

**Circadian and epigenetic control of Nocturnin in**  
**Non-alcoholic steatohepatitis**

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**DOCTOR OF PHILOSOPHY IN ZOOLOGY**

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## **CERTIFICATE**

This is to certify that the thesis entitled, "*Circadian and epigenetic control of Nocturnin in Non-alcoholic steatohepatitis*" incorporates results of investigations carried out by the candidate herself under my supervision and guidance in the Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara. The contents of the thesis, in full or in parts have not been submitted to any other Institute or University for the award of any other degree or diploma.

Verified and certified

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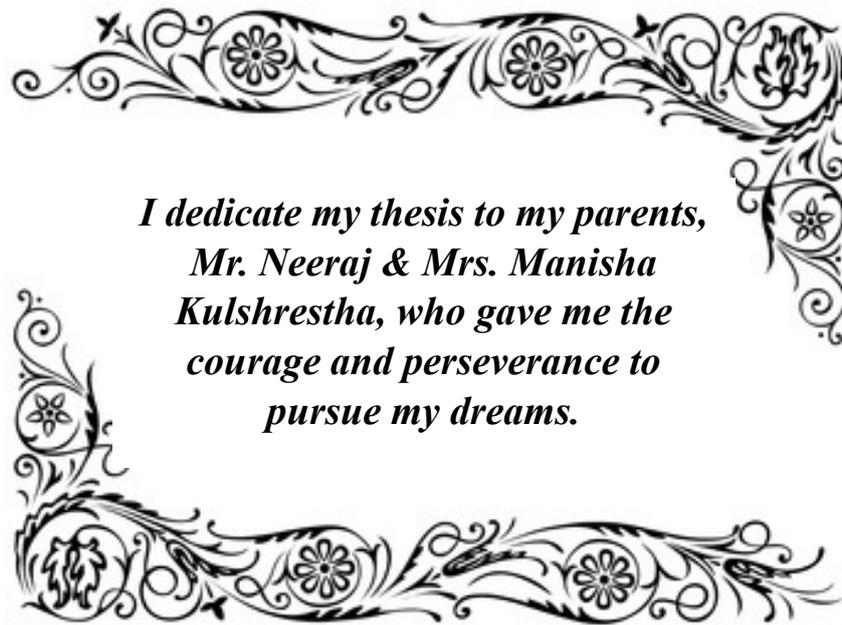


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*I dedicate my thesis to my parents,  
Mr. Neeraj & Mrs. Manisha  
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courage and perseverance to  
pursue my dreams.*

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## List of Figures

<b>Figures</b>		<b>Page No.</b>
<b>General Introduction</b>		
<b>Figure 1.</b>	Various types of lifestyle disorders.	<b>4</b>
<b>Figure 2.</b>	Schematic representation of organization of circadian clock in mammals.	<b>6</b>
<b>Figure 3.</b>	Components of the mammalian circadian clock.	<b>8</b>
<b>Figure 4.</b>	Regulation of hepatic processes by circadian clock.	<b>10</b>
<b>Figure 5.</b>	Global burden of Non-alcoholic fatty liver disease (NAFLD).	<b>16</b>
<b>Figure 6.</b>	Flowchart representing the revised nomenclature for NAFLD and NASH.	<b>16</b>
<b>Figure 7.</b>	NAFLD/NASH pathogenesis explained by “multiple parallel hits” hypothesis.	<b>18</b>
<b>Figure 8.</b>	Cannonical and non-cannonical pathways of miRNA biogenesis.	<b>31</b>
<b>Figure 9.</b>	miRNAs implicated in NAFLD/NASH pathophysiology.	<b>34</b>
<b>Figure 10.</b>	Enzymatic activity of Nocturnin: (a) Nocturnin as a deadenylase and (b) Nocturnin as a NADPH phosphatase.	<b>38</b>
<b>Figure 11.</b>	Synthesis and metabolism of melatonin in mammals.	<b>44</b>
<b>Figure 12.</b>	Hepatoprotective effects of melatonin in NAFLD/NASH.	<b>47</b>

## Materials and Methods

<b>Figure M1.</b>	Schematic representation of normal and phase-advance-phase-delay induced photoperiodic regime in mice that was followed for 16 weeks.	57
<b>Figure M2.</b>	Alterations in serum liver function markers: in C57BL/6J mice subjected to H and/or CD regime for 16 weeks and melatonin-mediated improvements.	61
<b>Figure M3.</b>	High-fat-high-fructose (H) diet alone or in combination with chronodisruption (CD) for 16 weeks significantly alter lipid profile parameters.	62
<b>Figure M4.</b>	Histological evaluation of liver tissues of H and/or CD mice and melatonin-mediated improvements.	64

## Chapter 1.

<b>Figure 1.1.</b>	Differential Gene Expression Analysis (DGEA) of wildtype (WT) and <i>Noct</i> knockout ( <i>Noct</i> <sup>-/-</sup> ) A549 cells from RNA-seq data retrieved from Gene Expression Omnibus (GEO; GSE123477)	80-81
<b>Figure 1.2.</b>	Gene ontology (GO) analysis of the differentially expressed genes	82-83
<b>Figure 1.3.</b>	STRING network analysis identified DEGs.	84
<b>Figure 1.4.</b>	Alterations in <i>Noct</i> mRNA (at ZT12) in the livers of C57BL/6J mice subjected to H and/or CD regime for 16 weeks.	85

<b>Figure 1.5.</b>	H and/or CD for 16 weeks alters hepatic <i>Noct</i> mRNA oscillations in C57BL/6J mice.	<b>86</b>
<b>Figure 1.6.</b>	CircWave analysis of hepatic <i>Noct</i> mRNA rhythmicity in H and/or CD mice.	<b>87</b>
<b>Figure 1.7.</b>	Dose standardization of oleic acid (OA) in HepG2 cells and assessment of intracellular lipid accumulation in HepG2.	<b>88</b>
<b>Figure 1.8.</b>	Oleic acid (OA; 0.5 mM) treatment for 24 h significantly increases <i>Noct</i> expression in HepG2 cells.	<b>89</b>
<b>Figure 1.9.</b>	<i>NOCT</i> mRNA oscillations in Control and OA-treated HepG2 cells.	<b>90</b>
<b>Figure 1.10.</b>	CircWave analysis of <i>NOCT</i> oscillations in serum synchronized HepG2 cells subjected to OA treatment for 24 h	<b>91</b>
<b>Figure 1.11.</b>	Immunoblot analysis of <i>NOCT</i> protein oscillations in serum-synchronized HepG2 cells subjected to OA treatment for 24 h.	<b>92</b>
<b>Figure 1.12.</b>	Rhythmicity of <i>NOCT</i> protein Control (C) and OA groups analyzed by CircWave software	<b>93</b>

## **Chapter 2.**

<b>Figure 2.1.</b>	Full-length protein structure of mmu- <i>NOCT</i> generated by i-TASSER using the amino-acid sequence from NCBI.	<b>108</b>
<b>Figure 2.2.</b>	Ramachandran Plot analysis of the i-TASSER generated mmu- <i>NOCT</i> protein structure.	<b>109</b>

<b>Figure 2.3.</b>	Molecular docking between mmu-NOCT and melatonin using AutoDock, Pyrx and PyMol.	<b>110</b>
<b>Figure 2.4.</b>	Melatonin mediates corrective changes in hepatic <i>Noct</i> mRNA at ZT12 in mice subjected to H and/or CD regime for 16 weeks.	<b>111</b>
<b>Figure 2.5.</b>	Melatonin subtly hepatic <i>Noct</i> mRNA oscillations in H and/or CD mice.	<b>112</b>
<b>Figure 2.6.</b>	Hepatic <i>Noct</i> oscillations in the form of a combinatory sine-cosine waveform, as calculated by CircWave software.	<b>113</b>
<b>Figure 2.7.</b>	Percentage (%) relative amplitude of hepatic <i>Noct</i> oscillations in melatonin-treated H and/or CD mice.	<b>114</b>
<b>Figure 2.8.</b>	Peak time of hepatic <i>Noct</i> mRNA oscillations in melatonin-treated H and/or CD mice.	<b>115</b>
<b>Figure 2.9.</b>	Melatonin-mediated improvements in cumulative <i>Noct</i> expression in H and/or CD mice.	<b>116</b>
<b>Figure 2.10.</b>	Dose standardization of melatonin in HepG2 cells by MTT assay and ORO staining.	<b>117</b>
<b>Figure 2.11.</b>	Melatonin improves <i>Noct</i> (mRNA and protein) expression in OA-treated HepG2 cells.	<b>118</b>
<b>Figure 2.12.</b>	Possible alterations in <i>NOCT</i> oscillations in serum synchronized HepG2 cells subjected to OA and melatonin treatment.	<b>119</b>

<b>Figure 2.13.</b>	CircWave analysis of <i>NOCT</i> rhythmicity in OA and/or melatonin treated HepG2 cells.	<b>120</b>
<b>Figure 2.14.</b>	<i>NOCT</i> protein oscillations in serum synchronized HepG2 cells subjected to OA and melatonin treatment.	<b>121</b>
<b>Figure 2.15.</b>	CircWave analysis of <i>NOCT</i> protein rhythmicity in HepG2 cells.	<b>122</b>
<b>Chapter 3.</b>		
<b>Figure 3.1.</b>	miRNAs regulating <i>NOCT</i> expression in Humans.	<b>136</b>
<b>Figure 3.2.</b>	miRNAs regulating <i>Noct</i> expression in Mice.	<b>137</b>
<b>Figure 3.3.</b>	miRNAs regulating <i>Noct</i> expression in Rats.	<b>138</b>
<b>Figure 3.4.</b>	miRNAs implicated in NAFLD/NASH.	<b>139</b>
<b>Figure 3.5.</b>	Functional enrichment of miRNAs in miRNet.	<b>140</b>
<b>Figure 3.6.</b>	Overlapping screening identified miR-122 as the most potent epigenetic regulator of <i>Noct</i> in NASH pathology.	<b>141</b>
<b>Figure 3.7.</b>	miR-122 has a conserved seed sequence in <i>Noct</i> gene across species.	<b>142</b>
<b>Figure 3.8.</b>	Hepatic <i>Noct</i> and miR-122 expression inversely correlate at ZT12 in H and/or CD mice.	<b>142</b>
<b>Figure 3.9.</b>	Dose standardisation of miR-122 inhibitor in HepG2 cells.	<b>143</b>

<b>Figure 3.10.</b>	Intracellular miR-122 levels in HepG2 cells treated OA alone or in combination with miR-122 inhibitor.	<b>144</b>
<b>Figure 3.11.</b>	<i>NOCT</i> mRNA oscillations in serum-synchronized HepG2 cells.	<b>145</b>
<b>Figure 3.12.</b>	CircWave analysis of <i>NOCT</i> mRNA rhythmicity in OA and/or miR-122 inhibitor-treated HepG2 cells.	<b>146</b>
<b>Figure 3.13.</b>	NOCT protein oscillations in serum-synchronized HepG2 cells.	<b>147</b>
<b>Figure 3.14.</b>	NOCT protein rhythmicity in HepG2 cells analysed by CircWave software.	<b>148</b>

## List of Tables

<b>Tables</b>		<b>Page No.</b>
<b>General Introduction</b>		
<b>Table 1.</b>	Metabolic phenotypes in clock genes mutant animal models.	<b>27-28</b>
<b>Materials and Methods</b>		
<b>Table M1.</b>	Composition of high-fat diet.	<b>57-58</b>
<b>Table M2.</b>	Experimental design for <i>in vivo</i> studies.	<b>59</b>
<b>Table M3.</b>	List of primer sequences used in the study.	<b>68</b>

## Abbreviations

AASLD	American Association for the Study of Liver Diseases
AGO	Argonaute
ALAN	Artificial Light at Night
ALT	Alanine aminotransferase
AST	Aspartate transferase
ATP	Adenosine Triphosphate
BA	Bile Acids
bHLH	Basic-helix-loop-helix
BMAL1	Brain and Muscle Arnt-like 1
BMI	Body Mass Index
cAMP	Cyclic adenosine monophosphate
CCR2/4/5	C-C chemokine receptor type 2/4/5
CD	Chronodisruption
CD8 <sup>+</sup>	Cluster of differentiation 8 <sup>+</sup>
<i>CK1δ/ε</i>	Casein kinase 1 isoform delta/epsilon
CLOCK	Circadian Locomotor Output Cycles Kaput
CREB	cAMP AMP Response Element
CRY1/2	Cryptochrome 1/2
<i>Cu</i>	Curled
CVDs	Cardiovascular diseases
DAMPs	Danger Associated Molecular Patterns
DBP	DNA-Binding Protein
DEGs	Differential Expressed Genes
DGCR8	DiGeorge syndrome critical region 8
DGEA	Differential Gene Expression Analysis
DILI	Drug induced liver injury
DNL	<i>de novo</i> lipogenesis
EEP	Exonuclease Endonuclease Phosphatase

ELOVL3/6	Elongation of very long chain fatty acids-like 3/6
ER	Endoplasmic reticulum
<i>Fabp2</i>	Fatty acid binding protein 2
FAs	Fatty acids
FAS	Fatty acid synthase
FDA	Food and Drug Administration
FFA	Free fatty acids
FGF15	Fibroblast growth factor 15
FOXO3	Forkhead box O3
FXR	Farnesoid X receptor
<i>GCKR</i>	Glucokinase regulatory protein
GEO	Gene expression omnibus
GLP-1	Glucagon-like peptide-1
GO	Gene ontology
GPCRs	G-protein coupled receptors
GSH: GSSG	Glutathione: glutathione disulfide
HCV	Hepatitis-C virus
HDAC3	Histone deacetylase 3
HDL	High-density lipoprotein
HFD	High fat diet
H	High-fat-high-fructose
HO-1	Heme oxygenase-1
hsa	homo sapiens
IEG	Immediate early gene
IL-6	Interleukin-6
kDa	Kilo Dalton
KLF10/15	Kruppel-like factor 10/15
KO	Knockout
LD	Light-dark
LDL	Low-density lipoprotein
LPS	Lipopolysaccharide

LSDs	Lifestyle disorders
LXR	Liver X receptor
MAMPs	Molecule associated molecular patterns
MASH	Metabolic dysfunction-associated steatohepatitis
MASLD	Metabolic dysfunction-associated steatotic liver disease
MCD	Methionine and choline deficient diet
MCP-1	Monocyte chemoattractant protein-1
MDA	Malondialdehyde
MTS	Mitochondrial transfer sequence
Mmu	Mus musculus
NAD	Nicotinamide adenine dinucleotide
NADP	Nicotinamide adenine dinucleotide phosphate
NADPH	Nicotinamide dinucleotide phosphate hydrogen
NAFLD	Non-alcoholic fatty liver disease
NASH	Non-alcoholic steatohepatitis
NF- $\kappa$ B	Nuclear factor kappa B
NHANES	National Health and Nutrition Examination Survey
NLRP3	Nucleotide-binding domain (NOD)-like receptor pyrin domain containing 3
NOCT	Nocturnin
NOS	Nitric oxide synthase
NR1D1/2	Nuclear factor subfamily 1, group D, member 1
Nrf2	Nuclear factor erythroid-related factor 2
NR4A1	Nuclear receptor subfamily 4 group A member 1
OA	Oleic acid
OCA	Obeticholic acid
ORO	Oil Red O
PA	Palmitic acid
pCREB	phosphorylated cAMP AMP Response Element
PER1/2/3	Period 1/2/3
<i>PNPLA3</i>	Patatin-like phospholipase domain-containing 3

PPAR $\alpha/\gamma$	Peroxisome-proliferator-activated receptor $\alpha/\gamma$
PPI	Protein-protein interactions
Pre-miRNA	precursor- microRNA
Pri-miRNA	Primary- microRNA
qPCR	Quantitative polymerase chain reaction
RHT	Retinohypothalamic tract
RMSD	Root mean square deviation
ROREs	ROR response elements
RORG/ $\alpha$	Retinoic acid receptor-related orphan receptor-G/ $\alpha$
ROS	Reactive oxygen species
SCC	Squamous cell carcinoma
SCD-1	Steroyl-CoA desaturase
SHP	Small heterodimer partner
shRNA	short-hairpin RNA
SIRT1/6	Sirtuin 1/6
SREBP1c	Sterol regulatory element-binding protein-1c
TG	Triglycerides
T2DM	Type-2 diabetes mellitus
TLR4	Toll-like receptor 4
TNF- $\alpha$	Tumor necrosis factor- $\alpha$
UC	Ulcerative colitis
UTR	Untranslated region
VAT	Visceral adipose tissue
VLDL	Very low-density lipoprotein
WAT	White adipose tissue
WHO	World Health Organization
WT	Wildtype
XPO5	Exportin 5
ZT	Zeitgeber