RNA. We have also come to recognize the increasingly common role of microARN in post-transcripticyclic gene regulation, not only in relation to normal cell behavior, but also in pathologies such as cancer and heart disease. Finally, the most important progress has been in the potential clinical application of stem cells, in part through the exciting discovery that adult somatic cells can be reprogrammed to act as pluripotent stem cells in crops. Since the publication of the previous edition, progress has been made in addressing some of the classic problems, such as the role of various EUkaryotic DNA-polysas in the replication fork and the mechanism of transporting proteins through the Golgi machine. We would like to present once again, not only the most up-to-date information, but also the excitement and challenges offered by research in cellular biology. At the same time, continues to be an accessible and clear text for students in their first year in cellular and molecular biology. Among the distinctive features of this book are sections of molecular medicine and key experiments that emphasize clinical application and describe fundamental research, respectively. New trials presented in this edition in key experiments include the discovery of interference RNA (demonstrating tra- 12. i - Andrew Fire and Craig Mello) and the identification of odorants receptors as large family receptors d? (emphasizing the work of Linda Buck and Richard Axel). With the experiments reviewed in the text, these essays show students -'ue produced in our field and an idea of how hypotheses are formulated and the results are inter-similar as in the previous edition, each chapter also contains several side notes to highlight areas of interest or medical significance, as well as a list of questions at the end of each chapter with their respective responses on the last pages of the book. In our quest to continue the cell's guide to experimental analysis, Mr. --- of these questions lead the student to think about experimental approaches or interpret attacks, in addition to offering a review of the material. Et. In this edition of LaC'lula, as in previous editions, our most important goal was to resr'tir illusions and exciting cell research and molecular biology. Rr-inities in our field has never been more and we hope that LaC'lula will encourage today Itoli mi I know the challenges of future research. The fifth edition of LaC'lula won even more than previous editions of nods and suggestions from critics, colleagues, teachers and students who read ror. Previous. Your special thanks to the next teachers for their advice and contribution - Dr. Felipe Kirstenbaum, Michigan State University Dr. Karen Guzman, Campbell University Dr. T. Paige Owen Jr., Connecticut College Dr. Junjun Liu, California State University, Pomona Dr. Floyd Knoop, Creighton University Dr. Jason Bush, California State University, Fresno Dr. Jean Sayle, University of Arizona Dr. Amelia Ahern-Rindell, Boston University Dr. Ullah Hansen, Boston University As always, it was a pleasure to work with Andy Sinauer and Dean Scudder of Sinauer Associates and Jeff Stmeier of ASMPress. Christopher Small and Janice Holabird played excellent -.: in the creation of this book. We are particularly pleased to thank Holabird once again for his care, patience and good humor in the production process of Jeffrey M. Cooper and Robert E. AXI Fer- 13. ^ . .x acid/1 - Organization and features - zgt; - if i The Cell is an accessible and simple text that can be treated for one semester, and also allows students to master the subject throughout the book. Many of them should take introductory courses in general biology and chemistry, but not in organic chemistry, biochemistry or molecular biology. The organization and characteristics of the book will help students to approach and understand its contents. The Cell organization is divided into four parts, each of which is independent, so you can easily change the subject or emphasize what is considered appropriate, depending on the needs of each course. The first part includes previous chapters on cell evolution, methods of studying them, cellular chemistry and the basics of modern molecular biology. For students who have a very solid basis for studying an introductory course in biology or another previous course in molecular biology, these chapters can be used for review. The second part is devoted to molecular cell biology, devoted to chapters on the organization and sequence of the genome, replication, repair and recombination of DNA, transcription and treatment of RNA, synthesis, treatment and regulation of protein. The order follows a course of genetic information (DNA - 'RNA -' protein), and provides an overview of these issues briefly, but is updated. The third part contains a central block of chapters about the structure and function of cells, including others on the nucleus, cytoplasmic organelles, cytoskellet, plasma membrane and extracellular matrix. This part of the book begins by providing the nucleus coverage, which introduces processed molecular biology into the second part into the context of the eukaryoti-ka cell, and then continues outwards through the cytoplasmic organelles and cytolet cells, to the plasma membrane and outside the cell. However, these chapters are relatively independent and can be changed depending on the needs of each course. Finally, a quarter focus on the exciting and accelerated area of cell regulation, addressing topics such as cell signaling, cell cycle, programmed cell death and stem cells. This part ends with a chapter on cancer that synthesizes the regulatory mechanisms of the main cells. * . :-c ;. • 14. Features Of various pedagogical functions have been included in LaC'lula to help students iominate their content. They are explained below as a guide for the student. Chapter iTianization. Each chapter is divided into three to five main sections, which - j vez, are divided into a similar number of subsections. Elresumen listed: the main task at the beginning of each chapter, there is a brief picture of its contents. Key and glossary terms. Key terms appear bold and red every time they are shortened in each chapter. They are repeated in the summary of the same, and their definition appears in the th delllibro alfinal losario. Micrograph. Illustration program with full color drawings and - :::?graf'as has been carefully designed as a supplement and visual reinforcement of key experiments and molecular medicine. Each chapter has two key pmmental tests or a key experiment and test in molecular medicine. These features- rv3 are designed to provide the student as knowledge on an experimental basis :- :- e:ula, as well as molecular biology and its application to modern medicine, we use these essays as a useful basis for discussing the sections of the student that can accompany with the study of the original article on which the notes are experiments are based. In each chapter you can find a few notes that briefly highlight Nrer's points related to the material covered in the text. They are an addition to the text and encourage discussion in the classroom. 7'r_nen of chapters. They are organized as a diagram where the main i:res and subsections of each chapter appear. Is this format section by section complemented by i!? list of the key terms entered in each of them, becoming a con-K, but an exhaustive overview. r-reuntas and answers. A wide range of questions was developed at the end of each with their own answers at the end of the book) to facilitate the review of the material presented in the chapter, and encourage students to use it to predict or interpret the results of experimen-K.. Bibliographic rerenations. An extensive list of bibliographic references at the end of chapters that allow access to both research and individual articles from primary schools. Primary studies and articles differ from R and P respectively. Zr_: these are web pages. New icons located on the margins lead the student to know the animations, videos, games, problems and other research materials that are found- hare. T. E. HAUSMAN 15. www.sinauer.com/cooper5e of heavy chain genes in the development of B-cells, placenta-specific recombination unites the gene areas of heavy immunoglobulm chains, which leads to the production of unique heavy immunoglobuline chains. ANISIA 1.1 Fractional Cell Part 30 2.1 - Link Formation 43 2.2 - Passive Transport 64 3.1 - Catalysts and Energy Activation 74 3.2 - Enzyme cat reaction 75 3.3 - Glycolysis 84 3.4 - Cytic acid 86 3.5 - Calvin Elchik 92 4.1 - Avery, MacLeod and McCarthy 107 4.2 - Bacterial Transformation 108 4.3 - Central Dogma 113 4.4 - Mutations ADD 114 4.5 - Reproduction VIH 116 4.6 118 4.7 - ADD Molecules, recombinant 120 4.8 - DNA strand sequencing125 4.9 - Polymerase chain reaction 128 4.10 - hybridization of nucleic deacids 130 4.11 - southern blot 131 4.12 4.13 Monoclonal antibodies 13 5.1 - Chromatin and chromosomes 166 6.1 - REPLICAN fork THEADN 209 6.2 - Recombination approved 229 6.3 . . . . . .

. . . . He said that I was the one who was the one who was the one who was the one who was not He said , he said, he said, he said, he said, he said, he said. . . . . The opposite direction of the secretion of RE 390 proteins throughout the book you will find in the margins of these small tables that refer to the various web animations that relate to the topic discussed by PAG. ANIMATION 10.21 11.1 11.21 12.1 litre 12.2 12.31 12.4! 13.1 13.21 13.31 13.4 14.1 l 15.1 15.2 15.31 16.1 1 6 1 16.3 16.4 16.5 16.6 16.7 16.8 16.9 16.10 17.17 1 17 .2 18.1 18.2 i Organization Golgi 409 From prolate to chloroplast 459 Light Reactions 461 l Assembling Actide Thread 47 4 A thin thread 491 Microtubulum assembly 506 i kinezin 511 Chemical synopsis 547 sodium potassium pump 553 liters of endoctosis 558 Inv. and bubbles coated with the synthesis of clatrin 558 cellulose during the lengthening of 576 - Signaling with secret molecules 605 - Transduction signal 615 - Signal Amplification 623 - Cell Cycle Phases 654 - Embryonic Cell Cycles 655 - Cell Cycle Checkpoints 658 - Cyclins, Cdk and Cell Cycle 665 - Cell Cell Cycle 655 - Cell Cycle Control - Cytokinesenlasplants top 680 - Mayosis 682 - Comparison of meyosis I and mitosis 682 - Profase I meiosis 683 - Formation of the polar body 684 - Apoptosis 694 apoptosis 701 - Metastases of cancer 730 - Dependent on density inhibition 730 16. SECTION Introduction: -- -.? o 7 - Global Cell Vision and Cell Research Chapter 2 m Composition of CAPITULO 3 m Cell Metabolism Chapter 4 m Basics of Molecular Biology 17. YOUR GLOBAL Cellular Vision and Cell Research and Evolution 4 as 16% ntos Biology 27 - 3KTJ-KEY ENTO: :::-..: Animals 35 and 9EHOHA MOLECULAR: . :;-:; 37 MOLECULAR BIOLOGY OF CELLS is an active research field whose understanding is fundamental to all life sciences. This applies not only to the starting point of basic sciences, but also to the growing number of practical applications in agriculture, biotechnology and biomedical engineering. Especially after the complete sequence of the human genome, the progress of cellular and molecular biology opens up new horizons in medical practice. Examples include the identification of genes that affect individual rheumatoid arthritis and diabetes; Development of new drugs specifically designed to interfere with the growth of cancer cells and the potential use of maternal cells to replace damaged tissue and treat patients with diseases such as diabetes, par-kins disease, Alzheimer's disease and spinal cord injuries. Since cellular and molecular biology is a rapidly growing field of research, this chapter will focus on how cells are studied as well as serve to consider their underlying properties. Assessing the similarities and differences between cells is especially important for understanding cell biology. Therefore, the first section of this chapter will discuss the unity and diversity of cells present today in terms of their evolution from common ancestor. In addition, all cells have fundamental properties that have been preserved in the course of evolution. For example, all cells use DNA as a genetic material, are surrounded by a plasma-ca membrane, and use the same basic mechanisms for energy metabolism. On the other hand, the current cells have become a different way of life. Many organisms, such as bacteria, amoeba and yeast, are made up of unique cells that can reproduce independently. The most complex organisms consist of a collection of cells that work in a coordinated manner, with various special cells to develop specific functions. The human body, for example, consists of more than 200 different cell types, each specializing in distinctive functions such as memory, vision, movement or digestion. The variety shown by different cell types is amazing; for example, consider the differences between bacteria and cells in the human brain. 18. Section I - Introducing a fundamental similarity between different cell types provides a common basis for cell biology, allowing for extrapolation and common basic principles extracted from experiments with one type of dt cell, and the generalization of other cell types. Different types of cells and organisms are widely used to study different aspects of cellular and molecular biology; The second section of this chapter reveals some of the properties of these cells that make them particularly valuable as experimental models. Finally, it is important to recognize that the progress of cellular biology also hangs on experimental instruments that allow scientists to make new observations or develop new experiments. Thus, this chapter concludes with an exhibition of some of the experiments used to study cells, while summing up some that led to our current knowledge of the cell's structure and function. The origin and evolution of cell cells are divided into two main classes, initially determined according to or correctly by the nucleus. Prokaryote cells (bacteria) do not have nuclear packaging; Eukaryotic cells have a nucleus where the genetic elma-terial is separated from the cytoplasm. Prokaryotic cells are geologically smaller and simpler than eukaryotic cells; in addition to the absence of a nucleus, its genomes are less complex and do not contain cytoplasmic organelles (table 1.1). Aside from these differences, isn't it? the same basic molecular mechanisms control the life of prokario-tas and eukaryotes, which indicates that all the cells present today come from a unique primitive ancestor. How did the first cell develop? 1 How did the complexity and diversity developed, demonstrated by today's cells? The first cell appeared at least 3.8 billion years ago, about 750 million years after the earth was formed. How life originated and how the first cell became a creature are speculation issues, since these events cannot be replicated in the laboratory. However, different types of experiments have provided important evidence for some stages of the process. In 1920, it was first suggested that simple organic molecules could spontaneously polymerize and form macromolecules under con-tions, which are thought to exist in a primitive atmosphere. In the movement in which life originated, the Earth's atmosphere is thought to contain little or no free oxygen consisting mainly of CO_2 and N_2 in addition to a small amount of gases such as H_2/H_2S and CO. Талатмес- Таблица i.l Прокариотические клетки и эукариоты Характеристики Диаметр ядра типичных органелл содержания ДНК клеток (базовые пары) Отсутствующие прокариотические хромосомы 1 (им Отсутствует 1 x 1 0 от 5 x 10' Круговая молекула ДНК Eukaryote Настоящее время 10-100 им Настоящее 1,5 x 107 до 5 x 10' Несколько линейных молекул ДНК 19. Глобальное клеточное зрение и исследования клеток ' Спонтанное образование органических молекул. Вода elvapor i в атмосферу, состоящую из CH_4, NH_3 и H_2, в котором я искры электричества. Анализ реакционной продукции :росмации различных органических молекул, в том числе аминокислот. аспарагин индо, глутамовая кислота и глицин. он имеет условия, в которых органические молекулы, ток энергии, такие как солнечный свет или электрическим током, могут быть спонтанно в состоянии. Спонтанное образование молекул - ru' продемонстрировали впервые экспериментально в годы я Стэнли Миллер (аспирант в то время) из-- играя разряда электрических искр в смеси H_2 , CH_4 and the presence of water, led to including several amino acids (Figure 1.1). Although Miller's former did not accurately reproduce the primitive conditions of the A. clearly demonstrated the plausibility of spontaneous synthesis organic Klychulas, providing basic materials from ; the first living organisms were born. The step in evolution was the formation of macromoleque-demonstrated that the monomeric blocks that make up das are spontaneously polymerized in plausible conditions prebio- f. Heating dry amino acid mixtures, by or. leads to polymerization to form polypeptides. : the fundamental feature of macromolecule, from which ? have the ability to replicate themselves. Only ma-ila, able to lead the synthesis of new copies of itself, will be; multiply and develop. The two main classes of macromolecules that provide current rslul information (nucleic acids and proteins), the only nuclei acid - th are able to direct their own replication. Nucleic acids can be used as a form for their own synthesis as a result of mat-qgt; specific bases between additional nucleotides (Figure 1.2). ; critical steps in the study of molecular evolution in the 1980s, when it was discovered in laboratories i and Tom Cech that RNA is able to catalyze numerous chemical reactions, including nucleotide polymerization. RNA is, or, only one, capable of serving as mold and catalyzing its own replica - Heat Organic Molecule Alanin Aspartic acid Glutamic acid glycin urea lactic acid acetic acid Formic Acid 2 Self-producing RNA. Additional pairs between ;-:-d os (adenine (A) with urazil (U) and guanine (G) with cytosine (C)) - ::ue strand of RNA serves as a form for the synthesis of the new TI additional sequence. Section I and Introduction. As a result, RNA is believed to have been the original genetic system, and that early stage of chemical evolution was founded by RNA molecules with their own replication-period evolution and nocided as the world of RNA. The interactions in order between the zlt; and amino acids evolved into what is now a genetic code, and eventually DNA replaced RNA as a genetic material. It is assumed that the first cell originated as a result of the wrap of the RNA itself reuse in the membrane consisting of phospholipids (Figure 1.3). As will be explained in detail in the next chapter, phospholipids are the main components of all the biological membranes I have presented today, including the plasma membrane of prokaryotic cells and euca rhymes. The characteristic of phospholipids, which make up the membranes, is that they are antipathic molecules, which means that one part of the molecule is soluble in water and the other part is not. Phospholipids have long hydrocarbon chains Water (hydrophobic) together; water-soluble (hydrophilic) groups containing phosphates. When in contact with water, phosphates are spontaneously grouped into a brum for groups containing phosphates on the outside in contact with the water and its hydrocarbon tails inside in contact with each other. This phospholipid bicap forms a stable barrier between two akuosk compartments - for example, separating the inner cell from its external environment. The packaging of self-replicating RNA and molecules associated with?, the lipid membrane, therefore, remained as a unit, a layer of reproduction itself and develops. The synthesis of protein from RNA may have already evolved, in which case the first cell will contain its own RNA replication and encoded proteins. Evolution of Metabolism Because cells originated in a sea of organic molecules, they were able to get food and energy directly from the environment. But the situation, as it is limited in itself, is so RNA Membrane dephospholipid phosphate molecule: Figure 1.3 Coverage of the SELF-regulating RPNC with the phospholipid membrane. It is believed that the first cell originated from the coating of self-replicating RNA and its molecules associated with a membrane consisting of phospholipids. Each phospholipid molecule has two long hydrophobic tails attached to the hydrophilic group. Hydrophobic-seeded tails embedded in the lipid beep; hydrophilic heads are exposed to water on both sides of the membrane. 21. Global cell vision and cell research are needed to develop their own creation mechanisms -curling molecules needed for replication. Creation - . r-i: ::6n controlled metabolic energy is the primary for all i.a.is it is cellular, and the basic processes of energy metabolism- Kanalized in detail in Chapter 3) have been preserved virtually in-er. current cells. All cells use adenosine 5'-triphos::no source of metabolic energy for synthesis - : ::::cell helating and other activities that require T-J : rr.o movement (e.g. muscle contraction). Losmecanis - T-cells for THEF generation turned into three - - - - in response to the evolution of glycolysis, photosynthesis and meta-avebal (Figure 1.4). The development of these metabolic processes jarar..; The Earth's atmosphere, thus altering the course of the Earth's original anaerobic atmosphere, the first ge-i - _J and energy reactions, presumably related to the excision of molecules. - . - in the absence of oxygen. These reactions appear to be the current ba form of glycolysis - anaerobic rupture of lactic acid glucose, with . -- :_-::?. pure energy from two ATP molecules. In addition to using it as an intracellular chemical energy source, all act-evan of glycolysis, according to the idea that these reactions. In : very soon inevolution. Ли психолиз обеспечивал механизм, с помощью которого энергия в уже сформированных органических эолиях (например. глюкоза) может стать р-кием, который можно было бы использовать в качестве источника энергии для прямых других реакций... ... . The development of photosynthesis was the next most important step of evolution, which allowed the cell to generate energy at r from sunlight and be independent of the use of existing molecules. The first photosynthetic bacterium that evolved x over 3 trillion years probably used H_2S to convert IV ER. organic molecules - some bacteria still use similar -rc.-;:ntesis process. Using H_2O as a donor of GScolysis electrons 2C3H603 s -i:sa Lactic acid cystesis i:C-- 6H20 s C6H1 206 y 602 Glucose oxidative uetabolism C-H12O6 6 O2 s 6 CO2 and 6 H2O 3 -Figure 1.4 Glycolysis is an anaerobic rupture of the lactic acid mucosa. Photosynthesis uses sun energy to conduct a glucose thesis from CO_2 and H_2O, releasing O_2 as a product. '. CX released by photosynthesis is used by oxidative metabolism, in which glucose is broken down into CO_2 and H_2O, releasing much more energy than the resulting ij± _í slycolysis. 22. Title I - Introduction - The existence of organisms in extreme conditions has led to the hypothesis that life may exist in sy-lar environments in other parts of the solar system. The field of astrobiology (or exobiology) seeks to find signs of this extraterrestrial life. hydrogen to convert CO_2 into organic compounds later evolved and had an important effect of changing the Earth's atmosphere. The use of H_2O in photosynthetic reactions produces free O_2; it is believed that this mechanism was responsible for making the Tie-rra atmosphere so abundant in the O_2. The release of O_2 as a result of photosynthesis changed the extent to which the cells evolved, and is believed to have determined the development of oxidative metabolism. In addition, oxidative metabolism could develop prior to photosynthesis, and an increase in atmospheric O_2 would provide a significant selective advantage for organisms capable of using O_2 in energy production reactions. In any case, O_2 is a highly reactive molecule, and the metabolism of o:-dative, using this reactivity, has provided a mechanism for generating energy from much more efficient organic molecules than glycolysis. For example, a complete oxidative rupture of swallows in CO_2 and H_2O produces energy equivalent to 36 or 38 ATP molecules. compared to the two ATP molecules that form in anaerobic glycolysis (see figure 1.4). With a few exceptions, cell cell oxyative reactions as the main source of energy. Modern Prokaryotes Today prokaryotes, which include all kinds of bacteria, are designed into two groups - archabacteria and eubacteria, which differed at the beginning of evolution. Some archabatteria live in extreme conditions, which today are unusual, but may be pre-ed on early Earth. For example, thermoacidophiles live in hot sulphide pots with temperatures of up to 80oC and pH values of 2. Eubacteria include the common forms that are present today - a large group of organisms living in a wide range of environments, such as earth, water and other organisms (e.g. human pathogens). Most bacterial cells are spherical, cane-shaped, or spiral, with diameters of 1 to 10p.m. Its DNA content ranges from 0.6 million to 5 million base pairs, enough to encode about 5,000 different proteins. The largest and most complex prokaryotes are cyanobacteria, bacteria in which photo synthesis has evolved. The typical structure of prokaryote cells is the structure of E. coli, a common inhabitant of the human gastrointestinal tract (Figure 1.5). The cell has a cane shape, about 1st it is in diameter and about 2'im longi-tud. Like most other prokaryotes, E. coli is surrounded by a rigid bacterial cell wall consisting of polysaccharides and peptides. Inside the cell wall is a plasma membrane that is a bipa of phospholipids and related proteins. While the ce-lular wall is porous and can be riddled with different molecules, the plasma membrane provides a functional separation between the cell's inte-rior and its external environment. Dna. E. coli is a unique round molecule in the nucleoid, which, compared to the nucleus of eukaryotes, is not surrounded by a membrane separated from cytopla-ma. Cytoplasm contains about 30,000 ribosomes (a place of protein synthesis) that stand out for their granular appearance. Eukaryotic cells, like prokaryotic cells, all eukaryotic cells are surrounded by plasma membranes and contain ribosomes. However, eukaryotic kells are much more complex and contain a nucleus, a variety of 23. Global Cell Vision and Cell Research 1.5 E.cali Micrography. The cell is surrounded by a cell inside which is a plasma membrane. DNA will go into the nucleoid. (Menge and Wurz/Biosentrum, University of Science Photobibometheteics/Photos, Inc.). cytoplasmic inulos and cytoskkelet (Figure 1.6). The most visible organella of eukaryotic cells is the nucleus with one metre 5'0, m. The nucleus contains genetic information about the cell in eukaryotes organized instead of circular DNA leculs. The nucleus is a place of RNA synthesis and replication; The transfer of RNA into proteins has lu-se ribosomes of cytoplasm. In addition to the nucleus, eukaryotic cells contain various membrane-delimitated zeros in the cytoplasm. They provide a variety of compartments in which the estuary is located metabolic activity. Thus, eukaryotic cells are larger than prokaryotic cells, often zr.in cells a hundred times larger. Disunization ensures the cytoplasmic organelle is what allows eucario-nmation of cells to be effective. Two of these organelles, mitochondria and iplastics, play an important role in energy metabolism. :r::ochondrias, which are found in almost all eukaryotic cells, are among the inductees of oxidative metabolism and are therefore responsible for the erar of most ATP derived from the rupture of organic molecules, lyerorplasts are the centers where photosynthesis is performed and en trance exclusively in plant cells and green algae. Soma and peroxysoma also provide specialized meta-cos compartments for the digestion of macromolecules and various oxidative reactions, respectively. In addition, most tire cells contain large vacuoles that develop a variety of functions, including the digestion of macromolecules and the production of waste and nutrients. Drunk in the size and complexity of eukaryotic cells, transporting the Oleinas to their destination in a cage is a huge task. Two cytoplasmic zr.ulos, endoplasmic reticulum and Gol apparatus - specifically designed to differentiate and transport healthy, designed for secretion, for inclusion in plasma membrane, inclusion in lysosomes. Endoplasmic cytolulum is a vast network of intracellular membranes stretching from the nuclear frog to the entire cytoplasm. It acts not only in CESO transporting proteins, but also in lipid enlasynthesis. i.e. reticulendoplasmatic, the proteins are transported inside the baby bubbles to the Golgi apparatus, where they are still processed and inginged for transportation to their final destinations. In addition to this fun, i.e. transporting proteins, the Golgi apparatus represents the synthesis of plant lipid cells) the synthesis of some polysaccharides that eat the cell wall. :eukaryotic lulas have another level of internal organization: elcitoes - oeieto. The network of protein strands that extend through the cytoples --oskeleton provides the structural basis of the cell, determi-io cell shape and general organization of the cytoplasm. In addition, the ascelet is responsible for the movements of all cells (e.g. ccntraction of muscle cells), intracellular transport and po- organelles and other structures, including wasp movement during cell division. Nucleoid 0.5 nm 24. Title I - Introduction of 10 Animal Cell Peroxisome Centn'olo Rough Endoplasmic Plasma Membrane Golgi Lisosoma Citoesqueie Ribosomas Apparatus Figure 1.6 Structures of animal cells and plants. Animal and plant cells are surrounded by a plasma membrane and contain a nucleus, a cytoskelet and many common cytoplasmic organelles. Plant cells are also surrounded by a cell wall and contain chloroplasts and large vacuoles. The origin of eukaryotes a critical step in the evolution of eukaryotic cells was the acquisition of subcellular organelles encased in membranes, allowing the development of the complexity characteristic of these cells. Eukaryotic organelles are thought to have arisen due to ingosbiosis - one cell seen-seeing inside another. Specifically, eucariotic organelles are thought to have evolved from prokaryotic cells that lived in the ancestors of eukaryotes. The hypothesis that eukaryotic cells have evolved endosymbio-sis is particularly well supported by studies of mitochondria and chloroplasts, which are believed to have evolved from bacteria living in larger cells. Mitochondria and chloroplasts are similar in size to bacteria and, like them, multiply through their bipartite excision. Most importantly, the mitochondria and chloro-layers contain their own DNA, which encodes some of their components. The DNA of mitochondria and chloroplasts is replicated every time the organel is separated, and the genes it contains are transcribes inside the organella and transferred to organella ribosomes. Therefore, mitochondria and chloroplasts contain their own genetic systems, which differ from the nuclear genome of cells. In addition, the ribosomes and ribosomes of these organelles are more associated with tank-terians than those encoded by the nuclear genomes of euca rebels. 25. 11 Global Cell Vision and Cell Research of Mitochondria Endoplasmic Reticlasmic Reticulamic Carpet Nucl'olo Nucleus Golgi igeneral plasma membrane, endibobiotic origin of these organelles has been adopted, the qgt; which mitochondria have evolved from zgt; eubacteria and chloroplastic photosynthetic ebacteria. Bacteri aerobics can come from c'lu-i with the possibility of oxidative metabolism. I photosynthetic bacteria can come from the independence achieved by developing photosynthesis. Thus, these eriosymbiotic associations have been very useful for their partners who have chosen in the course of evolution. Over time, ma-genes in these bacteria by appearance r. 2 are included in the nuclear cell genome, so that only K aLsunos components of mitochondria and chloroplasts continue to be found in organelle genomes. Accurate eukaryotic cells remain an unopian theme in our understanding of early evolution. The loss of DNA amenium indicates that archiobacteria and eubacteria are larger than each other, as each of them is from modern eukaryotes. ? both, a very early event in evolution, seem to have been --. with two descending lines from the ancestor prokaryo-rr.---.r., which generates current archeobacteria and eubacteria. Without: :d difficult to determine if some eukaryotes evolve and Je eubacteriao from archeobacteria. Surprisingly, al-- - - - - of rutariums are more like eubacterial genes, while some current marine proteas cover algae to serve as endosimbiots that conduct photosynthesis for their hosts. 26. Title I - Introduction 12 Figure 1.7 Cell Evolution. Modern cells evolved from a common ancestor of prokaryote to three long lines of offspring, leading to archeobacteria and eubacteria. Eukaryotic cells may have arisen as a result of the enneobiotic association of aerobic eubacteria with archeobacteria, which led to the development of mitochondria in addition to the formation of an eukaryotic genome with genes derived from both eubacteria and archeobacteria. Chloroplasts subsequently evolved as a result of enosi symbiotic communication of cyanobacteria with the ancestor of plants. The model of the formation of the first eukaryotic cell is based on M. C. Rivera and J. A. Lake,2004. Naure431:152. others are more similar to archoeacterial genes. Thus, the genome of eukaryotic loes consists of some genes derived from eubacteria v from others from archeobacteria, instead of reflecting the genome of an eubacterial or archobacterial ancestor. Surprisingly, may ria eukaryotic genes associated with information processes (such as DNA replication, transcription and protein synthesis, comes from archeobacteria, while most eukaryotic genes associated with the main processes of cell function (such as glycolysis and amino acid biosynthesis) comes from eubacteria. , enosi symbiotic link between eubacteria and archeobacteria was accompanied by the fusion of two prokaryotic genomes, which led to an eucariotic anti-anti-alternative genome with the contribution of both eubacteria and archeobacteria. The simplest version The hypo-thesis is that the initial enosi symbiotic relationships of the eubiotic eubiotic eubiotic relationships that lived inside the archeobacteria gave rise not only to mitochondria, but also to the genome of eukaryotic cells containing the deri-vadostic genes of both prokaryotic ancestors. The development of multicellular organisms Many eukaryotes are single-celled organisms that, like bacteria, are made up of unique cells capable of their own replication. The simplest eucario-tas are yeast. Lifts are more complex than bacteria, but much smaller and simpler than animal cells or 27. Global Cell Vision and Cell Research 1.8 Electronic Radical Micrograph Saccharomyces cerev'siae. Artificial color spelling. (©Medical-on-Line/Alamy.) sets. For example, the most studied yeast, The Sahara-Cfrevisiae, has a diameter of about 6o,m and contains 12 million rare DNA bases (Figure 1.8). However, other eukaryotes unicelu- ESson cells are much more complex, some contain both DNA and ;e contain human cells. These include special organisms - Dawn develop a wide range of functions, including photosynth-movement and capture and intake of other organisms such as food. Amoeba proteus, for example, is a large, complex cell. It is 100,000 times larger than E. coli, and its length can be so-;r?sar 1 mm when the cell is completely enlarged (Figure 1.9). amebas are very mobile organisms that use cytople extensions-Cis. called pseudopodia or pseudopods to move and wrap I nanismos, including bacteria and yeast, as food. Other single-cell notes (green algae) contain chloroplasts and are layered and carry out photosynthesis. Multicellular organisms evolved from unicelu-e eukaryotes over 1 billion years ago. Some multicellular aggregated single-celled eukaryotes appear to represent a willual transition from a single cell to a multicellular organism. For example, many algae (such as Volvox green algae) flowed along with i to form multicellular colonies (Figure 1.10), which are believed to be ?' evolutionary precursors of current plants. The increase in cellular fation has determined the transition from colonies attached to inderos multicellular organisms. Continuous specialization and di-n functions among the body's cells has ensured T-rlejity and diversity is observed in many types of cells that put today's plants and animals, including humans. B plants consist of fewer cell types than animals, 5 different types of plant cells specialize in specific events required by the body as a whole lid. Plant cells are organized into three tissue systems: basal tissues, skin tissues and vascular tissue. Basal tissue jans on parenchima, which carries out most of the plant's metabolic aons, including photosynthesis. The ba-tsbian tissue contains two types of specialized cells (knee-v cells of sclerenchima cells) that are characterized by cell walls - 0.2 mm Figure 1.9 Optical micrography Amoeba proteus. (M. I. Walker/Photo Researchers, Inc.) Figure 1.10 Colonial Green Algae. Individual Volvox cells form colonies consisting of hollow spheres in which hundreds or thousands of cells are embedded in the gelatinous mass. (Cabisco/Visuals Unlimited.) 28. Title I - Introduction 14 Figure 1.11 Optical Micrographs of Representative Plant Cells. (A) Parenchem cells responsible for photosynthesis and other metabolic reactions. (B) Coenchem cells specializing in cell wall support and hardening. (C) Epidermal cells on the surface of the sheet. Small pores (stomat) are surrounded by specialized cells called guard cells. (D) I don't want to. Vascular and tracheida elements are elongated cells that are set together to form xylem vessels. (A, Jack M. Bastsak / Visual Unlimited; BA 1. Karpoff/Visual Effects Unlimited; C, Alfred Ovcharzak/ Biological Photo Service; D, Biophoto Associates/Science Source/Photo Researchers Inc.) (A) 50 nm thick and to provide structural support to the plant. Skin tissue covers the surface of the plant and consists of epi-dermal cells, which form a protective coating and allow the absorption of nutrients. Finally, the vascular system (xima and flam) consists of different types of elongated cells and is responsible for transporting water and nutrients through the plant. Cells present in animals are much more diverse than plant cells. The human body, for example, is made up of more than 200 different cell types, usually seen as components of five main tissue types: epithelial tissue, connective tissue, blood, nerve tissue and muscle tissue (Figure 1.12). Epithelial cells form sheets that cover the surface of the body and delimit internal organs. There are many different types of cells, each specializing in specific functions, including protection (skin), absorption (e.g. small intestine cells) and secretion (e.g. salivary gland cells). Connective tissue includes bones, cartilage and fat tissue, each formed by different cell types (osteoblasts, chondrocytes and adipocytes, respectively). Free connective tissue, delimit epithelial layers and filling gaps between organs and tissues of the body, is formed by other types of cells, fibroblasts. Blood contains different types of cells: red blood cells (erythrocytes) work in transport and white gli-bulo (granulocytes, monocytes, macrophages and lymphocytes) functioned in inflammatory responses and in the immune response. Nervous tissue is made up of nerve cells, or neurons, that specialize in transmitting signals through the body. Several types 29. Global cell vision and research of sensory cells, such as eye and ear cells, are even more important in getting environmental signals. Finally, different muscle eloles are responsible for the production of strength, and animal sleep clearly involves the development of a significant specialization at the cellular level. Understanding Mecca - the olan growth and differentiation of these specialized V cells, from fertilization of a single egg, is one of the problems of modern cellular and molecular biology. (A)i Gall duct : Optical micrographs of representative rhythms. (A) Mouth ekala (fat-stratified), libar and intestines. (B) - n tissue cells are unreformed by their long form. (C) Erytrocytes, :s? iinfocytes and monocytes in nana. (A)i and (A)ii, G. W. su-l'nliniited; (A) iii, Associates / Photo:B, DonW. Unlimited; C, 5,000. (C) Red blood cell Granulocyte Monolith 30. Title I - Introduction 16 Table 1.2 DNA Content in Cells Dna Body Number (Millions of Base Pairs) Genes Bacteria Mycoplasma E. stick single-celled eukaryotes Saccharormjces cerevisiae (yeast) Diktiostelium discoideum Euglena Plants Arabidopss Taliaa May (corn) animals Caenorhabdit elegan Drosophila melanogaster (fruit fly) Chicken zebrafish Human mouse 0.6 4.6 12 70 300 1255,00 97 x180 1200 1700 3000 3000 470 4300 6000 Unknown Unknown 26000 Unknown 19000 14000 20-23000 20-25000 20-25000 20-25000 cells as experimental models The evolution of current cells from their common ancestor has important implications for cellular and molecular biology, as an experimental science. Since the fundamental properties of all cells have been preserved during evolution, the basic principles derived from experiments developed with one cell type are specifically applicable to other cells. Also, because of the diversity of current cells, many of the experiments are easier to perform with one type of cell rather than the other. Different types of cells and organisms are used as experimental models to study different aspects of cellular and molecular biology. Characteristics of some of these cells that are particularly beneficial as experi-mental patterns are discussed in the following sections. In many cases, the presence of complete genomic sequences increases the value of these organisms as model systems for understanding cell biology. Due to the simplicity of their comparison, prokaryotic cells (bacte-rias) are ideal models for studying the fundamental aspects of molecular biology and biochemistry. The most rated type of bacteria is E. coli, which has been the body's predominantly study of the basic mechanisms of molecular genetics. Most of today's conditions of molecular biology, including our understanding of DNA replication, genetic code, gene expression and protein synthesis, stem from studies of this humble bacterium. E. coli has been particularly useful for molecular biologists because of their relative simplicity and ease of distribution and is studied in the laboratory. For example, the E.coli genome consists of approximately 4.6 million base pairs and contains about 4,300 genes. The human genome is almost a thousand times larger (approximately 3 trillion basic pairs) and is believed to contain between 20,000 and 25,000 genes (see. Ta- bla 1.2). The small size of the E. coli genome (which was completely sequered in 1997) provides clear benefits for genetic testing. Molecular genetic experiments are facilitated by the rapid growth of E.coli in pre-defined laboratory conditions. Under optimal growing conditions, E. coli is divided every 20 minutes. In addition, the E. coli clone population, in which all cells are derived from the division of a single original cell, can be easily isolated as a growing colony in an environment containing semi-solid agar (Figure 1.13). Because bacterial colonies containing more than 108 cells can develop overnight, choosing genetic variants of the E. coli strain - such as mutants that are once again resistant to antibiotics such as penicili-on - is quick and easy. The ease with which these mutants can be selected and 31. t7 The general vision of cells and cell research were the key to the success of the experiments defining the basic xypios of molecular genetics discussed in Chapter 4. nutritional compounds in which E.coli is more quickly divided, including glucose, salts and various organic compounds such as amino acids, girls and precursors of nucleic acid. However, E. coli also grows in a much simpler environment containing only salt, and a source of nitrogen (e.g. ammonia), and a source of carbon and energy; (omo glucose). In this environment, the bacterium grows a little slower ::empo division for about 40 minutes), as it must synthesize - amino acids, nucleotides and other organic compounds. The xabi-i.e. E.coli feet performing these biosynthetic reactions in half a foot made it extremely useful for discovering the biochemical ce-app involved. So growth and nutritional needs of E. coli contributed to amental experiments in molecular biology and biochemistry. Laaduras acue lasbacteria have been a model of invaluable value for studying many of the surviving properties of cells, these obvious-ce can not be used to study aspects of cell structure and oon that are unique to eukaryotes. Yeast, a simple eukario-r, provides numerous experimental benefits similar to E. coli. As a result, yeast provided a digi model to explore many fundamental aspects of bio- ; :-__-.; Eucar eukaryote. The genome of yeast, which was most commonly studied, Sac-s::---cerevisiae, consists of 12 million pairs of DNA bases and jans about 6,000 genes. Although the yeast genome - especially three times larger than E. coli, it is more manageable ie'enomas de eukaryotes more complex as in humans. In its simplicity, the yeast cell has the characteristics of eukaryotic cells (Figure 1.14): It contains a separate nucleus surrounded by the nuclear membrane ana, its genomic DNA is organized in 16 linear regions, and its cytopplasma contains cytopcelleton and organelles - era. T-. They can easily grow in the lab and can be snrated under many of the same molecular-genetic protocols that have been satisfactory with E. coli. Although yeast does not re-F. as fast as bacteria, they divide every 2 hours and can easily grow as a result of colonies from a single cell. You can use a variety of genetic manipulations that can be performed with the help of bacteria. these characteristics have made yeast eukaryotic cells more than a month in terms of molecular biology. Yeast has previously been important for understanding many processes in eukaryotes, including DNA replication, trans-on, RNA processing, protein assembly, and cell regulation, as discussed in the following chapters. A little bit of molecular cellular biology is clear, due to the fact that. The general principles shown by cellular structure and function, or yeast studies can be applied to all cells of euca-cmsoorhabditis elegans I single-cell yeast are important models for studying r---?. eukaryotes, but understand the development of multicellular organisms - figure 1.13 Colonies of bacteria. Photo Colonies of E. coli growing on the surface of the agar. (A. M. Siegelman/Visuals Unlimited.) Figure 1.14 Electronic micrograph Saccharomyces cerevisiae. (David Scharf/Peter Arnold, Inc.) 32. Section I - Introduction Figure 1.15 Caenorhabditis elegans. (From J.E. Sulston and H. R. Horwitz,1977. Dev. Biol. 56:110.) Figure 1.16 Drosophila (Photo by David McLair.) requires experimental analysis of plants and animals, organisms that are much more complex. The Nematode Caenorhabditis elegans (Fi 1.15) has several notable characteristics that make it one of the most widely used models in animal development research and cell differentiation. Although the C. elegans genome (approximately 100 million basic pas-ress) is larger than single-celled eukaryotes, it is simpler and mis-driven than the genomes of most animals. Its sequence was fully defined, showing that the C.elegans con gene has approximately 19,000 genes - about three times as many yeast genes as it is, and one-fifth of the number of prev:-bles genes in humans. Biologically, C. elegans is also a relatively simple multicellular organisrr: Adult worms are only covered with 959 somatic cells, and 1,000 to 2,000 germ cells. Ade-plus, C.elegans can be easily reproduced and subjected to genetic pulsations in the lab. The simplicity of C.elegans allowed us to study in detail the course of its development with the help of microscopic observations. These anali sisters successfully traced the embryonic origin and pedigree of all cells of the adult worm. Genetic studies have also identified some mutations responsible for developmental abnormalities that have led to the isolation and description of key genes that con-l troll development and nematode differentiation. It should be noted that sJ found similar genes that work in complex animals (including humans), making C. elegans an important model for animal development research. Drosophila melanogaster Like C. elegans, fruit fly Drosophila melanogaster (FijJ 1.16) was the most important model of the organism in the biology of development! Drosophila's genome consists of 180 million base pairs, more than I C. elegans, but the Drosophila genome contains only about 14,000 genes. In addition, the short breeding cycle of drosophila (about 2 weeks) makes it a very useful organism for genetic experiments. Many fundamental concepts of genetics, such as the relationship between genesI and chromosomes, were derived from studies in Drosophila in the early twentieth century (see chapter 4). Extensive genetic analyses in Drosophila have found many of the genes that control development and differentiation, with modern methods of molecular biology en allow for detailed analysis of the functions of these genes. As a result of the study, drosophila has made it possible to advance the understanding of the molecular mechanisms that govern the development of animals, especially in terms of the body formation of complex multicellular organisms. Like 33. B studies of cell cells and elegans, vertebrates have genes and similar mechanisms that should be used drosophila as one of the most olant experimental models of modern developmental biology. Talian taliana taliana taliana talian development and molecular plant biology is an active extension of the area of significant economic importance, as well as inte---T.venial. Since the genomes of the plants cover the measurement :'rlejity comparable to animal genomes (see Table 1.2), one for the study of plant development would be simply a re-r.ente organism possessing some of the benefits of the YDro- C.elegans. A small plant with the flower Arabidopsis thaliana (caterpillar) (Figure 1.17) these criteria, so it is used as a model for studying molecular ogia in plants. Dopsis is notable for its genome only about 125 million; Base. However, Arabidopsis contains a total of about 26,000 - many of which are repeated, so the number of ge- 006 arabidopsis is about 15,000 - is a difficulty if C. elegans and Drosophila. In addition, Arabidopsis is easy to go to the laboratory, and techniques have already been developed for its molecular-genetic mani-SCTI. These studies have led to the identification of ene involved in various aspects of plant development, such as olia flowers. Analysis of these genes indicates the existence of nu------lilithud, but also noticeable differences, between mecanis - and control the development of plants and animals. T-r-ados nimal more complex vertebrates, including humans K mammals. The human genome consists of approximately nes base pairs - about 20-30 times larger than geno-C.elegans, Drosophila, or Arabidopsis- and contains between 20,000 and 25,000 i. In addition, the human body consists of more than 200 different classes of specialized cell types. This complexity makes it difficult to study them from the point of view of biology - olecular, although the greatest interest in biological sciences is born, that is, to understand the human body. In addition, the understanding of many stions about the importance of immediate practice (e.g. in measurement) is based on studies of human cells (oestrechamente onadas). The use of cultural cells also allowed research on various aspects of mammalian biology to go, including experiments that illuminated : I replicated DNA, gene expression, protein synthesis and procession, and cell division. In addition, the ability to cultivate S in a particular chemical environment has allowed signaling echaniisms, which usually control cell growth, and untouched by the body. Specialized caves of some types of highly digestible cells have made them important models for the study of certain types of cellular biology. Muscle cells, according to arelo, are highly specialized for contraction, pro-tion and movement. Because of this specialization, mous is an essential model for the study of cellular to nilcular movement. Another example is given by brain cells (neurons), figure 1.17 Arabidopsis thaliana. (Jeremy Burgess/Photo Investigators, Inc.) 34. Title I - Introduction Figure 1.18 Eggs Frog Xenopus laevis. (Courtesy of Michael Danilchik and KimberlyRay.) that specialize in conducting electrochemical signals over long distances. In humans, axons : nerve lulas can be more than one meter long, and invertebrate gunos, such as squid, have giant neurons with axons up to 1 mm in diameter. Because of this specialized structure and function, these gi gantes neurons were important models in the study of trarts-1 the size of ions across the membrane, and the role of the cystito skeleton in the transportation of cytoplasmic organelles. Xenopus laevis frog is an important model for '. Studies of early vertebrate development, Xenoopus eggs are usually large cells with a diameter of about 1 mm (Figure 1.18). Since these eggs develop outside the mother, all stages (development from egg to tadpole can be easily stretched in the lab. In addition, I Xenopus eggs can be obtained in large quantities, facilitate biochemical analysis. This small fish is easily manfa ner in the laboratory and reproduces rapidly. such as C.elegans and Drosophila. Among mammals, the mouse is the most controlled for geological analysis, aided by the recent completion of the sequence of the mouse. Although the technical difficulties of studying mice genoti ca (compared, for example, with the genetics of yeast or Drosophik mutations affecting mouse dysarthelium have been identified. More important are recent advances in molecular biolkes, which allowed the production of mice to receive half of the genetic engineering in which mutant spice genes were injected into the mouse's germline, so that its effect on the developmenti other aspects of cellular function can be studied in contexii Figure 1.19 zebrafish. (A) Council within 24 hours. (B) I'm not her adult fish. (A, courtesy of Charles Kimmel, Oregon State University; © Max Gibbs/OSF/Photolibrary.com.) 35. Global Cell Vision and Cell Research Figure 1.20 Mouse as a model of human development. Children and mice exhibit similar pigmentation defects (pyebaldism) as a result of mutations in the gene necessary for the normal migration of melanocytes (cells responsible for skin pigmentation) during embryonic development. (Courtesy of R.A. Fleischmann, Markey Cancer Center, University of Kentucky.) :full end. The controllability of the mouse as a model of the developing hand corresponds to the fact that mutations in ho-genes lead to similar developmental defects in both species; feme is a naive example (Figure 1.20). fcslnimentos cell biology I all experimental science, research in biology ce-laboratory techniques that can be used for es-r cell structure and function. Many important advances in cell development have led directly to the development of 5 research methods. Therefore, the evaluation of the former instruments available to the cell biologist is critical of the current and future state of the directions of this area i, which is moving so fast. Some of the common methods of cell biology ites are described in the following sections. experimental r.ces, which include biochemistry and 4 molecular methods, will be discussed in later chapters. optical fcroscopy or that most cells are too small to be curd to the naked eye, the study of cells depended first on the use of a microscope. More importantly, the real discovery of centurion development of the microscope: Robert Hook was the first to term a cell after his observation of a piece with a simple optical microscope in 1665 (Figure 1.21). Using an er that expanded objects to 300 times their actual size, Wang Leeuwenhoek, in 1670 and later, was able to obser-tentes cell types, including sperm, red blood cells andbacte-.proposal of cell theory presented by Matthias Schleiden and R Schwann in 1838 should be taken as birth by modern biology. Microscopic studies of plant tissue den and animal tissue Schwann led to the same con- All organisms are made up of cells. It was later thought that they do not form de novo but emerge only Figure 1.21 Tube cell structure. A reproduction of a drawing by Robert Hook from a cork sheet, examined under an optical microscope. Hook cells observed are actually cell walls that remain when cells die long ago. 36. I - Introduction 22 Figure 1.22 Numerical hole. The light focuses on the sample by condensing the lens and assembling on the lens of the microscope lens. The numerical diaphragm is determined by the angle of the light cone entering the target lens (a) lens and the refractive index of the environment (usually water or oil) between the lens and the sample. dividing existing cells. Thus, the cell has achieved its current recognition as the main unit of all living organisms thanks to observations made with the help of an optical microscope. The optical microscope continues to be the main tool for cellular biologists, which, with technical improvements, allows to visualize the elevated details of the cell structure. Modern optical microscopes are capable of magnifying objects about a thousand times - since most cells are located between 1 and 100-a-meter dia-meter, they can be observed in an optical microscope, such as some of the subcellular organelles such as the nucleus, chlorine layers and mitochondria. However, the optical microscope is not strong enough to observe the fine parts of the ce-lular structure, the resolution of which - the ability of the microscope to distinguish objects separated by small distances - is much more important than the increase. Images can be magnified as much as you would like (such as a projection on a large screen), but such an increase is not incrw mint level of detail that can be observed. The optical microscope's limit resolution is approximately 0.2 m; The two objects, separated less than that distance, seem to make one image rather than distinguish each other. This theoretical limitation of optical microscopy is determined by two factors - the wavelength (X) of visible light and the force of the capture of the light of the lenses delmy-croscope (number aperture, AN) - according to the following equation: Resolution - AN wavelength of visible light is from 0.4 to 0.7 Jim, so that the value of A. is calculated at 0.5 microns for an optical microscope. A large diaphragm can be foreseen as the size of a light cone entering the lens of a microscope after passing through a sample (Figure 1.22). This is derived from the AN' T' equation without where T) is a refractive index of the environment through which light passes between the sample and the lens. The R for air is 1.0, but it can increase to a maximum of about 1.4 using an oil lens to see the sample on drops of oil. Angle to 37. 13 Global cell vision and rruponde cell research up to half the width of the light cone re- ncdo lens. The maximum value of a is 90 degrees, in m Sen to s 1, so the highest value of the numerical Aper-T3 is 1.4. The theoretical resolution limit of the optical microscope: so it is necessary to calculate as follows: Resolution with 0.22 it -?? microscopes unable to reach this level of re-tion were made in the late nineteenth century; (i: i) we can expect new improvements and optical microscopy in this relationship. different types of micro-optics are commonly used to study different aspects of the structure. The simplest is a lu-o field microscope in which light passes directly through it and in which the ability to distinguish different parts of the cell depends on the contrast that is touched by the absorption of light visible by the cells. In many cases the cells are stained before they react with proteins and nucleic acids to separate the zrtraste between different parts of the cell. Before staining, samples r.ormally processed by retainers (such as alcohol, acetic acid or - Aldehyde) to stabilize and preserve their structures. The study of tev.dos fixed and painted using a glowing field microscope is standard for analyzing tissue samples in biological laboratories (Figure 1.23). Such a coloring process kills, however, cells and therefore not suitable for many onde experiments is the

observation of living cells desired. re1 . Coloring, direct passage of light does not provide sufi-srte contrast to distinguish many parts of the cell, limiting the use of a glowing field microscope. However, the optical microscope in opti- variations can be used to enhance the contrast of re light waves passing through the area of the dife cell-is density. The two most common methods of displaying live waves are phase contrast microscopy and differential microscopy,contrast (Figure 1.24). Two types of microscopy;_z optical systems that convert density changes or gro-ar between different parts of the cell into contrasting differences that can be seen in the final image. In glowing field microscopy, transparent structures (such as the nucleus) have a bad contrast, absorbing light. However, light decreases when through these structures, so its phase changes compared to the light that has passed through the cytoplasm that surrounds them. Phase contrast and differential interference contrast mimic these phase differences in contrasting differences, thus improving images of inconsolable living cells. and p:'der optical microscope has spread with the help of Video and computer cameras for analysis and processing of images, such imaging systems can improve the figure of 1.23 glowing field micrography of stained fabric. A section of benign kidney tumor. (G.W.Willis/ Visuals Unlimited.) 1.24 Microscopic observation of living cells. Micrograph:? human mouthpieces derived from (A) glowing field, (B) contrast phase microscopy of differential interference contrast. (Courtesy of Morta Lovitz, Olympus America, Inc.) 50 nm nm la celula libro cooper pdf. la celula libro de biologia. la celula libro cooper. la celula libro pdf. la celula libros vivos. como funciona la celula libro. el mundo de la celula libro. que es la celula libro