

专论与讲座

一氧化氮与哺乳动物卵母细胞成熟

李 潇,李亚杰,刘 珊,雷安民
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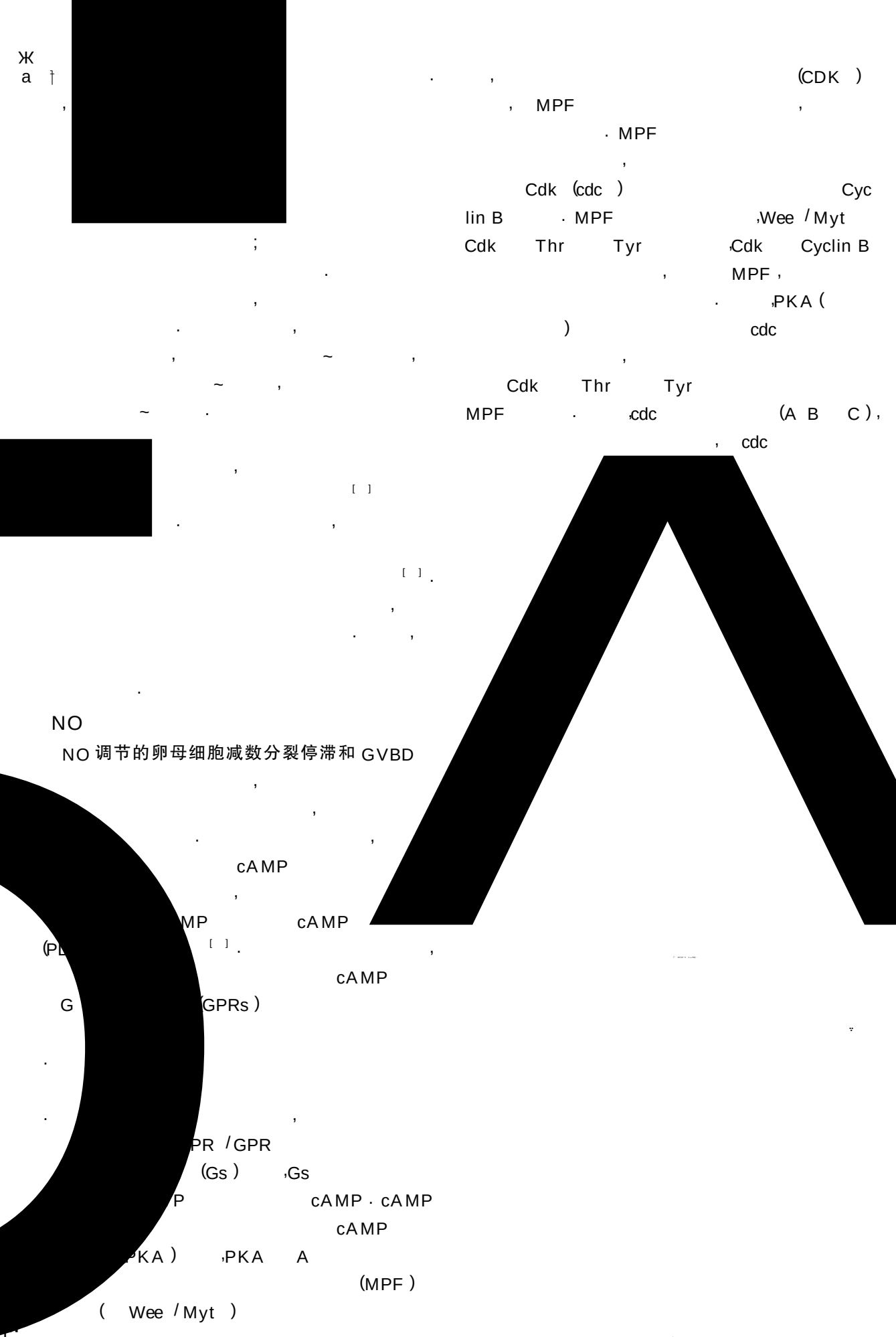
摘 要:一氧化氮(NO)是生物机体内第一种被发现的气体分子信号传导介质,不同组织中均可生成NO,并在机体内发挥相应的调节作用。哺乳动物卵巢卵泡主要通过一氧化氮合酶(NOS)途径将 L 精氨酸氧化为 L 瓜氨酸,在此过程中产生等量的 NO 参与调节卵母细胞生长发育进程。卵母细胞的质量优劣是与辅助生殖中体外受精(IVF)率和辅助生殖技术(ART)成败相关的关键因素,而卵母细胞质量的优劣在很大程度上取决于其所在卵泡微环境内的减数分裂进程与状态。论文从卵巢卵泡中 NO 的来源和作用机制出发,介绍 NO 与卵母细胞成熟进程的关系,通过阐明 NO 相关作用途径为医学临床改善卵母细胞质量的相关药物研发与治疗提供参考。

关键词:一氧化氮;卵母细胞;信号传导通路

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um derived relaxing factor ,EDRF);
(nitric oxide ,NO) EDRF (NO),
NO . Furchgott
NO
(nitric ox
ide synthase ,NOS) ,NO
cGMP/PDE/Cdc B/MPF , NO
(germinal vesicle
breakdown ,GVBD) (M) NO NO cGMP PKG [] .
NO NO
NO
(sGC) (AC) ,
(cGMP)
(cAMP) ,
(PKG) ,
Murad NO cGMP PKG PKG
(cGMP) : Ca
(BK_{Ca}) , K
,Furchgott , Ca
Ca
(endotheli (IP) PKG

(IP receptor associated PKG substrate , , ,
IRAG) Ca IP (IP R)Ca [] .
; (PLB) ,NF κB iNOS
/ (SERCA) Ca iNOS NO ,NO
, Ca , Ca [] . NO
(CaM) (MLCK) T B
(MCL) : T
Ca . eNOS iNOS NO ;
(MLCP) MCL , NO .
, ; Rho A MLCP ,MAPK (ERK / JNK / p) iNOS NO
Rho (ROCK) MLCP NO . eNOS
, MCL , NO PI K / AKT / eNOS / NO []
[] . NO Ca / CaMKK CaMK / AMPK / eNOS / NO
AMPK / AKT / eNOS / NO []
(O) (reactive oxygen species ,
ROS) [] .
NO
NO
, NO (NOS)
, NO NOS , LH
, NO NOS (GVBD)
, NOS
NO NOS (M)
(neuronal nitricoxidesyn
thase nNOS) (endothelial ni
tricoxidesynthase eNOS)
(inducible nitricoxidesynthase , iNOS)
nNOS eNOS ()
(constitutive nitricoxidesynthase ,
cNOS) . cNOS Ca .
NOS (iNOS) iNOS
(LPS) (IL) α
(TNF α) [] . NO
NOS /
, c
NO , NO NO RH)
(gonadotropin releasing hormone , Gn
(LH)
,
(germinal vesicle ,GV) ,
, GV (ger
minal vesicle)
breakdown ,GVBD) ,



NO

NO 调节的卵母细胞减数分裂停滞和 GVBD

cAMP

MP

cAMP

cAMP

(PL

[]

G

(GPRs)

PR /GPR

(Gs)

Gs

P

cAMP · cAMP

cAMP

PKA)

PKA

A

(MPF)

(Wee / Myt)

,

9

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2

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1



[1] HIROSHI W Role of NO cGMP PKG axis in pulmonary arterial hypertension [J] Nihon Yakurigaku Zasshi , 2000 , 120 (1) : 1-10

[1] HUANG Y T , ZHANG K , LIU M i et al An herbal preparation ameliorates heart failure with preserved ejection fraction by al

[] THOMPSON J G ,BROWN H M ,KIND K L ,et al The ovari antral follicle :Living on the edge of hypoxia or not? [J] Biol Reprod , 2004 , 70 (2):

[] SHILPA P ,BIPLOB K ,CHAUBE S K Maturation promoting factor destabilization facilitates postovulatory aging mediated abortive spontaneous egg activation in rat [J] Dev Growth Differ , 2005 , 16 (1):

[] TATIANA C ,JANE T ,J M J ,et al Rat eggs cannot wait : Spontaneous exit from meiotic metaphase II arrest [J] Mol Reprod Develop , 2005 , 73 (1):

[] SHILPA P ,MEENAKSHI T ,BIPLOB K ,et al Morphological cellular and molecular changes during postovulatory egg aging in mammals [J] J Biomed Sci , 2005 , 18 (1):

[] JONES K T Mammalian egg activation :from Ca²⁺ spiking to cell cycle progression [J] Reproduction (Cambridge ,England) , 2005 , 130 (1):

[] ELENA P ,GIULIA A ,SILVIA F ,et al Cockayne syndrome group A protein localizes at centrosomes during mitosis and regulates Cyclin B ubiquitination [J] Eur J Cell Biol , 2005 , 75 (1):

[] MIAO Y L ,KIKUCHI K ,SUN Q Y ,et al Oocyte aging :cellular and molecular changes ,developmental potential and reversal possibility [J] Human Reprod Update , 2005 , 11 (1):

[] MEINECKE B ,JANAS U ,PODHAJSKY E ,et al Histone H4 and MAP kinase activities in bovine oocytes following protein synthesis inhibition [J] Reprod Domest Anim , 2005 , 40 (1):

[] LIANG C G ,SU Y Q ,FAN H Y ,et al Mechanisms regulating oocyte meiotic resumption :roles of mitogen activated protein kinase [J] Mol Endocrinol (Baltimore Md) , 2005 , 19 (1):

[] RADEK P ,ALEXANDRA B ,LUCIE N ,et al The role of MAPK 1/2 and AKT in the acquisition of high meiotic and developmental competence of porcine oocytes cultured *in vitro* in FLI medium [J] Int J Mol Sci , 2005 , 6 (1):

[] GOUD A P ,GOUD P T ,DIAMOND P ,et al Nitric oxide delays oocyte aging [J] Biochemistry , 2005 , 44 (1):

[] BILODEAU GOESEELS S Effects of manipulating the nitric oxide/cyclic GMP pathway on bovine oocyte meiotic resumption *in vitro* [J] Theriogenology , 2005 , 63 (1):

[] MEENAKSHI T ,K C S Reduction of nitric oxide level results in maturation promoting factor destabilization during spontaneous meiotic exit from diplotene arrest in rat cumulus oocytes complexes cultured *in vitro* [J] Dev Growth Differ , 2005 , 16 (1):

[] PRASAD S ,CHAUBE S K S nitroso -N-acetyl penicillamine inhibits spontaneous exit from metaphase II arrest in rat eggs cultured *in vitro* [J] Biomed Pharmacother , 2005 , 69 (1):

[] SAGIT S A ,DALIA G ,NAVA N ,et al Inhibition of rat oocyte maturation and ovulation by nitric oxide :mechanism of action [J] Biol Reprod , 2005 , 73 (1):

[] , β [J] , ():

Nitric Oxide and Maturation of Mammalian Oocytes

LI Xiao ,LI Ya jie ,LIU Shan ,LEI An min

(College of Veterinary Medicine ,Northwest A&F University Yangling ,Shaanxi ,China)

Abstract :Nitric oxide (NO) is the first gas molecule identified as a signal mediator in the organism and can be produced in different tissues and plays a corresponding regulatory role in the biological organism The mammalian ovarian follicle oxidizes L arginine to L citrulline mainly through the nitric oxide synthase (NOS) pathway ,producing equal amounts of nitric oxide (NO) in the process ,which allows it to participate in regulating the oocyte growth and development process The quality of oocytes is a key factor in the success or failure of *In Vitro* Fertilisation (IVF) rates and Assisted Reproduction Techniques (ART) in assisted reproduction and the quality of oocytes is largely dependent on the meiotic process and state of the follicular microenvironment in which they reside This paper introduces the relationship between NO and oocyte maturation process from the source and mechanism of action of NO in ovarian follicles and provides a reference for the development and treatment of drugs related to improving oocyte quality in medical clinics through NO related pathways

Key words :nitric oxide ; oocyte ; signal transduction pathway