



Preimplantation Embryo Development

Barry D. Bavister



Preimplantation Embryo Development:

Preimplantation Embryo Development Barry D. Bavister, 2012-12-06 This volume contains the Proceedings of the Sero Symposium on Pre implantation Embryo Development held in Newton Massachusetts in 1991 The idea for the symposium grew out of the 1989 Sero Symposium on Fertilization in Mammals at which preimplantation development was the predominant suggestion for a follow up topic This was indeed a timely subject in view of the recent resurgence of interest in this fundamental phase of embryogenesis and its relevance to basic research and applied fertility studies in humans food producing animals and endangered species The symposium brought together speakers from a broad range of disciplines in order to focus on key regulatory mechanisms in embryo development using a wide variety of animal models and on representative topics in human preimplantation embryogenesis The culmination of preimplantation development is a blastocyst containing the first differentiated embryonic tissues and capable of initiating and sustaining pregnancy The central objective of the symposium was to throw light on the regulation of cellular and molecular events underlying blastocyst formation It was particularly appropriate that the date of the symposium marked the 20th anniversary of the publication of the classic volume *Biology of the Blastocyst* the proceedings of an international workshop held in 1970 This book which summarized most of the information then available on this topic in mammals was edited by the pioneer in blastocyst research Dr Richard Blandau who was the guest speaker at the symposium

Preimplantation Embryo Development Barry D. Bavister, 1998-07-17 This volume contains the Proceedings of the Sero Symposium on Pre implantation Embryo Development held in Newton Massachusetts in 1991 The idea for the symposium grew out of the 1989 Sero Symposium on Fertilization in Mammals at which preimplantation development was the predominant suggestion for a follow up topic This was indeed a timely subject in view of the recent resurgence of interest in this fundamental phase of embryogenesis and its relevance to basic research and applied fertility studies in humans food producing animals and endangered species The symposium brought together speakers from a broad range of disciplines in order to focus on key regulatory mechanisms in embryo development using a wide variety of animal models and on representative topics in human preimplantation embryogenesis The culmination of preimplantation development is a blastocyst containing the first differentiated embryonic tissues and capable of initiating and sustaining pregnancy The central objective of the symposium was to throw light on the regulation of cellular and molecular events underlying blastocyst formation It was particularly appropriate that the date of the symposium marked the 20th anniversary of the publication of the classic volume *Biology of the Blastocyst* the proceedings of an international workshop held in 1970 This book which summarized most of the information then available on this topic in mammals was edited by the pioneer in blastocyst research Dr Richard Blandau who was the guest speaker at the symposium

The Mammalian Preimplantation Embryo Barry D. Bavister, 2012-12-06 With a few notable exceptions mammalian preimplantation embryos grown in vitro are likely to exhibit sub optimal or

retarded development This may be manifested in different ways depending on the species and on the stages of embryonic development that are being examined For example bovine embryos often experience difficulty in cleaving under in vitro conditions and usually cease development at about the 8 cell stage Wright and Bondioli 1981 The block to development is stage dependent embryos cultured for 24 hr from the 1 cell stage are much more capable of developing into viable blastocysts after transfer to oviducts than embryos cultured for 24 hr from the 4 cell stage prior to transfer Eyestone et al 1985 Similar problems with in vitro embryo development are encountered in other species Pig embryos can be grown up to the 4 cell stage in vitro but usually no further Davis and Day 1978 In the golden hamster in the rat and in many outbred strains of mice development of zygotes in vitro is blocked at the 2 cell stage Yanagimachi and Chang 1964 Whittingham 1975 Even with some inbred mouse strains embryo development is reduced if very early cleavage stages are used as the starting point for in vitro culture Spielmann et al 1980 A common finding is that embryos grown in vitro have reduced cell counts Harlow and Quinn 1982 Kane 1985 and their viability is reduced Bowman and McLaren 1970 Papaioannou and Ebert 1986 compared to equivalent developmental stages recovered from mated animals

Mammalian Preimplantation Development

,2016-07-26 Mammalian Preimplantation Development the latest volume in the Current Topics in Developmental Biology series covers mammalian preimplantation development and includes contributions from an international board of authors The book's chapters provide a comprehensive set of reviews covering such topics as cell proliferation cell differentiation and biological significance Covers the area of mammalian preimplantation development Includes contributions from an International board of authors Provides a comprehensive set of reviews covering such topics as cell proliferation cell differentiation and biological significance

Nitric Oxide Regulation of Preimplantation Embryo Development Susanne Lynn Tranguich,2002 ABSTRACT Nitric Oxide NO production plays an important role in regulating pre implantation embryo development NO is produced from L arginine by the enzyme nitric oxide synthase NOS which has three isoforms endothelial eNOS neuronal nNOS and inducible iNOS Studies have shown that NO mediates its effects through a variety of pathways It has been previously shown that inhibition of NO production by N^{superscript} G nitro L arginine LNA inhibits the development of 2 cell embryos to the 4 cell stage However excess NO also halts embryo development possibly through the production of free radicals We hypothesize that multiple NOS isoforms are expressed in order to ensure normal embryo development We performed RT PCR to demonstrate the presence of mRNA for all three NOS isoforms in 2 cell 4 cell morula and blastocyst stage embryos We next hypothesize that NO acts through the cGMP pathway in preimplantation embryo development To test this embryos from CD 1 day 1 pregnant female mice were cultured in various concentrations of Whitten's positive control NO donor S nitroso N acetylpenicillamine SNP L NA or 8 Br cGMP Embryos were assessed every 24 hours to determine their stage of development 2 cell 4 cell morula or blastocyst We found that a critical concentration of NO and cGMP is required for normal embryo development and deviations from this concentration lead to developmental arrest and or apoptosis of the

embryo We also found that NO is acting at least in part through cGMP in preimplantation embryo development From this data we have directly demonstrated the importance of NO and its role in preimplantation embryo development *Human Preimplantation Embryo Selection* Jacques Cohen,Kay Elder,2007-09-26 The most profound dilemma in assisted reproduction to date is the inability to recognize potentially viable embryos before their replacement into the reproductive tract Application of increasingly advanced new technology has allowed the field of embryo evaluation to evolve rapidly and dramatically over the past five years Human Preimplantation Embryo **Human Gametes and Preimplantation Embryos** David K. Gardner,Denny Sakkas,Emre Seli,Dagan Wells,2013-05-27 In recent years the advancing science and increasing availability of assisted reproduction have given new hope to infertile couples However the use of IVF and ART has also led to marked increases in the number of multiple infant live births This poses a public health concern as these neonates have a higher rate of pre term delivery compromising their survival chances and increasing their risk of lifelong disability By optimizing the selection of gametes and embryos with high probabilities of implantation it is possible to reduce the number of embryos transferred and by extension the number of high risk multiple gestations while maintaining or increasing pregnancy rates Human Gametes and Preimplantation Embryos Assessment and Diagnosis provides a broad yet concise overview of established and developing methodologies for assessment of gamete and embryo viability in assisted reproduction This book elucidates the best practices for precisely selecting viable specimens based on morphology and cleavage rate and covers the spectrum of emerging adjunctive technologies for predicting reproductive potential The authors present their extensive knowledge of omics approaches genomics transcriptomics proteomics and metabolomics with unbiased delineation of the associated advantages and potential pitfalls This valuable clinical resource is well suited to infertility specialists Ob Gyn physicians IVF laboratory technicians and researchers in the fields of embryology and reproductive medicine

Development of Preimplantation Embryos and Their Environment Koji Yoshinaga,Takahide Mori,1989 *In-Vitro Fertilization* Kay Elder,Brian Dale,2010-12-02 This fully updated new edition of a successful and popular practical guide is an indispensable account of modern in vitro fertilization practice Initial chapters cover theoretical aspects of gametogenesis and embryo development at the cellular and molecular level while the latter half of the book describes the requisites for a successful IVF laboratory and the basic technologies in ART Advanced techniques including pre implantation genetic diagnosis vitrification and stem cell technology are comprehensively covered providing up to date analyses of these groundbreaking technologies This edition includes New practical techniques including preservation of fertility for cancer patients stem cell biology technology vitrification and in vitro maturation A refresher study review of fundamental principles of cell and molecular biology The latest information available from animal and human research in reproductive biology Packed with a wealth of practical and scientific detail this is a must for all IVF practitioners *Experimental Approaches to Mammalian Embryonic Development* Janet Rossant,Roger A. Pedersen,1988-11-25 Recent advances in the experimental

analysis of the mammalian embryo are discussed from various scientific perspectives in this summary of major breakthroughs in embryonic development

Genetic Characterization of the Preimplantation Embryo Development (PED) Gene Using the Congenic B6.K1 and B6.K2 Strains of Mice

Michael J. Byrne (Ph. D.), 2008 In viviparous mammals preimplantation embryo development occurs post fertilization and prior to implantation in the uterus During this period of time the egg develops into a zygote which activates its own genome and goes through a series of cell divisions called cleavage divisions to ultimately become a blastocyst ready to implant in the uterus and develop into a new organism The preimplantation embryo development Ped gene regulates the rate of preimplantation embryonic cleavage division and subsequent embryo survival in mice In the mouse the Ped gene product is Qa 2 protein a non classical major histocompatibility complex MHC class Ib molecule encoded by four tandem genes Q6 Q7 Q8 Q9 Most inbred strains of mice have all four genes on each allelic chromosome making a total of eight Qa 2 encoding genes but there are a few strains that are missing all eight genes defining a null allele Mouse embryos possessing the Qa 2 encoding genes express Qa 2 protein on their surface and develop at a faster rate and have a greater chance of survival compared to mouse embryos expressing the null allele The B6 K1 and B6 K2 strains of mice are congenic strains that have identical genetic loci with the exception of the genes that encode Qa 2 The B6 K1 mice have a deletion of the four Qa 2 encoding genes whereas the B6 K2 mice do possess all four Qa 2 encoding genes Using these mice as either controls or subjects I have done research towards three specific aims

- 1 Test the hypothesis that the number of Qa 2 encoding genes varies in the wild mouse population
- 2 Test the hypothesis that male preimplantation embryos develop faster than female preimplantation embryos from the B6 K1 and B6 K2 strains of mice
- 3 Test the hypothesis that the Ped gene is influenced by the expression of two microRNAs miR 125a and miR 125b

The results from the first specific aim showed that there was great variability in the number of Qa 2 encoding genes in 32 wild mice tested The wild mouse with the highest number of Qa 2 encoding genes had 85 such genes whereas one wild mouse was discovered without any Qa 2 encoding genes The results from the second specific aim showed that there was no statistically significant difference in the ratio of male to female preimplantation embryos in either strain Therefore the Ped gene is entirely responsible for mediating the faster development of B6 K2 embryos compared to B6 K1 embryos Finally the results from the third specific aim showed that the absence of one of the Qa 2 encoding genes Q9 resulted in a 10 fold increase in expression of the developmental timing miRNA miR 125a but not of its close family member miR 125b This finding is significant because miR 125a and its homolog lin 4 have been found to play important roles in development in many species Our results suggest that similar to lower organisms miRNAs play an important role in developmental timing in mice Taken together the findings presented in this dissertation have answered important basic research questions regarding Ped gene control of the rate of preimplantation embryo development and have led to the discovery of an entirely new way of thinking about gene regulation during mouse embryo development namely the involvement of miRNAs

Characterization of

Genes Required for Preimplantation Embryo Development Marc P. Maserati, 2013 Preimplantation embryo development in the mouse is a time of rapid cellular morphological and molecular changes leading to embryo implantation for the generation of offspring. The Mager lab studies these events occurring between fertilization and implantation in order to better understand the initial events which set the stage for all future aspects of development. The result of this research impacts many scientific disciplines including in vitro based means of embryo culture, establishment of epigenetic marks, differentiation and cellular reprogramming, and can be used in translational research for the improvement of in vitro culture techniques and develop novel therapies such as cell replacement in the case of macular degeneration. Bin L 2009. Through the use of in vitro embryo culture, RNA interference (RNAi) approaches and daily observations, gene function required in preimplantation embryo development can be determined. In the initial published body of work evaluating gene knockdown using our RNAi approach, Maserati M 2011, WDR74 was characterized in preimplantation embryo development. We now understand that WDR74 is implicated in RNA production and/or stability as gene knockdown at the 1 cell stage significantly depletes mRNA within the embryo by the morula stage. Furthermore, double knockdown of Trp53 and Wdr74 results in a partial rescue of blastocyst formation, suggesting p53 mediated apoptosis in the failure to make a blastocyst phenotype. The initial characterization of 4 RNA processing genes, SF3b14, SF3b1, SAP155, Rpl7l1 and Rrp7a, required for blastocyst formation was later evaluated. The results of this work have been submitted for publication and will be published soon in the journal *Zygote*. SF3b14 and SF3b1 identified as being part of the spliceosome complex disproportionately contribute to gene transcription of those genes containing more than 1 exon, verifying a role in RNA splicing. Rpl7l1 identified by GO terms as a possible ribosomal gene was found to be present in the cytoplasm and surprisingly in the nucleus. It is surmised this gene influences polymerase 2 activity as Rpl7l1 gene knockdown embryos demonstrate reduced active polymerase 2 activity at the morula stage. Rrp7a was identified as being critical in blastocyst formation and is present in the cytoplasm while excluded from the nucleus. Based on location and GO terms, this suggests a role in translation. Taken together, these 4 genes act in 3 different ways impacting RNA production, splicing or translation, promoting blastocyst formation in the mouse. The final gene evaluated in this work was Bcl 6 corepressor Bcor. As opposed to our previous work with RNA processing factors, this gene knockdown does not result in a failure to make a blastocyst. Bcor knockdown increases the rate of physiologically normal blastocysts in both murine and bovine models. Although further characterization must be done, temporary Bcor gene knockdown might be a useful improvement of in vitro embryo culture systems including murine, bovine, equine and possibly even human. This manuscript is divided into 4 chapters, the first of which is a review of preimplantation embryo development. This covers selected and relevant events between fertilization and just before implantation of the embryo into the uterus. I mainly focus on events after fertilization and the necessary changes required for zygotic genome transcription and lineage specification. The second chapter characterizes WDR74, a gene we identified as critical in the formation of a blastocyst in a

reverse genetic screen As state before we assess WDR74 function with the developing embryo and conclude the protein plays a role in RNA production and or stability of RNA transcripts We also test to rescue blastocyst formation in WDR74 knockdown embryos in an attempt to further evaluate WDR74 function We continue the characterization of genes whose temporary reduction causes the failure of blastocyst formation in the third chapter Here we report on four additional RNA processing genes in a body of work which has been published in the journal Zygote Since these genes contained similar GO terms we assumed they may all function in a similar way so they were assayed together as a group As function of these genes were unknown we determined protein localization within the cell function in RNA splicing alternative splicing and to determine if the failure to make a blastocyst is due to lineage specification In the final chapter BCOR gene expression is characterized in preimplantation embryo development as in the former 2 chapters However the result of this gene knockdown does not lead to the failure to make a blastocyst rather this improves the number of blastocysts formed during the correct physiological time the same time that blastocysts form invivo Undoubtedly this could lead to possible commercial applications which are reviewed along with the preliminary data we have been able to collect thus far Specifically the continuation of the BCOR gene knockdown research in preimplantation embryo development is pitched in the form of academic and international business collaboration with InvitroBrasil for the production of cloned bovine equine and ICSI in equine

Cell Signaling During Mammalian Early Embryo Development Henry J. Leese, Daniel R. Brison, 2015-05-08 The book considers signaling events from the zygote embryo through to the blastocyst with relevant data from embryonic stem ES cells including dialogue with the extracellular environment and with the maternal tract during the implantation process Application of the knowledge described to improve the success of human and animal assisted conception is considered where appropriate but the focus is largely on fundamental rather than applied cell molecular biology as this is the area that has historically been neglected While the general features of metabolism during preimplantation development are well established especially in terms of nutrient requirements uptake and fate remarkably little is known about early embryo signaling events intracellular or intercellular between individual embryos in vitro or with the female reproductive tract in vivo This contrasts with the wealth of information on cell signaling in somatic cells and tissues as a glance at any textbook of biochemistry illustrates This lack of information is such that our understanding of the molecular cell biology of early embryos a prerequisite to defining the mechanisms which regulate development at this critical stage of the life cycle is seriously incomplete This volume is the first to address this issue by describing the current state of knowledge on cell signaling during mammalian early embryo development and highlighting priority areas for research

Human Assisted Reproductive Technology David K. Gardner, Botros R. M. B. Rizk, Tommaso Falcone, 2011-03-31 Human Assisted Reproductive Technology Future Trends in Laboratory and Clinical Practice offers a collection of concise practical review articles on cutting edge topics within reproductive medicine Each article presents a balanced view of clinically relevant information and looks ahead

to how practice will change over the next five years The clinical section discusses advances in reproductive surgery and current use of robotic surgery for tubal reversal and removal of fibroids It looks into the refinement of surgical procedures for fertility preservation purposes Chapters also discuss non invasive diagnosis of endometriosis with proteomics technology new concepts in ovarian stimulation and in the management of polycystic ovary syndrome and evidence based ART The embryology section discusses issues ranging from three dimensional in vitro ovarian follicle culture and morphometric and proteomics analysis of embryos to oocyte and embryo cryopreservation This forward looking volume of review articles is key reading for reproductive medicine physicians gynecologists reproductive endocrinologists urologists and andrologists

Cumulated Index Medicus, 1994 *Handbook of the Assisted Reproduction Laboratory* Brooks A. Keel, Jeffrey V. May, Christopher J. DeJonge, 2000-05-15 With the advent of Assisted Reproductive Technologies our understanding of the reproductive system in both men and women has progressed in an exponential manner Along with this increase in knowledge has emerged new and advanced laboratories performing unique techniques aimed at diagnosing and treating infertility problems And as these lab **Fetal Medicine** Charles H. Rodeck, Martin J. Whittle, 2009-01-01 Fetal medicine has emerged as a separate subspecialty over the last 30 years as a result of major advances in a number of areas in particular ultrasound imaging cytogenetics molecular biology and biochemistry The widespread use of antenatal screening and diagnostic tests has led to an increased need for obstetricians to have knowledge and skills in fetal medicine This book provides the information that underpins training programmes in fetal medicine and integrates science and clinical disciplines in a practical and useful way Clinical sections include the latest advances in prenatal screening a systems based presentation of the diagnosis and management of fetal malformations complete coverage of common and rare fetal conditions including growth restriction endocrine and platelet disorders early pregnancy loss and twins multiple pregnancy More focus on important basic science concepts such as maternofetal cell trafficking and the relevance to clinical management **Comprehensive Toxicology**, 2010-06-01 An explosive increase in the knowledge of the effects of chemical and physical agents on biological systems has led to an increased understanding of normal cellular functions and the consequences of their perturbations The 14 volume Second Edition of Comprehensive Toxicology has been revised and updated to reflect new advances in toxicology research including content by some of the leading researchers in the field It remains the premier resource for toxicologists in academia medicine and corporations Comprehensive Toxicology Second Edition provides a unique organ systems structure that allows the user to explore the toxic effects of various substances on each human system aiding in providing diagnoses and proving essential in situations where the toxic substance is unknown but its effects on a system are obvious Comprehensive Toxicology Second Edition is the most complete and valuable toxicology work available to researchers today Contents updated and revised to reflect developments in toxicology research Organized with a unique organ system approach Features full color throughout Available electronically on sciencedirect com as well as in a limited edition print version

Fetal Alcohol Syndrome Ernest L. Abel, 2022-01-26 Recognition of the relationship between alcohol abuse and adverse prenatal outcomes is reflected in the warning labels on every alcoholic beverage sold in the United States Because alcohol abuse has serious consequences for both individuals and society as a whole much research has been devoted to this problem Fetal Alcohol Syndrome provides straightforward facts regarding the impact of alcohol consumption as it affects the development of the embryo and fetus Surveying current research of fetal alcohol syndrome and its related problems the book addresses the immediate effects on development at various stages Long term action of prenatal alcohol exposure later in life is also considered A chapter devoted to assessing the behavior of children who were prenatally exposed to alcohol emphasizes the necessity of longitudinal studies of fetal alcohol syndrome This important reference offers a thorough overview of a problem that cannot be ignored

Adiponectin Gerald Litwack, 2012-09-26 First published in 1943 Vitamins and Hormones is the longest running serial published by Academic Press Under the capable and qualified editorial leadership of Dr Gerald Litwack Vitamins and Hormones continues to publish cutting edge reviews of interest to endocrinologists biochemists nutritionists pharmacologists cell biologists and molecular biologists Others interested in the structure and function of biologically active molecules like hormones and vitamins will as always turn to this series for comprehensive reviews by leading contributors to this and related disciplines Contributions from leading authorities Informs and updates on all the latest developments in the field

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