Anti-GENA (germ cell-specific antigen) antibody, rat clone TRA98

73-003 100 ug,

Storage: Ship at 4℃ and store at -20℃ (Avoid freezing by storing below -20℃)

Reactivity: mouse

Immunogen: Cell lysate of adult mouse testis. Rat hybridoma clone TRA98 was established by Dr. Tanaka H and Prof. Nishimune Y at Osaka University

Applications:

1. Western blotting (1/1,000- 1/5,000)
2. Immunoprecipitation (1/200)
2. Immunofluorescence staining (1/400)
3. Immunohistochemical staining (1/200-1/500)
4. Flow Cytometry

Form: Purified IgG (1 mg/ml) in PBS(-), 50% glycerol. Azide and carrier free)

Isotype: Rat IgG2a

Background: A monoclonal antibody TRA98 recognizes a mouse testicular germ cell-specific antigen (1). In adult tissues, bands of 60-100 kDa proteins are detected only in the testis by Western blotting analysis with TRA98 (Fig. 1). The signals are observed in male and female embryos after embryonic day 12.5. The signal in male is detected during development of germ cells and also after birth, but the signal in female disappears by 5 days after birth. The antigen is localized only in the nuclear fraction of testicular germ cells and this antibody can be used for immunohistochemical staining of testicular germ cells (1, 2).

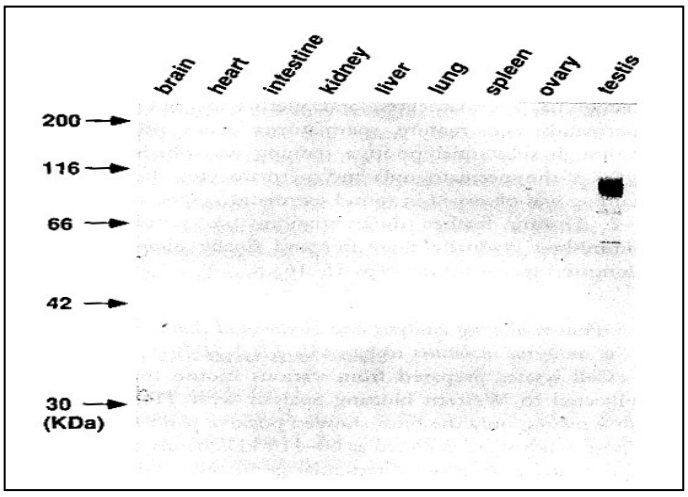

Fig.1. Western blot analysis with TRA98 of various mouse tissues.

The antibody was used at 1 ug/ml The tissue homogenate samples were applied at 100 ug protein per lane. Note that TRA98 is detected only in testis lysate.

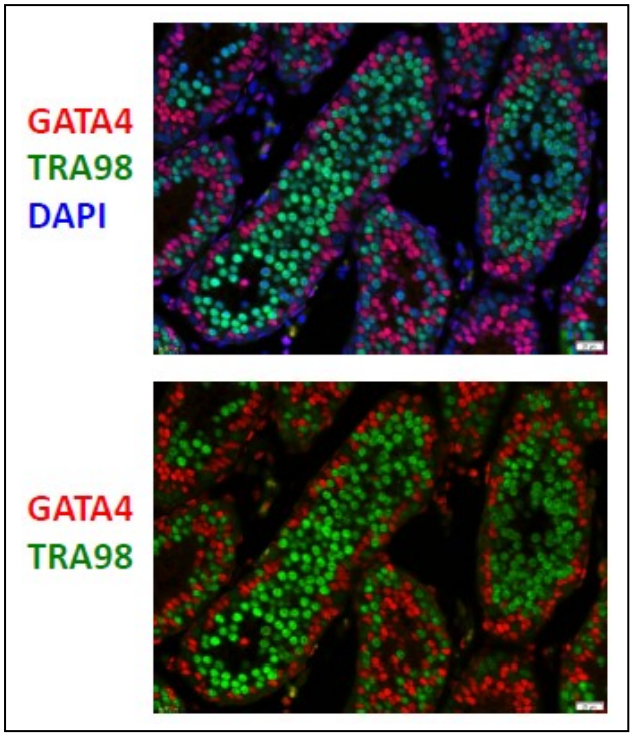

Fig.2. Immunohistochemical staining of a 10-day-old testis with germ cell-specific antibody, TRA98.

Sections of 10-day-old mouse testis were fixed with 4% paraformaldehyde and embedded in paraffin. After antigen retrieval by boiling for 10 min in 10 mM citrate buffer (pH 6), they were reacted with the anti-TRA98 antibody (Green) at 1/400 dilution and anti-GATA4 antibody (Red). As the 2nd antibody, Donky anti-rat Alexa Fluor488 and Donkey anti-rabbit Alexa Fluor594 were used. DNA was stained with DAPI (Blue) in the above figure.

Anti-GATA antibody stains nuclei of Sertoli cells in seminiferous tubule while anti-TRA98 stains reproductive cells.

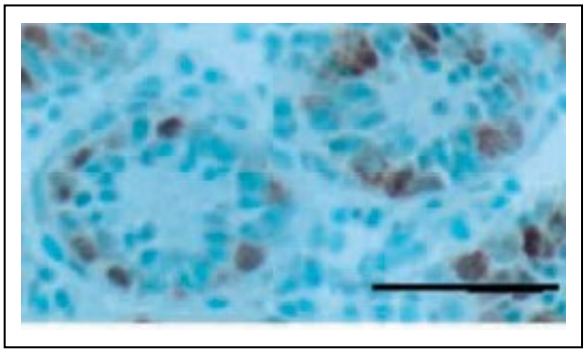

Fig.3. Immunohistochemical staining of a 7-day-old testis with germ cell-specific antibody, TRA98.

Frozen sections were reacted with the antibody and the antibody was detected by the avidin-biotin-peroxidase complex method with hydrogen peroxide and diaminobenzidine.

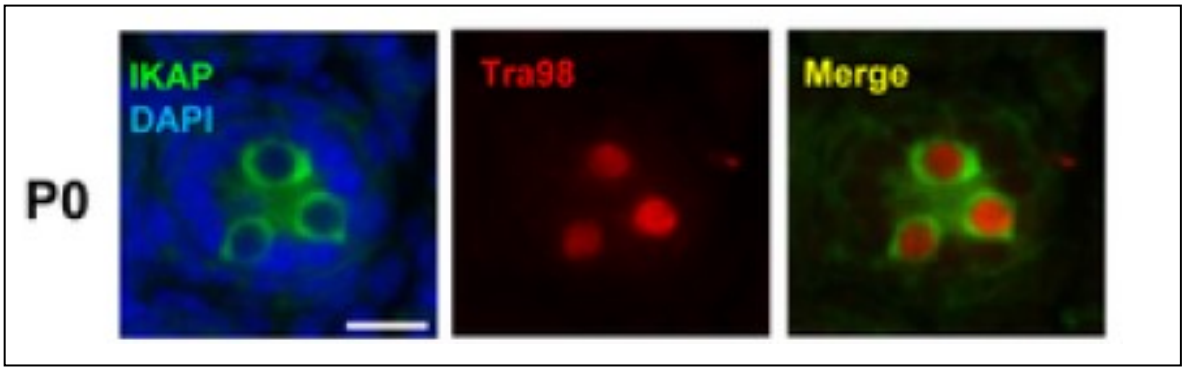

Fig.4 Colocalization of germ cell specific marker, Tra98, with IKAP at PO during spermatogenesis as shown by imunohistological staining. Image from . PLoS Genet. 2013 May;9(5):e1003516 authored by Lin FJ et al.

Related products: #73-001 Anti-SLA (spermatid specific antigen) antibody, clone TRA54

References: This product has been used in the following publications (77).

1.Fukunaga H et al. Application of an Ex Vivo Tissue Model to Investigate Radiobiological Effects on Spermatogenesis. Radiat Res. 2018 Jun;189(6):661-667. PMID: 29595376. **IHC (mouse)**

2, Gu W et al. Dnd1-mediated epigenetic control of teratoma formation in mouse. Biol Open. 2018 Jan 29;7(1). PMID: 29378702.**IHC-F (mouse)**

3. Pui HP, Saga Y . Gonocytes-to-spermatogonia transition initiates prior to birth in murine testes and it requires FGF signaling. Mech Dev. 2017 Apr;144(Pt B):125-139. PMID: 28341395. **IHC-F (mouse)**

4.Okada R et al. Expression Profile of NOTCH3 in Mouse Spermatogonia. Cells Tissues Organs. 2017;204(5-6):283-292. PMID: 29161703. **IHC-F (mouse)**

5.Matsuura T et al. Zfp296 negatively regulates H3K9 methylation in embryonic development as a component of heterochromatin. Sci Rep. 2017 Sep 29;7(1):12462. PMID: 28963472. **IHC-F (mouse)**

6.Kang HS et al. Transcription Factor GLIS3: A New and Critical Regulator of Postnatal Stages of Mouse Spermatogenesis. Stem Cells. 2016 Nov;34(11):2772-2783. PMID: 27350140. **IHC-F (mouse)**

7.Ozawa M et al. The Histone Demethylase FBXL10 Regulates the Proliferation of Spermatogonia and Ensures Long-Term Sustainable Spermatogenesis in Mice. Biol Reprod. 2016 Apr;94(4):92. PMID: 26984996. **IHC-P (mouse)**

8.Dean A et al. Analgesic exposure in pregnant rats affects fetal germ cell development with inter-generational reproductive consequences. Sci Rep. 2016 Jan 27;6:19789. PMID:26813099. **IHC-P (mouse)**

9.Malki S et al. A Whole-Mount Approach for Accurate Quantitative and Spatial Assessment of Fetal Oocyte Dynamics in Mice. Biol Reprod. 2015 Nov;93(5):113. PMID: 26423126. **IHC (mouse)**

10.Lovasco LA et al. TAF4b is required for mouse spermatogonial stem cell development.Stem Cells. 2015 Apr;33(4):1267-76. PMID:25727968. **IF (mouse)**

11.Sun T et al. Lats1 Deletion Causes Increased Germ Cell Apoptosis and Follicular Cysts in MouseOvaries. Biol Reprod. 2015 Jul;93(1):22. PMID:26040669. **IHC (mouse)**

12.Matsubara Y. et al. TALEN-Mediated Gene Disruption on Y Chromosome Reveals

Critical Role of EIF2S3Y in Mouse Spermatogenesis. Stem Cells Dev. 2015 May 15;24(10):1164-70. PMID:25579647**IHC-P (mouse)**

13.Okuda H. et al. A novel transcriptional factor Nkapl is a germ cell-specific suppressor
of Notch signaling and is indispensable for spermatogenesis.PLoS One. 2015 Apr 14;10(4). **IHC-P (mouse)**

14.Ito K et al. Gene targeting study reveals unexpected expression of brain-expressed X-linked 2 in endocrine and tissue stem/progenitor cells in mice. J Biol Chem. 2014 Oct 24;289(43):29892-911. PMID: 25143383.**IHC-P (mouse)**

15.Zhang T et al. The mammalian Doublesex homolog DMRT6 coordinates the transition
between mitotic and meiotic developmental programs during spermatogenesis. Development. 2014 Oct;141(19):3662-71. PMID: 25249458. **IHC-P (mouse)**

16.Zhang J et al. Reconstruction of a seminiferous tubule-like structure in a 3 dimensional culture system of re-aggregated mouse neonatal testicular cells within a collagen matrix. Gen Comp Endocrinol. 2014 Sep 1;205:121-32. PMID: 24717811.**IHC-P (mouse)**

17.Grive KJ et al. TAF4b promotes mouse primordial follicle assembly and oocyte survival. Dev Biol. 2014 Aug 1;392(1):42-51. PMID:24836512. **IHC-F (mouse)**

18.Kuroki S et al. JMJD1C, a JmjC Domain-Containing Protein, Is Required for Long-Term Maintenance of Male Germ Cells in Mice. Biol Reprod. 2013 Oct 17;89(4):93. PMID:24006281. IHC-P (mouse)

19.Shirakawa T et al. An epigenetic switch is crucial for spermatogonia to exit the undifferentiated state toward a Kit-positive identity. Development. 2013 Sep;140(17):3565-76 PMID: 23903187. **IHC (mouse)**

20.Bi J et al. Basigin null mutant male mice are sterile and exhibit impaired interactions between germ cells and Sertoli cells. Dev Biol. 2013 Aug 15; 380 (2): 145-56. PMID:23727514. **IHC-P (mouse)**

21.Lin FJ et al. Ikbkap/Elp1 deficiency causes male infertility by disrupting meiotic progression. PLoS Genet. 2013 May;9(5):e1003516. **IHC (mouse)**

22.Manosalva I et al. Hes1 in the somatic cells of the murine ovary is necessary for oocyte survival and maturation. Dev Biol. 2013 Mar 15;375(2):140-51. PMID: 23274689. **IHC-F (mouse)**

23.Wu Q et al. Nodal/activin signaling promotes male germ cell fate and suppresses female programming in somatic cells. Development. 2013 Jan 15;140(2):291-300. PMID:23221368. **IHC-F (mouse)**

24.Yamaguchi S et al. Dynamics of 5-methylcytosine and 5-hydroxymethylcytosine during
germ cell reprogramming. Cell Research 2013,Feb: 23, 329–339. PMID: 23399596 **IHC-F (mouse)**

25.Yamaguchi S. et al. Tet1 controls meiosis by regulating meiotic gene expression. Nature. 2012 Dec 20;492(7429):443-7. PMID: 23151479. **IHC (mouse)**

26.Kim Y et al. An essential role for a mammalian SWI/SNF chromatin-remodeling complex during male meiosis. Development. 2012 Mar;139(6):1133-40. PMID: 22318225. **IHC-F (mouse)**

27.Krentz AD et al. DMRT1 promotes oogenesis by transcriptional activation of *Stra8* in the mammalian fetal ovary. Dev Biol. 2011 Aug 1;356(1):63-70. PMID: 21621532. **IHC-P , IF (mouse)**

28.Geyer CB et al. Rhox13 is translated in premeiotic germ cells in male and female mice
and is regulated by NANOS2 in the male. Biol Reprod. 2012 Apr 27;86(4):127. PMID: 22190708. **IHC-P (mouse)**

29.Sada A et al. NANOS2 acts downstream of glial cell line-derived neurotrophic factor signaling to suppress differentiation of spermatogonial stem cells. Stem Cells. 2012 Feb;30(2):280-91. PMID: 22102605. **IHC (mouse)**

30.Mazaud-Guittot S et al. Phenotyping the claudin 11 deficiency in testis:from histology to immunohistochemistry. Methods Mol Biol. 2011;763:223-36. PMID: 21874455. **IHC-P (mouse)**

31.Maekawa M et al. Localisation of RA175 (Cadm1), a cell adhesion molecule of the immunoglobulin superfamily, in the mouse testis, and analysis of male infertility in the RA175 - deficient mouse. Andrologia. 2011 Jun;43(3):180-8. PMID:21486398. **IHC-P (mouse)**

32.Ebata KT et al. Soluble growth factors stimulate spermatogonial stem cell divisions that maintain a stem cell pool and produce progenitors in vitro. Exp Cell Res. 2011 Jun 10;317(10):1319-29. PMID:21420950. **IHC-P (mouse)**

33.Holloway K et al. NEK1 Facilitates Cohesin Removal during Mammalian Spermatogenesis. Genes (Basel). 2011 Mar 7;2(1):260-79. PMID: 21931878 **IHC (mouse)**

34.Gao L et al. Two regions within the proximal steroidogenic factor 1 promoter drive somatic cell-specific activity in developing gonads of the female mouse. Biol Reprod. 2011 Mar;84(3):422-34. PMID: 20962249. **IHC-F (mouse)**

35.Inoue N et al. Expression of a Testis-Specific Nuclear Protein, TRA98, in Mouse

Testis during Spermatogenesis. A Quantitative and Qualitative Immunoelectron Microscopy (IEM) Analysis. Open Journal of Cell Biology, 2011, 1, 11-20. **WB, Dot blot, IHC-F, Immuno-Electron Microscopy (mouse)**

36.Saga Y. Function of Nanos2 in the male germ cell lineage in mice. Cellular and Molecular Life Sciences November 2010, Volume 67, Issue 22, pp 3815–382. PMID: 20652721. **IHC (mouse)**

37.Matson CK et al. The Mammalian Doublesex Homolog DMRT1 Is a Transcriptional Gatekeeper that Controls the Mitosis versus Meiosis Decision in Male Germ Cells. Dev Cell. 2010 Oct 19;19(4):612-24. PMID:20951351. **IHC-P (mouse)**

38Ciraolo E et al. Essential Role of the p110 Subunit of Phosphoinositide 3-OH Kinase in Male Fertility. Mol Biol Cell. 2010 Mar 1;21(5):704-11. PMID:20053680.**IHC-P (mouse)**

39.Huang CC, and Yao HH Inactivation of Dicer1 in Steroidogenic factor 1-positive cells reveals tissue-specific requirement for Dicer1 in adrenal, testis, and ovary. BMC Dev Biol. 2010 Jun 11;10:66. PMID:20540774. **IHC-P (mouse)**

40.Nicholas CR et al. Intact fetal ovarian cord formation promotes mouse oocyte survival and development. BMC Dev Biol. 2010 Jan 8;10:2 PMID: 20064216 **IHC-P (mouse)**

41.Sun J et al. Rad18 is required for long-term maintenance of spermatogenesis in mouse testes. Mech Dev. 2009 Mar-Apr;126(3-4):173-83. PMID:19068231. **IHC-P (mouse)**

42.Ohta H et al. Male germline and embryonic stem cell lines from NOD mice: efficient derivation of GS cells from a nonpermissive strain for ES cell derivation. Biol Reprod. 2009 Dec;81(6):1147-53. PMID: 19726737. **IF (mouse)**

43.Yamaguchi S et al. Conditional knockdown of Nanog induces apoptotic cell death in mouse migrating primordial germ cells. Development. 2009 Dec;136(23):4011-20. PMID:19906868. **IHC-F (mouse)**

44.Krentz AD et al. The DM domain protein DMRT1 is a dose-sensitive regulator of fetal germ cell proliferation and pluripotency. Proc Natl Acad Sci U S A. 2009 Dec 29;106(52):22323-8. PMID:20007774. **IHC (mouse)**

45.Shoji M et al. The TDRD9-MIWI2 complex is essential for piRNA-mediated retrotransposon silencing in the mouse male germline. Dev Cell. 2009 Dec;17(6):775-87. PMID:20059948. **IHC-F (mouse)**

46.Nicholas CR et al. Transplantation directs oocyte maturation from embryonic stem cells and provides a therapeutic strategy for female infertility. Hum Mol Genet. 2009 Nov 15;18(22):4376-89. **IHC-P (mouse)**

47.Hirai T et al. Effect of 1,25-Dihydroxyvitamin D on Testicular Morphology and Gene Expression in Experimental Cryptorchid Mouse: Testis Specific cDNA Microarray Analysis and Potential Implication in Male Infertility. J Urol. 2009 Mar;181(3):1487-92. PMID:19157449. **IHC-P (mouse)**

48.Barrionuevo F etal. estis cord differentiation after the sex determination stage is independent of Sox9 but fails in the combined absence of Sox9 and Sox8. Dev Biol. 2009 Mar 15;327(2):301-12. PMID: 19124014. **IHC-P (mouse)**

49.Toyoda S et al.*Sohlh2* affects differentiation of KIT positive oocytes and spermatogonia. Dev Biol. 2009 Jan 1;325(1):238-48. PMID:19014927. **IHC-F (mouse)**

50.Huang X et al. Inhibitory Phosphorylation of Separase Is Essential for Genome Stability and Viability of Murine Embryonic Germ Cells. PLoS Biol. 2008 Jan;6(1):e15. PMID:18232736. **IHC-P (mouse)**

51.Tokuhiro K et al. The 193-Base Pair *Gsg2* (Haspin) Promoter Region Regulates Germ Cell-Specific Expression Bidirectionally and Synchronously. Biol Reprod. 2007 Mar;76(3):407-14. PMID:17123944. **WB (mouse).**

52.Kim S et al. Cell type-autonomous and non-autonomous requirements for Dmrt1 in postnatal testis differentiation. Dev Biol. 2007 Jul 15;307(2):314-27. PMID:17540358. **IHC-P (mouse)**

53.Suzuki A et al. Functional redundancy among Nanos proteins and a distinct role of Nanos2 during male germ cell development. Development. 2007 Jan;134(1):77-83. PMID:17138666. **IHC-P (mouse)**

54.Kimura T et al. The stabilization of beta-catenin leads to impaired primordial germ cell development via aberrant cell cycle progression. Dev Biol. 2006 Dec 15;300(2):545-53. **PMID:17055474. IHC-F (mouse)**

55.Chuma S et al. Tdrd1/Mtr-1, a tudor-related gene, is essential for male germ-cell differentiation and nuage/germinal granule formation in mice. Proc Natl Acad Sci U S A. 2006 Oct 24;103(43):15894-9. PMID:17038506. **IHC-P (mouse)**

56.Yamaguchi YL et al. Expression of low density lipoprotein receptor-related protein 4 (*Lrp4*) gene in the mouse germ cells. Gene Expr Patterns. 2006 Aug;6(6):607-12. PMID:16434236. **IHC-P (mouse)**

57.Hasegawa K et al. Testatin transgenic and knockout mice exhibit normal sex-differentiation. Biochem Biophys Res Commun. 2006 Mar 10;341(2):369-75. PMID: 16427609. **IHC-P (mouse)**

58.Isotani A et al. Genomic imprinting of XX spermatogonia and XX oocytes recovered from XX<-->XY chimeric testes. Proc Natl Acad Sci U S A. 2005 Mar 15; 102(11): 4039-44. PMID:15746241 **IHC -P (mouse)**

59.Shoji M et al. RNA interference during spermatogenesis in mice. Dev Biol. 2005 Jun 15;282(2):524-34. PMID:15950615. **IHC, FC (mouse)**

60.Yamaguchi Nanog expression in mouse germ cell development. Gene Expr Patterns. 2005 Jun;5(5):639-46. PMID:15939376. **IHC-F (mouse)**

61.Sakai Y et al. Co-expression of de novo DNA methyltransferases Dnmt3a2 and Dnmt3L in gonocytes of mouse embryos. Gene Expr Patterns. 2004 Dec;5(2):231-7. PMID:15567719. **IHC-F (mouse)**

62.Ohta H et al.Commitment of fetal male germcells to spermatogonial stemcells during mouse embryonic development. Biol Reprod. 2004 May;70(5):1286-91. PMID:14695910. **IHC-P (mouse)**

63.Ohta H et al. Proliferation and Differentiation of Spermatogonial Stem Cells in the *W/W*^{v} Mutant Mouse Testis Biol Reprod. 2003 Dec;69(6):1815-21. PMID: 12890724. **IHC-P (mouse)**

64.Kasai S et al. Haploinsufficiency of Bcl-x leads to male-specific defects in fetal germ cells: differential regulation of germ cell apoptosis between the sexes. Dev Biol. 2003 Dec 1;264(1):202-16. PMID:14623242. **IHC-P (mouse)**

65.Yomogida K et al. Dramatic expansion of germinal stem cells by ectopically expressed human glial cell line-derived neurotrophic factor in mouse Sertoli cells. Biol Reprod. 2003 Oct;69(4):1303-7. PMID:12801989. **IHC-P (mouse)**

66.Kim JM. Hypomorphic mutation in an essential cell-cycle kinase causes growth retardation and impaired spermatogenesis. EMBO J. 2003 Oct 1;22(19):5260-72. PMID:14517263. **WB, IHC-P (mouse)**

67.Ohbo K et al. Identification and characterization of stem cells in prepubertal spermatogenesis in mice. Dev Biol. 2003 Jun 1;258(1):209-25. PMID:12781694. **IHC-F (mouse)**

68.Kimura T et al. Conditional loss of PTEN leads to testicular teratoma and enhances embryonic germ cell production Development. 2003 Apr;130(8):1691-700. PMID:12620992. **IHC (mouse)**

69.Sakata S et al. Involvement of death receptor Fas in germ cell degeneration in gonads of Kit-deficient Wv/Wv mutant mice. Cell Death Differ. 2003 Jun;10(6):676-86. PMID:12761576. **IHC-F (mouse)**

70.Sato M et al. Identification of PGC7, a new gene expressed specifically in preimplantation embryos and germ cells. Mech Dev. 2002 Apr;113(1):91-4. PMID:11900980. **IHC (mouse)**

71.Tadokora Y et al. Homeostatic regulation of germinal stem cell proliferation by the

GDNF/FSH pathway. Mech Dev. 2002 Apr;113(1):29-39. PMID:11900972. **IHC-P (mouse)**

72.Meng X et al.Promotion of seminomatous tumors by targeted overexpression of glial cell line-derived neurotrophic factor in mouse testis. Cancer Res. 2001 Apr 15; 61(8):3267-71. PMID:11309277. **IHC-P (mouse)**

73.Ohta H et al. Defect in germ cells, not in supporting cells, is the cause of male infertility in the jsd mutant mouse: proliferation of spermatogonial stem cells without differentiation. Int J Androl. 2001 Feb;24(1):15-23. PMID:11168646. **IHC-F (mouse)**

74.Ohta H et al. Regulation of proliferation and differentiation in spermatogonial stem cells: the role of c-kit and its ligand SCF. *Development* 127: 2125-2131 (2000) PMID: 10769236 **IHC (mouse)**

75.Danno S. Decreased Expression of Mouse Rbm3, a Cold-Shock Protein, in Sertoli Cells of Cryptorchid Testis. Am J Pathol. 2000 May;156(5):1685-92. PMID:10793079. **IHC-P (mouse)**

76.Tanaka SS et al. The mouse homolog of Drosophila Vasa is required for the development of male germ cells. The mouse homolog of Drosophila Vasa is required for the development of male germ cells. Genes Dev. 2000 Apr 1;14(7):841-53. PMID:10766740. **WB, IHC-P (mouse)**

77.Toyoda-Ohno H et al..Members of the ErbB receptor tyrosine kinases are involved in germ cell development in fetal mouse gonads. Dev Biol. 1999 Nov 15;215(2):399-406. PMID:10545246. **IHC-P (mouse)**

78.Tanaka H et al . A germ cell-specific nuclear antigen recognized by a monoclonal antibody raised against mouse testicular germ cells. *Int J Androl* 20: 361-366 (1997) PMID: 9568529 **WB (mouse)**