Genetics as a Focus for Cross-disciplinary Learning

The study of genetics crosses several scientific disciplines, including biology, chemistry (e.g. the molecular structure of DNA), and environmental science (e.g. conservation genetics). In addition, certain facets of genetics strongly overlap with mathematics, social studies, and health and fitness. And like all the sciences, genetics provides ideal fodder for diverse communications activities—reading, writing, oral language—both in traditional science lab notebooks and poster and oral presentations, as well as the creative applications listed below.

When genetics is taught as an interdisciplinary subject, students come to understand how concepts in science apply to many aspects of learning and living. GEP teachers were asked how genetics could be used to teach other subjects in their classrooms. Their creative and diverse responses, given below, are by no means comprehensive and are certain to spark additional ideas for cross-disciplinary activities.

Subject Area	Sample Activities and Topics
Social Studies	History •The Watson-Crick discovery of DNA and its effect on the field of genetics is an example of a historical paradigm shift. •Technology influences people and promotes social change. The genetic engineering revolution has changed agriculture, medicine, etc. Civics •Examine the question: "Are all people created equal?" Will genetic differences between individuals affect personal liberties and opportunities? Will people be denied jobs or insurance coverage because of their genotype? •Study how privacy rights will be affected as we learn more about people's genetic make-up. What new policies will develop based on knowledge of people's genetic predispositions? Geography and Anthropology •The question of where man originated can be studied through examination of mitochondrial DNA. •Compare gene pools in different geographical areas. Discuss geographical influences on migration and environmental selection pressures. For example, examine the effects of environmental influences on phenotype by looking at the effects of altitude on the function of different hemoglobin variants. •Examine birth defects caused by changes in the DNA, which may have geographical-specific origins (e.g. radiation-induced mutations in Chernobyl). Economics •Study the development of the biotechnology industry, which is an important part of the economy in the Pacific Northwest. •Follow the stocks of biotechnology companies and relate their progress to key product discoveries.
Arts	Music •Translate the sequence of a gene into notes and play the composition. Drama/Dance •Choreograph a dance to illustrate a genetics concept, e.g. the movement of chromosomes during mitosis or meiosis. Visual Arts •Make models of DNA.

Arts ***(continued)***	•Organize data from an experiment into charts, diagrams, or other graphical representations. •Use an art form to communicate genetics concepts, e.g. the elegance of DNA structure, the complexity of a cell's cytoskeletal network.
Mathematics	•Sort, measure, and grade phenotypes (e.g. measure the heights of plants in a population). •Graph population phenotype data and determine mean, median, etc. •Predict the probabilities of phenotype classes in a cross. •Calculate the ratios of phenotype classes among progeny. •Calculate the match of expected to actual progeny ratios (chi-square statistical test). •Determine linkage (or non-linkage) in a two factor cross. •Determine gene and allele frequencies using the Hardy-Weinberg equilibrium. •Follow protocols and perform lab manipulations: measure volumes with micropipettes, calculate amounts of each component to add to enzyme reactions, prepare buffers and solutions.
Health and Fitness	•Learn about human reproduction, growth, and development. •Study environmental and genetic influences on health and behavior. •Learn about the transmission of both communicable (e.g. viral and bacterial) and non-communicable (i.e. inherited) diseases.
Writing	•Design an experiment. Write up the protocol as if for the instruction manual of a science kit. •Practice technical writing—write up lab results in report format, i.e. hypothesis, introduction, material and methods, results/data, and conclusions. •Keep a journal of the progress of an experiment. •Write lab reports for different audiences: teacher, peers, scientists, a brochure for the public. •Write up scientific results according to set conventions, e.g. as an essay, as a proposal for funding to a foundation, as a marketing piece to convince customers to buy a product. •Write creative stories on "what would happen if...?" using genetics content (e.g. What would happen if I could clone my mom?). •Write poems or song lyrics about genetics content, e.g. DNA structure. •Write a persuasive essay on an ethical issue related to genetics. Write an opinion piece from the opposing viewpoint.
Reading	•Learn genetics vocabulary, the language of researchers and genetic counselors. •Read, understand, and follow experimental protocols. •Read genetics texts, magazines, articles, and websites. •Read literature about children or individuals with disabilities or genetic conditions and how they cope with extraordinary pressures (e.g. *Lorenzo's Oil*, *The Ugly Duckling*).
Communications	•Explore genetics through role playing, e.g. act out protein synthesis, stage a mock trial on a genetics-related societal or ethical issue, or simulate a case study by acting out a genetic counseling session. •Observe and report orally on the similarities and differences among individuals in a population. •Pick out observable characteristics and communicate this orally. •Give an oral presentation on research. •Have students teach parents what they've learned about genetics.