Ontogeny of the ovarian follicular reserve of the African elephant (*Loxodonta africana*)

By

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Submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

in the Department of Production Animal Studies

in the Faculty of Veterinary Science,

University of Pretoria

Date submitted: May 2012

Acknowledgements

Working on this PhD thesis for over six years in Zimbabwe has been a long and, at times, isolated period of study and I am greatly indebted to the people in Zimbabwe, South Africa and England who have advised, supported and encouraged me throughout the process. My sincere thanks go out to all involved.

At the outset I express my thanks to my supervisors, Professor Johan Nöthling and Professor John Soley, for both sourcing financial support and for their meticulous statistical analyses and the care they took in arranging the content of this thesis and associated manuscripts. I am most grateful. I also acknowledge the role of the National Research Foundation of South Africa and the University of Pretoria in supporting my research.

I am most grateful to Professor Helen Picton of Leeds University for allowing me to deviate from human embryology to elephant folliculogenesis for my MSc thesis in Clinical Embryology in 2005. This started me on my path towards elephant research.

Dr Chris Foggin and the Wildlife Veterinary Unit listened kindly to initial thoughts on the study and they assisted greatly with obtaining the necessary permits to move specimens from Zimbabwe to England and South Africa for histology purposes.

But for Professor Twink Allen's, kind gesture to allow me the use of Dr Richard Laws collection of elephant ovaries, this study would not have proceeded past the protocol stage as new samples were, at the time, proving so difficult to obtain. His support in word and deed has been immeasurable and his kindness truly appreciated.

To Buzz Charlton and Myles McCallum of Charlton McCallum Safaris who have, faithfully over the years, collected so many of the ovary specimens during their hunting safaris. I thank them sincerely for the uniqueness of the specimens and the great trouble they went to collect and preserve them.

I am indebted to the members and owners of Savé Valley Conservancy for allowing me to collect particularly the young specimens involved in the study and for their constant support and generous hospitality. Without this the thesis would not have been possible.

Dr Sebastien le Bel of CIRAD tolerated my dogged determination to collect specimens from Savé Valley and generously allowed me to work alongside him and take part in his studies involving human wildlife conflict and sustainable usage of wildlife.

I am enourmously grateful to Dr Tahera Ansari and Professor Paul Sibbons of Northwick Park Medical Research Centre, England for their amazing stereological knowledge and kind input. Also to Joey Breedt and Marie Smit at Onderstepoort Veterinary School, and to Sue Gower at the Paul Mellon Laboratory in Newmarket England, for cutting and staining hundreds of 25 µm thick histological sections!

Many friends and family in England have carried me through the highs and lows of the exercise. Lorraine Prothero, Debby Hart, Adie and Ian Wilsher, Dave and Tess McFarlane and Michael and Emma Suddens. They all gave constant and loyal support and, Sandra Wilsher provided humour and thesis preparation survival techniques!

Finally, I offer love and appreciation to my precious son Tristan, throughout most of whose life to date this study has been taking place. For his amazing understanding that "Mum needs to work" and for all the joy he has brought to my life. When prompted by his nursery school teacher as to his mother's occupation, his reply of "My Mummy collects elephant eggs" has brightened many low moments.

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2n2c	Two chromosomes, 2 DNA strands, the genetic constitution of oogonia
2n4c	Two chromosomes, 4 DNA strands, the genetic constitution of primary oocytes
3β-HSD	3β-hydroxysteroid dehydrogenase
5α-DHP	5α-dihidroprogesterone
AMH	anti-mullerian hormone
Ap	Area associated with a point
BCL	B cell lymphoma/leukemia
BV	Biological variation
CE	Coefficient of error
CITES	The Convention in International Trade in Endangered Species
CL	One corpus luteum or more corpora lutea, as would be clear from the context
CN	Corpora nigra
CRL	Crown rump length
CV	Coefficient of variation
D	Dimension, eg. 0–D or 3–D
D1	Diameter 1
D2	Diameter 2
E	For example, E80, embryonic day 80
elPL	Elephant placental lactogen
EP	Early primary follicle, early primary follicles, or the early primary stage of development of a follicle, as would be clear from the context
FGF	Fibroblast-like growth factor
Fig	Factor in germline
FOV	Fields of view
FOX	Forkhead box

FSH	Follicle stimulating hormone
GDF	Growth differentiation factor
GSC	Germline stem cells
H&E	Haematoxylin and Eosin
HEC	Human elephant conflict
IMS	Industrial methylated spirits
KIT	Tyrosine protein kinase
LH	Luteinising hormone
LIF	Leucocyte inhibitory factor
M	Molar tooth eg MII or MVI
min	Minutes
n	Number of a sample
NGF	Non-growing follicle
NP	National Park
Nv	Number in volume
Oct4	Octamer binding transcription factor 4
OSE	Ovarian surface epithelium
PAC	Problem animal control
pZP	Porcine zona pellucida
P	Value of statistical significance
P13k	Phosphotidylinositol 3 kinase
PGC	Primordial germ cell
sec	Seconds
SF	Small follicle or small follicles, as would be clear from the context
SVC	Savé Valley Conservancy
$\sum$	Sum of
$\bar{t}$	Segment thickness

TGF	Transforming growth factor
TP	True primary follicle, true primary follicles or a follicle that is at the true primary stage of development, as would be clear from the context
TPM	True primordial follicle, true primordial follicles, or a follicle that is at the true primordial stage of development, as would be clear from the context
UCF	Unbiased counting frame
Vol.dis	Volume of disector
Vref	Reference volume

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SUMMARY

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By

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Promoter: Professor J O Nöthling

Co-promoter: Professor J Soley

Department: Production Animal Studies

Degree: PhD

The aim of this study was to define the ovarian follicular reserve of wild African elephants in terms of its type of small follicles (SF), its establishment and distribution throughout the ovaries, and the change in numbers of SF in the embryo and fetus as well as throughout prepubertal and adult life.

The large elephant population in Zimbabwe provided the opportunity to collect ovaries from elephants culled for management reasons and hunted professionally. In total, gross morphological and histological studies were done on the gonadal ridges from 5 embryos (76–96 days post conception) and ovaries from 11 fetuses (4.8–22.2 months), 29 prepubertal females (2 months–10 years), 24 adult females (11–55 years) and 7 aged females (56–70 years). Specimens were fixed in 4% buffered formalin before a series of 25 μm thick sections were cut and examined using stereological protocols to count SF numbers in each section and thereby calculate the follicle reserve of the whole ovary. Prior to counting SF numbers, their distribution throughout the ovary was studied and the repeatability of counts was validated.

Numbers of SF were highest in mid-term fetuses, lower in fetuses during the second half of gestation, even lower in calves younger than 4½ years, whereas the numbers in calves aged 4½–9 years were significantly higher than those in younger calves, and similar to

what they were in late-term fetuses. The numbers of SF were substantially and highly significantly lower in elephant 10–15 years in age compared to calves aged 4½9 years, suggesting a reduction around puberty. Thereafter the ovarian reserve fell steadily until depletion around the age of 70 years. During adult life the ovarian reserve was composed of early-primary (EP) and true-primary (TP) follicles. By 45 years of age only TP follicles remained although these enabled oestrous cyclical activity for many more years; of 7 sets of ovaries recovered from females aged 57–70 years, 6 showed evidence of cyclical activity or pregnancy within the preceding 6 years.

The study shows that EP and TP form the follicular reserve from before birth until 45 years, with TP forming the reserve thereafter, which depletes in some old elephants and persists to maximum life span in others.