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# Division of Genome Biology
# Department of Radiation Biology


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| Professor | Shinya MATSUURA, M.D., Ph.D. | |
| Research Associate | Miki SHINOHARA, Ph.D. | (～March 31, 2004) |
| Research Associate | Ken-ichi MORISHIMA, M.Sc. | (April 1, 2003～) |
| COE Research Assistant | Hiroki SHIMA, M.Sc. | (～March 31, 2004) |


The purpose of our department is to elucidate the molecular mechanisms of DNA repair and genome stability by using human cell lines from patients with cancer-prone genetic disorders. Previously, we have isolated the NBS1 gene for radiation-sensitive genetic disorder, and found that the gene could have the multiple cellular functions, such as homologous recombination repair, cell-cycle checkpoints, telomere maintenance, cellular senescence, and meiosis. At present, we are trying to isolate the novel DNA repair genes and characterize these functions, and also studying the mechanisms of mitotic-spindle assembly checkpoints, by using the cell lines of the novel premature chromatid separation syndrome. These studies will be useful for molecular mechanism of the DNA repair, cell-cycle checkpoints and carcinogenesis.

Following research projects were carried out during the fiscal year of 2003.

1. Cytogenetic analysis of cancer-prone genetic disorder, PCS.
2. The molecular function of Nbs1/Xrs2 in the coordination of DNA damage repair and cell cycle regulation to keep genome stability.
3. Molecular mechanisms of meiotic crossover control; Analysis for functional relationship between the recombination machinery and the ATR protein.
4. Analysis of homologous recombination repair in cells from patients with Fanconi anemia group D1.
5. Genetic analysis of Smith-Lemli-Opitz syndrome in Japan.

Research associate, Ken-ichi Morishima, was promoted in April 2003, and Dr. Miki Shinohara (research associate) moved to Osaka University in March 2004.

Dr. Shinya Matsuura gave lectures on medical science and molecular methodology to the postgraduate students. He also had lectures on radiation biology and human genetics to the medical and dental students.

Dr. Miki Shinohara performed a presentation in a special symposium entitled "The career and the life cycle of female scientists" in the 26th annual meeting of the Molecular Biology Society of Japan.

Mr. Ken-ichi Morishima studied BRCA2 function in homologous recombination DNA repair.

## 1. Cytogenetic analysis of cancer-prone genetic disorder, PCS.

Matsuura, S., Kajiwara, Y., Ikeuchi, T. (Tokyo Med. Dent. Univ.), Kajii, T. (Hachioji)

A chromosomal instability syndrome of premature chromatid separation (PCS syndrome) is a mitotic-spindle checkpoint disorder, characterized by a variety of mosaic aneuploidies, especially trisomies, double trisomies, and monosomies, a finding

called "mosaic variegated aneuploidy (MVA)" and premature separation of sister-chromatids in all chromosomes, called "premature chromatid separation (PCS)". To determine the molecular basis of this disorder, we established immortalized skin fibroblast cell lines from the two unrelated Japanese infants, and studied the expression and subcellular localization of mitotic checkpoint proteins by western blotting and immunofluorescence analysis. We found that the expression level of BubR1 protein was remarkably decreased in PCS cells, and only faint BubR1 signals were detected on kinetochores by immunofluorescence analysis. Furthermore, in PCS cells, p55cdc failed to associate with the kinetochores. These abnormal cellular features of PCS cells were normalized after introduction of BubR1 cDNA. Sequence analysis of the infants' cells detected no mutations in both coding and promoter regions of the BubR1 gene. From these results, we proposed the model that the reduced expression of BubR1 protein, possibly due to its instability caused by the deficiency of BubR1-associated unknown factor, might result in abolished kinetochore localization of p55cdc, and cause the mitotic checkpoint defects in PCS cells.

**2. The molecular function of Nbs1/Xrs2 in the coordination of DNA damage repair and cell cycle regulation to keep genome stability.**

Shinohara, M., Shima, H., Suzuki, M., Matsuura, S.

The Mre11/Rad50/Nbs1(Xrs2) protein complex; MRN(X) complex play important role in DNA damage repair, DNA damage response, telomere maintenance and meiotic DSB repair. So MRN(X) complex may be a key factor to maintain genome stability.

MRN(X) complex function is well conserved in eukaryotes from yeast to human. In human, the lacking function of the MRN complex causes genetic disorders show radiation sensitivity and genome instability, which like Nijmegen breakage syndrome (Nbs1 defect) or AT-LD (Mre11 defect). But the molecular function of MRN(X) complex and especially Nbs1/Xrs2 function is still unknown.

Here we analyzed the function of Xrs2, a homologue of Nbs1, in *Saccharomyces cerevisiae*. First we tried to identify the functional domains, which are corresponded to each function. From this analysis, we identified an Mre11-interaction domain in the C-terminal region of Xrs2 and showed xrs2 mutation lacking the domain loses all the functions. And we found a Tel1 binding domain in C-terminal end is required for recruitment of Tel1 to telomere. And also we showed the conserved FHA domain in N-terminus region is required for NHEJ and *rad50S* checkpoint pathway.

**3. Molecular mechanisms of meiotic crossover control; Analysis for functional relationship between the recombination machinery and the ATR protein.**

Shinohara, M.

Meiosis is an essential process to generate gametes. Reciprocal crossover recombination provides physical connections that facilitate proper segregation of homologous chromosomes at the first meiotic division.

While the recombination machinery is basically similar from each other, there are some differences between mitotic and meiotic recombination. And the small differences cause a big biological effect. In mitotic cell cycle, gene conversion occurs between the sisters to repair DNA lesions without any errors and arrangements. But in meiosis, crossover recombination is occurred between the homologues, thus renewed chromosome sets are given over to the next generation. To make sure the factors and the mechanisms that generates the difference mitotic and meiotic recombination, we analyzes using budding yeast.

We showed that the two RecAs, Rad51 and Dmc1, and their accessory protein Rad54 and Tid1 are the major factors to perform meiotic crossover recombination. And especially Dmc1 and Tid1 as meiotic specific RecA homologue and its accessory protein are important for crossover control during meiosis. And Mec1, an ATM-related; ATR homologue has an important role to coordinate Rad51 and Dmc1 on the Meiotic DSB repair and crossover regulation. We showed that the *mec1* mutation suppressed a delay of meiotic DSB repair of *tid1* mutant cell in Rad51-dependent Dmc1-independent manner. This result indicates that Rad51 is able to repair meiotic DSBs without Dmc1 in the absence of Mec1. Then Mec1 may regulate Rad51

activity during meiosis.

**4. Analysis of homologous recombination repair in cells from patients with Fanconi anemia group D1.**

Morishima, K., Matsuura, S., Sakamoto, S. (Kyoto Univ.), Komatsu, K. (Kyoto Univ.)

Fanconi Anemia (FA) is an autosomal recessive disorder characterized by bone marrow failure, high incidence of cancer, and a diverse variety of congenital malformations. Most FANC genes have been cloned, and their function has been analyzed. Recently, FANCD1 has been shown to be identical to BRCA2, which is known to interact with the homologous recombination (HR) protein Rad51. In this study, we analyzed several FA-D1 cell lines, which express distinct truncated FANCD1 (BRCA2) proteins, for their ability to interact with Rad51 and to form DNA damage-induced Rad51 nuclear foci. The FA-D1 cells showed normal nuclear localization of Rad51, but DNA damage-induced Rad51 focus formation has been impaired. Next, we examined the ability of HR-dependent DNA repair in the FA-D1 cells using DR-GFP reporter system. Reduced frequency of GFP-positive cells was observed in the FA-D1 cells. These results suggest that the impaired Rad51 focus formation in the FA-D1 cells could result in reduced HR-dependent DNA repair.

**5. Genetic analysis of Smith-Lemli-Opitz syndrome in Japan.**

Matsuura, S., Tsukahara, M. (Yamaguchi Univ.)

Smith-Lemli-Opitz syndrome (SLOS) is an autosomal recessive malformation syndrome characterized by microcephaly, syndactyly of toes, ambiguous genitalia, and mental retardation. The underlying DHCR7 gene has been isolated and a wide variety of distinct mutations were reported in USA and European SLOS patients. A significant difference has been suggested in the frequency of SLOS among different ethnic populations. We have analyzed DHCR7 genes of six Japanese SLOS patients, and identified distinct mutations. One of the mutations appeared to be most prevalent among Japanese SLOS patients, suggesting that this mutation might be a predominant founder mutation in Japanese SLOS patients.

**A. Original Papers**

1. Hama,S.[*1], Matsuura,S., Tauchi,H.[*2], Yamasaki,F.[*1], Kajiwara,Y.[*1], Arita,K.[*1], Yoshioka,H.[*1], Heike,Y.[*3], Mandai,K.[*4], Kurisu,K.[*1] ([*1]Dept. of Neurosurgery, Hiroshima Univ., Sch.of Med., [*2]Ibaraki Univ., Sch.of Sci., [*3]Division of Clinical Res., National Shikoku Cancer Center Hospital, [*4]Division of Pathology, National Shikoku Cancer Center Hospital) : p16 Gene transfer increases cell killing with abnormal nucleation after ionising radiation in glioma cells., Br.J.Cancer, 89:1802-1811, 2003. (G, I)

2. Matsuura,S., Kobayashi,J.[*1], Tauchi,H.[*2], Komatsu,K.[*3] ([*1]Fac.Dent., Hiroshima Univ., [*2]Faculty of Sci., Ibaraki Univ., [*3]Radiat.Biol.Center, Kyoto Univ.) : Nijmegen breakage syndrome and DNA double strand break repair by NBS1 complex., Advances in Biophys. (in press)

3. Miyazaki,T.[*1], D.A.Bressan[*4], M.Shinohara, J.E.Haber[*4] and A.Shinohara[*1,2,3] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]Institute for Protein Research, Osaka Univ., [*3]PRESTO, JST, [*4]Brandeis Univ.): *In vivo* assembly and disassembly of Rad51 and Rad52 complexes during double-strand break repair., EMBO J., 23:950-958, 2004. (I)

4. Tsukamoto,M.[*], K.Yamashita[*], T.Miyazaki[*], M.Shinohara and A.Shinohara[*] (Dept. of Biology, Graduate School of Science, Osaka Univ., PRESTO, JST): The N-terminal DNA-binding domain of Rad52 promotes *RAD51*-independent recombination in *Saccharomyces cerevisiae*., Genetics, 165:1703-1715, 2003. (I)

5. Shinohara,M., K.Sakai[*1], T.Ogawa[*2] and A.Shinohara[*1] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ.,

[*2]Iwate College of Nursing) : The mitotic damage checkpoint proteins Rad17 and Rad24 are required for repair of double-strand breaks during meiosis in yeast., Genetics, 164:855-865, 2003. (I)

6. Shinohara,A.[*1,2,3] and M.Shinohara ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]Institute for Protein Research, Osaka Univ., [*3]PRESTO, JST) : Roles of RecA homologues Rad51 and Dmc1 during meiotic recombination. Cytogenet Genome Res (2004) in press. (I)

7. Yamashita,K.,[*1], M.Shinohara and A.Shinohara[*1, 2, 3] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]Institute for Protein Research, Osaka Univ., [*3]PRESTO, JST) : Rad6-Bre1-mediated histone H2B ubiquitylation promotes the formation of double-strand breaks during meiosis., Proc.Natl.Acad.Sci.USA (2004) in press. (I)

8. Shima,H., S.Matsuura and M.Shinohara: The N-terminal domain of Xrs2 is required for the Tel1-mediated DNA damage response pathway in *Saccharomyces cerevisiae.* J.Hiroshima Med.Ass. (2004) in press. (R, G)

9. S.Matsuura, T.Ikeuchi[*1], S.Matsuura, T.Kajii[*2] ([*1]Division of Genetics, Med.Res.Inst., Tokyo Medical and Dental Univ., [*2]Yamaguchi Univ.) : Premature chromatid separation (PCS) syndrome. J.Clin.Exp.Med., vol.208, No.10, 870-874, 2004. (G)

**B. Meeting Presentations**

1. Y.Kajiwara[*1,2], K.Morishima, J.Kobayashi[*3], K.Kurishu[*2], H.Tauchi[*4], K.Komatsu[*5], M.Oshimura[*6], T.Ikeuchi[*7], T.Kajii[*8], S.Matsuura ([*1]Dept. Rad. Biol., RIRBM, Hiroshima Univ., [*2]Dept. Neurosurgery, Faculty of Medicine, Hiroshima Univ., [*3]Hiroshima Univ., Fac. Dent., [*4]Dept. Environ. Sci., Ibaraki Univ., [*5]RBC, Kyoto Univ., [*6]Tottori Univ., School of Life Science, Faculty of Medicine, [*7]Tokyo Med. Dent. Univ., [*8]Hachioji) : Analysis of mitotic spindle checkpoint defects in human mutant cells. Annual meeting of the brain tumor association, 2003.

2. S.Matsuura, A.Antoccia[*1], M.Shinohara, H.Tahara[*2], M.Yamada[*3], K.Kobayashi[*3] ([*1]Roma Univ., [*2]Hiroshima Univ., Dept. Cell. Mol. Biol., [*3]Dept. Pediatrics, Hokkaido Univ.) : Establishment of immortal cell lines from patient with hyper-radiation sensitivity. The 44 Annual Meeting of Research Society for Delayed Effects of Atomic Bomb Detonation, Hiroshima, June 1, 2003.

3. H.Shima, S.Matsuura, M.Shinohara: Roles of Xrs2 in the cell responses to DNA damage induced by ionizing-radiation. The 44 Annual Meeting of Research Society for Delayed Effects of Atomic Bomb Detonation, Hiroshima, June 1, 2003. (R, G)

4. T.Ikeuchi[*1], S.Matsuura, T.Kajii[*2] ([*1]Division of Genetics, Med.Res.Inst., Tokyo Medical and Dental Univ., [*2]Hachioji) : Cancer-prove genetic trait characterized by PCS and mosaic variegated aneuploidy. The 9th Meeting of Familiar Tumor Society, Tokyo, June 13-14, 2003.

5. T.Miyazaki[*1], D.E.Bressan[*3], J.E.Haber[*3], M.Shinohara and A.Shinohara[*1,2] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]PRESTO, JST, [*3]Brandeis Univ.) : *In vivo* assembly/disassembly pathway of Rad51 and Rad52 complexes in response to a single double strand break. FASEB Summer Research Conferences, Genetic Recombination and Chromosome Rearrangements, Snowmass, Colorado, USA, July 26-31, 2003.

6. M.Shinohara, H.Shima, S.Matsuura: A role of N-terminal region of Xrs2 for a damage response pathway in the MRX complex. FASEB Summer Research Conferences, Genetic Recombination and Chromosome Rearrangements, Snowmass,

Colorado, USA, July 26-31, 2003. (R, G)

7. H.Shima, S.Matsuura, M.Shinohara: Roles of Xrs2 in the cell responses to DNA damage induced by ionizing-radiation. 28th Annual Meeting of the Chugoku Radiation Research Society, Hiroshima, July 31, 2003. (R, G)

8. T.Ikeuchi[*1], S.Matsuura, T.Kajii[*2] ([*1]Division of Genetics, Med.Res.Inst., Tokyo Medical and Dental Univ., [*2]Hachioji) : Cancer-prove genetic trait characterized by PCS and mosaic variegated aneuploidy. The 73rd Pediatric Hematology and Oncology Society, Tokyo, September 17, 2003.

9. K.Komatsu[*1], J.Kobayashi, H.Tauchi[*2], A.Nakamura[*1], S.Sakamoto[*1], S.Matsuura ([*1]RBC, Kyoto Univ., [*2]Dept. Environ. Sci., Ibaraki Univ.) : Interaction of NBS1 with histone and genome stability in response to DNA double-strand breaks. 62th Annual Meeting of the Japanese Cancer Association, Nagoya, September 25-27, 2003.

10. H.Tauchi[*1], J.Kobayashi, S.Sakamoto[*2], S.Matsuura, K.Komatsu[*2] ([*1]Dept. Environ. Sci., Ibaraki Univ., [*2]RBC, Kyoto Univ.) : Functional domain of NBS1 in genetic stability. 62th Annual Meeting of the Japanese Cancer Association, Nagoya, September 25-27, 2003.

11. S.Matsuura, Y.Kajiwara, K.Morishima, H.Tauchi[*1], K.Komatsu[*2], T.Ikeuchi[*3], T.Kajii[*4] ([*1]Dept. Environ. Sci., Ibaraki Univ., [*2]RBC, Kyoto Univ. [*3]Tokyo Med. Dent. Univ., [*4]Hachioji) : Analysis of spindle-checkpoint proteins in a cancer-prone disorder of PCS by immuno-staining. 62th Annual Meeting of the Japanese Cancer Association, Nagoya, September 25-27, 2003.

12. H.Tauchi[*1], J.Kobayashi, C.Muranaka[*1], S.Sakamoto[*2], van Gent Dik[*3], Y.Ichimasa[*1], S.Matsuura, K.Komatsu[*2] ([*1]Dept. Environ. Sci., Ibaraki Univ., [*2]RBC, Kyoto Univ., [*3]Erasmus Univ., Rotterdam) : Mechanisms of DNA double-strand break repair. 46th Annual Meeting of the Japan Radiation Research Society, Kyoto, October 6-8, 2003.

13. K.Iijima[*1], S.Sakamoto[*2], S.Matsuura, K.Komatsu[*2], Y.Ichimasa[*1], H.Tauchi[*1] ([*1]Dept. Environ. Sci., Ibaraki Univ., [*2]RBC, Kyoto Univ.) : Functional Domain Analysis of NBS1 Gene in Homologous Recombinational Repair. 46th Annual Meeting of the Japan Radiation Research Society, Kyoto, October 6-8, 2003.

14. K.Morishima, A.Nakamura[*1], S.Sakamoto[*1], H.Tauchi[*2], A.Antoccia, S.Matsuura, K.Komatsu[*1] ([*1]RBC, Kyoto Univ., [*2]Dept. Environ. Sci., Ibaraki Univ.) : Localization of Rad51 protein in cells from patients with Fanconi Anemia D1 group. 46th Annual Meeting of the Japan Radiation Research Society, Kyoto, October 6-8, 2003.

15. H.Ogata[*1], C.Muranaka[*1], S.Sakamoto[*2], J.Kobayashi, M.Ichimasa[*1], Y.Ichimasa[*1], S.Matsuura, K.Komatsu[*2], H.Tauchi[*1] ([*1]Dept. Environ. Sci., Ibaraki Univ., [*2]RBC, Kyoto Univ., [*3]Erasmus Univ., Rotterdam) : Analysis of apoptosis induction in Nbs1 deficient cells. 46th Annual Meeting of the Japan Radiation Research Society, Kyoto, October 6-8, 2003.

16. S.Matsuura, Y.Kajiwara, K.Morishima, M.Shinohara, H.Tauchi[*1], K.Komatsu[*2], T.Ikeuchi[*3], T.Kajii[*4] ([*1]Dept. Environ. Sci., Ibaraki Univ., [*2]RBC, Kyoto Univ. [*3]Tokyo Med. Dent. Univ., [*4]Hachioji) : PCS syndrome : Analysis of mitotic spindle checkpoint proteins using immunofluorescence. The 48th Annual Meeting of the Japan Society of Human Genetics, Nagasaki, October 21-24, 2003.

17. K.Sakai[*1], A.Hayase[*1], M.Takagi[*1], K,Yamashita[*1], T.Miyazaki[*1], H.Oshiumi[*1], M.Shinohara and A.Shinohara[*1,2,3] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]PRESTO, JST, [*3]Institute for Protein Research, Osaka Univ.) : The

role of factors which promote the functions and the coordination of the RecA homologues Rad51 and Dmc1 during meiotic recombination. The 4th 3R International Symposium, Awaji, Hyogo, Nov 9-13, 2003.

18. T.Miyazaki[*1], D.E.Bressan[*2], M.Shinohara, J.E.Haber[*2] and A.Shinohara[*1,3,4] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]Brandeis Univ., [*3]PRESTO, JST, [*4]Institute for Protein Research, Osaka Univ.) : *In vivo* assembly/disassembly of Rad51 and Rad52 complexes during double-strand break repair. The 4th 3R International Symposium, Awaji, Hyogo, Nov 9-13, 2003.

19. M.Shinohara, H.Shima, S.Matsuura: A role of N-terminal region of Xrs2 for a damage response in the MRX complex in *Saccaromyces cerevisiae*. The 4th 3R International Symposium, Awaji, Hyogo, Nov 9-13, 2003. (R, G)

20. H.Shima, S.Matsuura and M.Shinohara: Analysis of functional domain mutants of yeast Xrs2. The 4th 3R International Symposium, Awaji, Hyogo, Nov 9-13, 2003. (R, G)

21. K.Sakai[*1], M.Shinohara and A.Shinohara[*1,2,3] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]PRESTO, JST, [*3]Institute for Protein Research, Osaka Univ.) : A complex containing DNA damage checkpoint protein Mec3 is associated with recombination hotspot and cooperates with Rad51 during meiotic recombination. The 4th 3R International Symposium, Awaji, Hyogo, Nov 9-13, 2003.

22. H.Tauchi[*1], K.Iijima[*1], D.Mochizuki[*1], J.Kobayashi[*2], S.Sakamoto[*3], S.Matsuura, K.Komatsu[*3] ([*1]Dept. Environ. Sci., Ibaraki Univ., [*2]Hiroshima Univ., Fac. Dent., [*3]RBC, Kyoto Univ.) : Functional domains in the NBS1 gene and DNA damage repair. The 26th Annual Meeting of The Molecular Biology Society of Japan, Kobe, December 10-13, 2003.

23. K.Sakai[*1], A.Hayase[*1], K.Yamashita[*1], M.Takagi[*1], H.Oshiumi[*1], T.Miyazaki[*1], M.Tsukamoto[*1], M.Shinohara, A.Shinohara[*1,2,3] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]PRESTO, JST, [*3]Institute for Protein Research, Osaka Univ.) : Roles of RecA homologues Rad51 and Dmc1 during meiotic recombination. The 26th Annual Meeting of The Molecular Biology Society of Japan, Kobe, December 10-13, 2003.

24. M.Shinohara, H.Shima, S.Matsuura: Isolation of novel *xrs2* mutants and its characterization in the genome homeostasis. The 26th Annual Meeting of The Molecular Biology Society of Japan, Kobe, December 10-13, 2003. (R, G)

25. H.Shima, S.Matsuura, M.Shinohara: Analysis of functional domain mutants of yeast Xrs2. The 26th Annual Meeting of The Molecular Biology Society of Japan, Kobe, December 10-13, 2003. (R, G)

26. T.Miyazaki[*1], M.Shinohara, J.Haber[*2], A.Shinohara[*1,3,4] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]Brandeis Univ., [*3]PRESTO, JST, [*4]Institute for Protein Research, Osaka Univ.) : *In vivo* assembly/disassembly pathway of Rad51 and Rad52 complexes in response to a single double-strand break. The 26th Annual Meeting of The Molecular Biology Society of Japan, Kobe, December 10-13, 2003.

27. K.Sakai[*1], M.Shinohara, A.Shinohara[*1,2,3] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]PRESTO, JST, [*3]Institute for Protein Research, Osaka Univ.) : The role of factors which promote the functions and the coordination of the RecA homologues Rad51 and Dmc1 during meiosis. The 26th Annual Meeting of The Molecular Biology Society of Japan, Kobe, December 10-13, 2003.

28. K.Yamashita[*1], M.Shinohara, A.Shinohara[*1,2,3] ([*1]Dept. of Biology, Graduate School of Science, Osaka Univ., [*2]PRESTO,

JST, [*3]Institute for Protein Research, Osaka Univ.): Rad6-Bre1-mediated histone H2B ubiquitylation promotes the formation of double-strand breaks during meiosis. The 26th Annual Meeting of The Molecular Biology Society of Japan, Kobe, December 10-13, 2003.

29. H.Shima, S.Matsuura, M.Shinohara: A role of N-terminal region of Xrs2 for a damage response pathway in the MRX complex. 21th Chromosome Workshop, Atami, January 29-31, 2004. (R, G)

30. K.Morishima, A.Nakamura[*1], S.Sakamoto[*1], H.Tauchi[*2], S.Matsuura and K.Komatsu[*2] ([*1]Radiat.Biol.Center, Kyoto Univ., [*2]Faculty of Sci., Ibaraki Univ.): Impaired Rad51 Nuclear Foci in Cells from Patients with Fanconi Anemia Group D1. The First International Symposium, Cellular Responses to Genome Damage and Chromatin Dynamics, Hiroshima University 21st Century COE Program -Radiation Casualty Medical Research Center-, Hiroshima, February 13, 2004.

31. S.Matsuura, T.Ikeuchi[*1] and T.Kajii[*2]([*1]Division of Genetics, Med.Res.Inst., Tokyo Medical and Dental Univ., [*2]Hachioji): Chromosomal Instability Syndrome of Premature Chromatid Separation (PCR): Reduced BubR1 Expression and Defective Mitotic-Spindle Checkpoint. The First International Symposium, Cellular Responses to Genome Damage and Chromatin Dynamics, Hiroshima University 21st Century COE Program -Radiation Casualty Medical Research Center-, Hiroshima, February 13, 2004.

32. M.Shinohara, H.Shima, M.Suzuki and S.Matsuura: A role of N-terminal region of Xrs2 for a damage response in the MRX complex in *Saccharomyces cerevisiae*. The First International Symposium, Cellular Responses to Genome Damage and Chromatin Dynamics, Hiroshima University 21st Century COE Program -Radiation Casualty Medical Research Center-, Hiroshima, February 13, 2004. (R, G)

33. H.Shima, S.Matsuura and M.Shinohara: Analysis of functional domain mutants of yeast Xrs2. The First International Symposium, Cellular Responses to Genome Damage and Chromatin Dynamics, Hiroshima University 21st Century COE Program -Radiation Casualty Medical Research Center-, Hiroshima, February 13, 2004. (R, G)

34. M.Suzuki, S.Matsuura and M.Shinohara: Xrs2 controls non-homologous end-joining in *Saccharomyces cerevisiae*. The First International Symposium, Cellular Responses to Genome Damage and Chromatin Dynamics, Hiroshima University 21st Century COE Program -Radiation Casualty Medical Research Center-, Hiroshima, February 13, 2004. (R, G)

(R), (A), (G) and (C) are reports on the study using Radiation Experiments, Animal Experiments, Gene Technology Facilities and Studies established at the International Radiation Information Center, respectively. (I) indicates reports printed in the scientific journals listed in Current Contents.