Stanford

Anne Villeneuve

Professor of Developmental Biology and of Genetics

Bio

ACADEMIC APPOINTMENTS

- Professor, Developmental Biology
- Professor, Genetics
- Member, Bio-X
- Member, Maternal & Child Health Research Institute (MCHRI)

HONORS AND AWARDS

- Member, National Acadmy of Sciences (elected 2017)
- Member, American Academy of Arts and Sciences (elected 2016)
- American Cancer Society Research Professor Award, American Cancer Society (01/01/2016 - 12/31/2020)
- Kirsch Investigator Award, Steven and Michele Kirsch Foundation (2003-2004)
- Junior Faculty Scholar Award, HHMI (1999)
- Esther Ehrman Lazard Faculty Scholar, Stanford University (1996, 1997, 1998)
- Searle Scholars Award, Chicago Community Trust (1996-99)
- Beginning Faculty Investigator Award, Baxter Foundation (1995)

PROFESSIONAL EDUCATION

- B.S., University of Notre Dame , Biochemistry (1981)
- Ph.D., M.I.T. , Biology (1989)

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

We investigate mechanisms underlying the faithful inheritance of eukaryotic chromosomes. Our primary focus is on elucidating the events required for orderly segregation of homologous chromosomes during meiosis, the crucial process by which diploid germ cells generate haploid gametes. These events are of central importance to sexually reproducing organisms, since errors in meiosis lead to chromosomal aneuploidy, one of the leading causes of miscarriages and birth defects in humans.

Diploid germ cells face several major challenges on the road to reducing their ploidy to generate haploid gametes: 1) Chromosomes must locate, identify and align with their appropriate homologous pairing partners. 2) Chromosomes must acquire a structural organization that will promote controlled breakage of DNA molecules and subsequent recombinational repair using the homologous chromosome as a repair partner to yield interhomolog crossovers. 3) Chromosomes must couple the events of recombination with further structural reorganization to yield an organization in which homologs are connected by chiasmata, yet oriented away from each other in a way that promotes their attachment to and segregation toward opposite poles of the meiosis I spindle. Moreover, the connections afforded by chiasmata must be coupled

with a two-step loss of cohesion, such that partial loss of cohesion occurs at meiosis I to permit dissolution of chiasmata and homolog separation while maintaining the connections between sisters required to permit bipolar attachment on the meiosis II spindle. 4) During oocyte meiosis, a bipolar spindle must be assembled and function without the aid of centrosomes. All of these events must be tightly coordinated to achieve a successful outcome.

Despite the fundamental importance of meiosis, the mechanisms underlying many key events remain poorly understood. We are approaching the study of meiosis using the nematode C. elegans, a simple metazoan that is especially amenable to combining genetic, genomic and cytological approaches in a single system, and in which the events of meiosis are particularly accessible. The germ line accounts for more than half of the cell nuclei in the adult worm, with nuclei in all stages of meiosis present simultaneously in a temporal/spatial gradient along the distal-proximal axis of the gonad, so that each gonad represents a complete meiotic time course. These features facilitate visualizing chromosome organization using high-resolution microscopic imaging in the context of intact 3D nuclear architecture.

Topics under investigation include:

HOMOLOGOUS CHROMOSOME PAIRING AND SYNAPSIS:
How do chromosomes locate and recognize their appropriate pairing partners? How is recognition coordinated with assembly of the synaptonemal complex (SC), a highly ordered protein scaffold that stabilizes homolog association, so that synapsis occurs only between correct partners?

“CROSSOVER CONTROL”:
How do cells sense a chromosome pair that has not yet undergone a crossover? How does a crossover trigger global changes in structure and function along a whole chromosome pair? How do crossover-triggered changes inhibit other crossovers?

COORDINATING CHROMOSOME STRUCTURE WITH RECOMBINATION:
Double-strand DNA breaks (DSBs) are dangerous to genomic integrity. How is their formation and repair coordinated with other features of the meiotic program? How does chromatin state affect competence for DSB formation?

CHROMOSOME SEGREGATION:
How does chromosome organization established during prophase lead to orderly segregation? How does the oocyte assemble a bipolar spindle in the absence of centrosomes? What special mechanisms ensure inheritance of sex chromosomes?

EVOLUTION OF MEIOTIC MACHINERY
What mechanisms are responsible for the rapid divergence of meiotic structural proteins?

Teaching

COURSES

2019-20

- Advanced Genetics: GENE 205 (Win)
- Frontiers in Biological Research: BIOC 215, DBIO 215, GENE 215 (Aut, Win, Spr)

2018-19

- Advanced Genetics: GENE 205 (Win)
- Frontiers in Biological Research: BIOC 215, DBIO 215, GENE 215 (Aut, Win, Spr)

2017-18

- Advanced Genetics: GENE 205 (Win)
- Frontiers in Biological Research: BIOC 215, DBIO 215, GENE 215 (Aut, Win, Spr)

2016-17

- Advanced Genetics: GENE 205 (Win)
- Frontiers in Biological Research: BIOC 215, DBIO 215, GENE 215 (Aut, Win, Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Cameron Berry, Ellen Bouchard, Devon Harris, Kyomi Igarashi, Garrett Kingman, Leslie Mateo, Wendy Wenderski

Postdoctoral Faculty Sponsor

Chloe Girard, Alexander Woglar

Doctoral Dissertation Advisor (AC)

Albert Hinman, Kei Yamaya

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Developmental Biology (Phd Program)
- Genetics (Phd Program)

Publications

PUBLICATIONS

- **Interdependent and separable functions of Caenorhabditis elegans MRN-C complex members couple formation and repair of meiotic DSBs** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Girard, C., Roelens, B., Zawadzki, K. A., Villeneuve, A. M.
  2018; 115 (19): E4443–E4452
- **Dynamic Architecture of DNA Repair Complexes and the Synaptonemal Complex at Sites of Meiotic Recombination.** *Cell*
  Woglar, A., Villeneuve, A. M.
  2018
- **Meiotic recombination modulates the structure and dynamics of the synaptonemal complex during C. elegans meiosis** *PLOS GENETICS*
  Pattabiraman, D., Roelens, B., Woglar, A., Villeneuve, A. M.
  2017; 13 (3)
- **Meiotic chromosome structures constrain and respond to designation of crossover sites.** *Nature*
  Libuda, D. E., Uzawa, S., Meyer, B. J., Villeneuve, A. M.
  2013; 502 (7473): 703-706
- **The C. elegans DSB-2 Protein Reveals a Regulatory Network that Controls Competence for Meiotic DSB Formation and Promotes Crossover Assurance.** *PLoS genetics*
  Rosu, S., Zawadzki, K. A., Stamper, E. L., Libuda, D. E., Reese, A. L., Dernburg, A. F., Villeneuve, A. M.
  2013; 9 (8)
- **COSA-1 Reveals Robust Homeostasis and Separable Licensing and Reinforcement Steps Governing Meiotic Crossovers** *CELL*
  Yokoo, R., Zawadzki, K. A., Nabeshima, K., Drake, M., Arur, S., Villeneuve, A. M.
  2012; 149 (1): 75-87
- **Time-Course Analysis of Early Meiotic Prophase Events Informs Mechanisms of Homolog Pairing and Synapsis in Caenorhabditis elegans** *GENETICS*
  Mlynarczyk-Evans, S., Villeneuve, A. M.
  2017; 207 (1): 103–14

- **Assembly of Caenorhabditis elegans acentrosomal spindles occurs without evident microtubule-organizing centers and requires microtubule sorting by KLP-18/kinesin-12 and MESP-1** *MOLECULAR BIOLOGY OF THE CELL*
  Wolff, I. D., Tran, M. V., Mullen, T. J., Villeneuve, A. M., Wignall, S. M.
  2016; 27 (20): 3122-3131

- **A streamlined tethered chromosome conformation capture protocol** *BMC GENOMICS*
  Gabdank, I., Ramakrishnan, S., Villeneuve, A. M., Fire, A. Z.
  2016; 17

- **Separable Roles for a Caenorhabditis elegans RMI1 Homolog in Promoting and Antagonizing Meiotic Crossovers Ensure Faithful Chromosome Inheritance.** *PLoS biology*
  Jagut, M., Hamminger, P., Woglar, A., Millonigg, S., Paulin, L., Mikl, M., Dello Stritto, M. R., Tang, L., Habacher, C., Tam, A., Gallach, M., von Haeseler, A., Villeneuve, et al
  2016; 14 (3)

- **Separable Roles for a Caenorhabditis elegans RMI1 Homolog in Promoting and Antagonizing Meiotic Crossovers Ensure Faithful Chromosome Inheritance** *PLOS BIOLOGY*
  Jagut, M., Hamminger, P., Woglar, A., Millonigg, S., Paulin, L., Mikl, M., Dello Stritto, M. R., Tang, L., Habacher, C., Tam, A., Gallach, M., von Haeseler, A., Villeneuve, et al
  2016; 14 (3)

- **Manipulation of Karyotype in Caenorhabditis elegans Reveals Multiple Inputs Driving Pairwise Chromosome Synapsis During Meiosis.** *Genetics*
  Roelens, B., Schvarzstein, M., Villeneuve, A. M.
  2015; 201 (4): 1363-1379

- **DNA Helicase HIM-6/BLM Both Promotes MutS gamma-Dependent Crossovers and Antagonizes MutS gamma-Independent Interhomolog Associations During Caenorhabditis elegans Meiosis** *GENETICS*
  Schvarzstein, M., Pattabiraman, D., Libuda, D. E., Ramadugu, A., Tam, A., Martinez-Perez, E., Roelens, B., Zawadzki, K. A., Yokoo, R., Rosu, S., Severson, A. F., Meyer, B. J., Nabeshima, et al
  2014; 198 (1): 193-?

- **DNA helicase HIM-6/BLM both promotes MutS?-dependent crossovers and antagonizes MutS?-independent interhomolog associations during caenorhabditis elegans meiosis.** *Genetics*
  Schvarzstein, M., Pattabiraman, D., Libuda, D. E., Ramadugu, A., Tam, A., Martinez-Perez, E., Roelens, B., Zawadzki, K. A., Yokoo, R., Rosu, S., Severson, A. F., Meyer, B. J., Nabeshima, et al
  2014; 198 (1): 193-207

- **Mammalian CNTD1 is critical for meiotic crossover maturation and deselection of excess precrossover sites.** *journal of cell biology*
  Holloway, J. K., Sun, X., Yokoo, R., Villeneuve, A. M., Cohen, P. E.
  2014; 205 (5): 633-641

- **Evidence that masking of synapsis imperfections counterbalances quality control to promote efficient meiosis.** *PLoS genetics*
  Mlynarczyk-Evans, S., Roelens, B., Villeneuve, A. M.
  2013; 9 (12)

- **Evidence that masking of synapsis imperfections counterbalances quality control to promote efficient meiosis.** *PLoS genetics*
  Mlynarczyk-Evans, S., Roelens, B., Villeneuve, A. M.
  2013; 9 (12)

- **Identification of DSB-1, a Protein Required for Initiation of Meiotic Recombination in Caenorhabditis elegans, Illuminates a Crossover Assurance Checkpoint** *PLOS GENETICS*
  Stamper, E. L., Rodenbusch, S. E., Rosu, S., Ahringer, J., Villeneuve, A. M., Dernburg, A. F.
  2013; 9 (8)

- **Chromosome movements promoted by the mitochondrial protein SPD-3 are required for homology search during Caenorhabditis elegans meiosis.** *PLoS genetics*
  Labrador, L., Barroso, C., Lightfoot, J., Müller-Reichert, T., Flibotte, S., Taylor, J., Moerman, D. G., Villeneuve, A. M., Martinez-Perez, E.
  2013; 9 (5)

- **Assembly of the Synaptonemal Complex Is a Highly Temperature-Sensitive Process That Is Supported by PGL-1 During Caenorhabditis elegans Meiosis** *G3-GENES GENOMES GENETICS*

Bilgir, C., Dombecki, C. R., Chen, P. F., Villeneuve, A. M., Nabeshima, K.
2013; 3 (4): 585-595

- **Meiotic HORMA domain proteins prevent untimely centriole disengagement during Caenorhabditis elegans spermatocyte meiosis** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Schvarzstein, M., Pattabiraman, D., Bembenek, J. N., Villeneuve, A. M.
  2013; 110 (10): E898-E907
- **Assembly of the Synaptonemal Complex is a Highly Temperature-Sensitive Process that is Supported by PGL-1 during Caenorhabditis elegans Meiosis.** *G3 (Bethesda, Md.)*
  Bilgir, C., Dombecki, C. R., Chen, P. F., Villeneuve, A. M., Nabeshima, K.
  2013
- **The C. elegans DSB-2 protein reveals a regulatory network that controls competence for meiotic DSB formation and promotes crossover assurance.** *PLoS genetics*
  Rosu, S., Zawadzki, K. A., Stamper, E. L., Libuda, D. E., Reese, A. L., Dernburg, A. F., Villeneuve, A. M.
  2013; 9 (8)
- **Full-Length Synaptonemal Complex Grows Continuously during Meiotic Prophase in Budding Yeast** *PLOS GENETICS*
  Voelkel-Meiman, K., Moustafa, S. S., Lefrancois, P., Villeneuve, A. M., MacQueen, A. J.
  2012; 8 (10)
- **HAL-2 Promotes Homologous Pairing during Caenorhabditis elegans Meiosis by Antagonizing Inhibitory Effects of Synaptonemal Complex Precursors** *PLOS GENETICS*
  Zhang, W., Miley, N., Zastrow, M. S., MacQueen, A. J., Sato, A., Nabeshima, K., Martinez-Perez, E., Mlynarczyk-Evans, S., Carlton, P. M., Villeneuve, A. M.
  2012; 8 (8)
- **Robust Crossover Assurance and Regulated Interhomolog Access Maintain Meiotic Crossover Number** *SCIENCE*
  Rosu, S., Libuda, D. E., Villeneuve, A. M.
  2011; 334 (6060): 1286-1289
- **Chromosome Painting Reveals Asynaptic Full Alignment of Homologs and HIM-8-Dependent Remodeling of X Chromosome Territories during Caenorhabditis elegans Meiosis** *PLOS GENETICS*
  Nabeshima, K., Mlynarczyk-Evans, S., Villeneuve, A. M.
  2011; 7 (8)
- **An Asymmetric Chromosome Pair Undergoes Synaptic Adjustment and Crossover Redistribution During Caenorhabditis elegans Meiosis: Implications for Sex Chromosome Evolution** *GENETICS*
  Henzel, J. V., Nabeshima, K., Schvarzstein, M., Turner, B. E., Villeneuve, A. M., Hillers, K. J.
  2011; 187 (3): 685-699
- **Meiotic Errors Activate Checkpoints that Improve Gamete Quality without Triggering Apoptosis in Male Germ Cells** *CURRENT BIOLOGY*
  Jaramillo-Lambert, A., Harigaya, Y., Vitt, J., Villeneuve, A., Engebrecht, J.
  2010; 20 (23): 2078-2089
- **The Synaptonemal Complex Shapes the Crossover Landscape Through Cooperative Assembly, Crossover Promotion and Crossover Inhibition During Caenorhabditis elegans Meiosis** *GENETICS*
  Hayashi, M., Mlynarczyk-Evans, S., Villeneuve, A. M.
  2010; 186 (1): 45-U101
- **Coordinating cohesion, co-orientation, and congression during meiosis: lessons from holocentric chromosomes** *GENES & DEVELOPMENT*
  Schvarzstein, M., Wignall, S. M., Villeneuve, A. M.
  2010; 24 (3): 219-228
- **Differential Localization and Independent Acquisition of the H3K9me2 and H3K9me3 Chromatin Modifications in the Caenorhabditis elegans Adult Germ Line** *PLOS GENETICS*
  Bessler, J. B., Andersen, E. C., Villeneuve, A. M.
  2010; 6 (1)
- **A Caenorhabditis elegans RNA-Directed RNA Polymerase in Sperm Development and Endogenous RNA Interference** *GENETICS*
  Gent, J. I., Schvarzstein, M., Villeneuve, A. M., Gu, S. G., Jantsch, V., Fire, A. Z., Baudrimont, A.

2009; 183 (4): 1297-1314

- **Lateral microtubule bundles promote chromosome alignment during acentrosomal oocyte meiosis** *NATURE CELL BIOLOGY*
  Wignall, S. M., Villeneuve, A. M.
  2009; 11 (7): 839-U135
- **Analysis of meiotic recombination in Caenorhabditis elegans.** *Methods in molecular biology (Clifton, N.J.)*
  Hillers, K. J., Villeneuve, A. M.
  2009; 557: 77-97
- **Ensuring an exit strategy: RTeL1 Restricts Rogue Recombination** *CELL*
  Villeneuve, A. M.
  2008; 135 (2): 213-215
- **Crossovers trigger a remodeling of meiotic chromosome axis composition that is linked to two-step loss of sister chromatid cohesion** *GENES & DEVELOPMENT*
  Martinez-Perez, E., Schvarzstein, M., Barroso, C., Lightfoot, J., Dernburg, A. F., Villeneuve, A. M.
  2008; 22 (20): 2886-2901
- **C. elegans germ cells switch between distinct modes of double-strand break repair during meiotic prophase progression** *PLOS GENETICS*
  Hayashi, M., Chin, G. M., Villeneuve, A. M.
  2007; 3 (11): 2068-2084
- **Differential timing of S phases, X chromosome replication, and meiotic prophase in the C-elegans germ line** *DEVELOPMENTAL BIOLOGY*
  Jaramillo-Lambert, A., Ellefson, M., Villeneuve, A. M., Engebrecht, J.
  2007; 308 (1): 206-221
- **Synapsis-Defective mutants reveal a correlation between chromosome conformation and the mode of double-strand break repair during Caenorhabditis elegans meiosis** *GENETICS*
  Smolikov, S., Eizinger, A., Hurlburt, A., Rogers, E., Villeneuve, A. M., Colaiacovo, M. P.
  2007; 176 (4): 2027-2033
- **SYP-3 restricts synaptonemal complex assembly to bridge paired. chromosome axes during meiosis in Caenorhabditis elegans** *GENETICS*
  Smolikov, S., Eizinger, A., Schild-Prufert, K., Hurlburt, A., McDonald, K., Engebrecht, J., Villeneuve, A. M., Colaiacovo, M. P.
  2007; 176 (4): 2015-2025
- **A role for Caenorhabditis elegans chromatin-associated protein HIM-17 in the proliferation vs. meiotic entry decision** *GENETICS*
  Bessler, J. B., Reddy, K. C., Hayashi, M., Hodgkin, J., Villeneuve, A. M.
  2007; 175 (4): 2029-2037
- **Regulation of sperm activation by SWM-1 is required for reproductive success of C-elegans males** *CURRENT BIOLOGY*
  Stanfield, G. M., Villeneuve, A. M.
  2006; 16 (3): 252-263
- **Chromosome sites play dual roles to establish homologous synapsis during meiosis in C-elegans** *CELL*
  MacQueen, A. J., Phillips, C. M., Bhalla, N., Weiser, P., Villeneuve, A. M., Dernburg, A. F.
  2005; 123 (6): 1037-1050
- **HTP-1-dependent constraints coordinate homolog pairing and synapsis and promote chiasma formation during C-elegans meiosis** *GENES & DEVELOPMENT*
  Martinez-Perez, E., Villeneuve, A. M.
  2005; 19 (22): 2727-2743
- **Crossing over is coupled to late meiotic prophase bivalent differentiation through asymmetric disassembly of the SC** *JOURNAL OF CELL BIOLOGY*
  Nabeshima, K., Villeneuve, A. M., Colaicovo, M. P.
  2005; 168 (5): 683-689
- **Chromosome-wide regulation of meiotic crossover formation in Caenorhabditis elegans requires properly assembled chromosome axes** *GENETICS*
  Nabeshima, K., Villeneuve, A. M., Hillers, K. J.
  2004; 168 (3): 1275-1292

- **C-elegans HIM-17 links chromatin modification and competence for initiation of meiotic recombination** *CELL*
  Reddy, K. C., Villeneuve, A. M.
  2004; 118 (4): 439-452

- **A component of C-elegans meiotic chromosome axes at the interface of homolog alignment, synapsis, nuclear reorganization, and recombination** *CURRENT BIOLOGY*
  Couteau, F., Nabeshima, K., Villeneuve, A., Zetka, M.
  2004; 14 (7): 585-592

- **Methods for analyzing checkpoint responses in Caenorhabditis elegans.** *Methods in molecular biology (Clifton, N.J.)*
  Gartner, A., MacQueen, A. J., Villeneuve, A. M.
  2004; 280: 257-274

- **Chromosome-wide control of meiotic crossing over in C-elegans** *CURRENT BIOLOGY*
  Hillers, K. J., Villeneuve, A. M.
  2003; 13 (18): 1641-1647

- **Synaptonemal complex assembly in C-elegans is dispensable for loading strand-exchange proteins but critical for proper completion of recombination** *DEVELOPMENTAL CELL*
  Colaiacovo, M. P., MacQueen, A. J., Martinez-Perez, E., McDonald, K., Adamo, A., La Volpe, A., Villeneuve, A. M.
  2003; 5 (3): 463-474

- **A gene recommender algorithm to identify coexpressed genes in C-elegans** *GENOME RESEARCH*
  Owen, A. B., Stuart, J., Mach, K., Villeneuve, A. M., Kim, S.
  2003; 13 (8): 1828-1837

- **Synapsis-dependent and -independent mechanisms stabilize homolog pairing during meiotic prophase in C-elegans** *GENES & DEVELOPMENT*
  MacQueen, A. J., Colaiacovo, M. P., McDonald, K., Villeneuve, A. M.
  2002; 16 (18): 2428-2442

- **A targeted RNAi screen for genes involved in chromosome morphogenesis and nuclear organization in the Caenorhabditis elegans germline** *GENETICS*
  Colaiacovo, M. P., Stanfield, G. M., Reddy, K. C., Reinke, V., Kim, S. K., Villeneuve, A. M.
  2002; 162 (1): 113-128

- **Whence meiosis?** *CELL*
  Villeneuve, A. M., Hillers, K. J.
  2001; 106 (6): 647-650

- **Nuclear reorganization and homologous chromosome pairing during meiotic prophase require C-elegans chk-2** *GENES & DEVELOPMENT*
  MacQueen, A. J., Villeneuve, A. M.
  2001; 15 (13): 1674-1687

- **Development - How to stimulate your partner** *SCIENCE*
  Villeneuve, A. M.
  2001; 291 (5511): 2099-?

- **C-elegans mre-11 is required for meiotic recombination and DNA repair but is dispensable for the meiotic G(2) DNA damage checkpoint** *GENES & DEVELOPMENT*
  Chin, G. M., Villeneuve, A. M.
  2001; 15 (5): 522-534

- **Caenorhabditis elegans msh-5 is required for both normal and radiation-induced meiotic crossing over but not for completion of meiosis** *GENETICS*
  Kelly, K. O., Dernburg, A. F., Stanfield, G. M., Villeneuve, A. M.
  2000; 156 (2): 617-630

- **Transgene-mediated cosuppression in the C-elegans germ line** *GENES & DEVELOPMENT*
  Dernburg, A. F., Zalevsky, J., Colaiacovo, M. P., Villeneuve, A. M.
  2000; 14 (13): 1578-1583

- **Crossing over during Caenorhabditis elegans meiosis requires a conserved MutS-based pathway that is partially dispensable in budding yeast** *GENETICS*

Zalevsky, J., MacQueen, A. J., Duffy, J. B., Kemphues, K. J., Villeneuve, A. M.
1999; 153 (3): 1271-1283

- **Meiotic recombination in C-elegans initiates by a conserved mechanism and is dispensable for homologous chromosome synapsis** *CELL*
  Dernburg, A. F., McDonald, K., Moulder, G., Barstead, R., Dresser, M., Villeneuve, A. M.
  1998; 94 (3): 387-398

- **?Chromosome Organization, Meiosis and Mitosis?. in C. elegans, II. (ed. D. Riddle, B. Meyer, Blumenthal, T. and Priess, J.)** *Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY*
  Villeneuve, A. M., Albertson, D. G., Rose, A. M.
  1997

- **Telomeric repeats (TTAGGC)(n) are sufficient for chromosome capping function in Caenorhabditis elegans** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Wicky, C., Villeneuve, A. M., Lauper, N., Codourey, L., Tobler, H., Muller, F.
  1996; 93 (17): 8983-8988

- **CIS-ACTING LOCUS THAT PROMOTES CROSSING-OVER BETWEEN X-CHROMOSOMES IN CAENORHABDITIS-ELEGANS** *GENETICS*
  Villeneuve, A. M.
  1994; 136 (3): 887-902