

MOMENTUM

NEWS FROM THE POPULATION COUNCIL

JUNE 2004

How long do we live?

Estimates of current life expectancy at birth are crucial to projecting public health care needs and pension expenditures. The United Nations Population Division publishes country-by-country estimates, ranging from a low of 37 years in Sierra Leone to a high of 80 years in Japan (1995–2000). In the United States, estimates are 74 years for men and 79 years for women as of 1997.

These figures, though, may be a few years too high in countries with long life expectancies, say John Bongaarts and Griffith Feeney, two demographers who have analyzed past and future trends in mortality. Bongaarts, vice president and director of the Population Council's Policy Research Division, and Feeney, an independent consultant, identify a distortion in the underlying calculations that generate life expectancy figures and provide a formula to amend it. Their paper, "Estimating mean lifetime," was published in 2003 in the *Proceedings of the National Academy of Sciences*.

The distortion, which Bongaarts and Feeney term the "tempo effect," has long been recognized by demographers studying fertility; the authors are the first to apply the concept to mortality. In the case of fertility, tempo refers to the timing of childbirth. When women delay childbearing to later in life, the birth rate temporarily will appear to drop; conversely, when women have children at a younger age, the birth rate appears to rise, even if they eventually bear the same number of children as if they had started later.

According to Bongaarts and Feeney, the tempo effect influences mortality rates in much the same way. Interventions to improve health, such as changes in diet or drugs to lower hypertension, raise the average age of death, whereas a widespread, deadly epidemic like AIDS can lower it.

The effect is clearest in societies with high life expectancy. According to the demographers' calculations, removal of the tempo effect reduces life expectancy for U.S. women by 1.6 years and for Japanese women by 3.3 years for the period

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Self-tutoring for mothers-to-be

At Hospital de la Mujer in Mexico City, Population Council researchers introduced and tested an interactive CD-ROM as a way of providing mothers-to-be with information about pregnancy, delivery, and care of their babies.

A prototype kiosk was designed to make using the CD-ROM engaging and easy. Users can elect to listen to rather than read the information.

The system employs a touch screen to ensure accessibility for those unfamiliar with using a computer mouse, and a printer enables women to take summaries home. An extra-wide bench allows husbands or other family members to participate, and movable side panels and headphones provide privacy in a crowded waiting room.

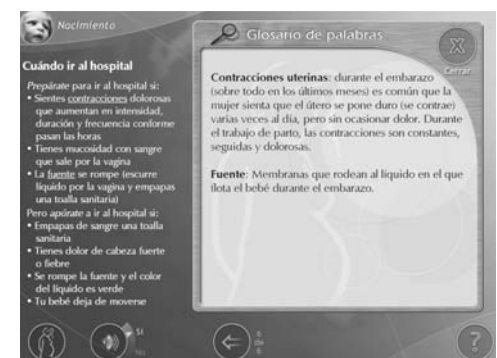
More than 200 screens of information are available, with topics ranging from how to talk effectively with a doctor to the signs of postpartum depression. After hearing the introduction, the user chooses a topic from four areas: Pregnancy, Birth, You and Your Baby, or Your Health. The researchers know from previous



Population Council

studies that the interests of pregnant women can often be summed up as "what's next?" The CD-ROM allows each woman to find answers to the questions of greatest concern to her, whether they involve changes occurring in the first trimester of pregnancy, breastfeeding, or postpartum family planning.

Illustrated slides run the gamut from photographs to cartoon drawings. Each section ends with a simple computer "game" reviewing the information covered. A glossary is available to



explain the terminology of pregnancy and birth. Council researcher Jennifer Catino explains, "The aim is to help women better understand what their health-care providers say when they meet with them."

The study, involving 831 women, was conducted from November 2002 through September 2003. The two test kiosks were donated to Hospital de la Mujer. After the material is copyrighted, the software will be made available at no cost to public hospitals and clinics. ■

The William and Flora Hewlett Foundation funded this study—"Mujeres más y mejor informadas: Explorando nuevas estrategias para mejorar la calidad de la atención prenatal en la Ciudad de México" ["More- and better-informed women: Exploring new strategies to improve the quality of prenatal care in Mexico City"], which was conducted by Ana Langer, regional director; Jennifer Catino, regional program coordinator for Gender, Family, and Development; and Tess Aldrich, research associate, all of the Council's office for Latin America and the Caribbean, in Mexico City.

Senators visit Horizons border program for truckers

In December 2003, two United States senators visited Foz do Iguacu, Brazil, to see an unusual clinic whose work the Population Council is evaluating. The senators were Tom Harkin of Iowa and Ernest Hollings of South Carolina, and the clinic—called *Saúde na Estrada* (“health on the road”)—serves truck drivers while their rigs are parked nearby.

Two years earlier, the U.S. Agency for International Development (USAID/Brazil) and the Brazilian Ministry of Health had asked the Population Council/Brazil to assess the prevalence of HIV/AIDS in six border communities. This research identified areas with the highest incidence of HIV and with high-risk social conditions, such as the presence of prostitution. These results became the springboard for a new initiative by the Council-led Horizons Program—with technical assistance and partial funding by USAID/Brazil—to design and support the ministry in implementing a prevention and care center for truck drivers.

The clinic is in Foz do Iguacu, a city of about a quarter million inhabitants at the border with Paraguay and Argentina. Each day approximately 400 trucks cross over this border; at any given time as many as 1,500 truckers are in the customs area, which is in close proximity to a red-light district. Truckers are at particular risk for sexually transmitted infections (STIs), including HIV, due to their mobility and their limited access to health care. STIs have been shown to be a significant factor in the spread of HIV globally.

Housed in a trailer near customs, the clinic provides easy access for the truckers. Advised by physician and Council principal investigator Juan Díaz, the ministry-trained clinic staff offer general preventive health care, deliver messages intended to decrease high-risk behavior, provide condoms, administer HIV and other tests, offer pre- and post-test education, and treat STIs. By evaluating these strategies, Council researchers hope to develop a replicable program to address the needs of truckers,



Photo courtesy U.S. Consulate São Paulo

Left to right: Juan Díaz, Michael Burkly of USAID Mission/Brazil, Senator Harkin, and three *Saúde na Estrada* clients

migrant workers, and other mobile groups elsewhere in Brazil and in neighboring countries.

Researchers are preparing an interim report on the project for the XV International AIDS Conference in Thailand, in July 2004. Full analysis of the program is not due until 2005, the final year of its funding from USAID. Meanwhile, as Díaz notes, “We have a better than 90 percent return rate on truckers picking up their test results, which is a very good sign that our health messages are getting through.”

Senators Hollings and Harkin conversed at length with the truckers, asking about their lives and work. Horizons researcher M. Silvia Setubal reports that Senator Harkin was particularly enthusiastic: “He paid attention to every detail. And when he left, he said he had ‘good news to take home’ about the program.” ■

Financial professional joins board



Melissa May

Lynn A. Foster

Lynn A. Foster of New York City was elected to the Population Council’s board of trustees at its December 2003 meeting.

A successful financial professional and volunteer leader of several major nonprofit organizations, Foster has a longstanding interest in conservation and has been a trustee of the World Wildlife Fund since 1993. She also has served as president of the Girl Scout Council of Greater New York and on the national board of the Girl Scouts, as well as on the boards of the Philadelphia

Orchestra, the Franklin Institute Science Museum, and the Institute for Human Gene Therapy at the University of Pennsylvania.

Population Council president Linda Martin noted, “Lynn brings high-level management experience in both the business and philanthropic worlds and substantive knowledge of health, environmental, and youth development issues that will be invaluable.”

Foster has an M.B.A. from Boston University and has held positions focusing on investment and health care at the New England Merchants National Bank, John Hancock Mutual Life, and Smith Barney. She served as consultant for 18 years to Foster Management Co., a private venture capital firm specializing in health care investments. From 1996 to 1999, she was senior vice president and director of investment research at Ashbridge Investment Management in Philadelphia. ■

Pakistan official visits PCNY

Shakil Durrani, Secretary of Pakistan’s Ministry of Population and Welfare, met with Council president Linda Martin and vice president Peter Donaldson on a visit to



Karen Tuvedy-Holmes

Shakil Durrani at Population Council headquarters in New York City

New York in December 2003. In addition to describing his goals for the ministry, he expressed his gratitude for the Population Council’s research, noting in particular that the Council’s name on a piece of analysis carries a lot of weight. He also stressed the value he places on the expertise and technical advice of Zeba Sathar, head of the Council’s office in Islamabad.

Secretary Durrani assumed leadership of the Ministry of Population and Welfare after serving as the chief secretary of the Northwest Frontier Province. Trained as an economist, he has a keen interest in population issues and is working to have primary health and family planning services delivered to every household in Pakistan. ■

Dissemination: Making results known

To ensure that its research makes a positive difference in people's lives, the Population Council emphasizes the dissemination of the findings of its staff and the broader research community. Dissemination takes many forms: a comprehensive Web site that in a recent month served over 50,000 visitors; the publication of two internationally recognized, peer-reviewed journals, *Population and Development Review* and *Studies in Family Planning*, books, and working papers; media interviews; presentations at international meetings; and information booths at major public health, social science, and biomedical conferences. Listed below are some of the events at which Council findings were presented to government representatives, scientists, health providers, and the general public in the second half of 2003:

- In June, Council researchers gave presentations at the 85th Annual Meeting of the Endocrine Society in Philadelphia, including Daniel J. Bernard's discussion of a study, later published in *Molecular Endocrinology*, that examined the mechanisms through which a pituitary factor, activin, stimulates production of follicle-stimulating hormones.
- Régine Sitruk-Ware, the Council's executive director of product research and development, led a panel on "Contraceptive Product Development and Evaluation" at the Institute of Medicine's International Symposium on New Frontiers in Contraceptive Research in Washington, DC, in July. Symposium findings were incorporated in the publication in January 2004 of *New Frontiers in Contraceptive Research: A Blueprint for Action*, to which Sitruk-Ware contributed.
- In August, Council researchers delivered presentations at the 13th International Conference on AIDS & STIs in Africa, in Nairobi, Kenya. In an associated event, Council staff members ran in the first International Women's AIDS Run to raise money for African AIDS orphans.
- In November, Population Council staff presented their research at the annual meeting of the American Public Health Association in San Francisco, addressing such issues as the key factors for tobacco and other substance abuse by adolescents in Bangladesh.
- Also in November, Council staff traveled to Santiago, Chile, for the XVII FIGO World Congress of Gynecology and Obstetrics, which was attended by over 8,400 physicians and health professionals from 121 countries. Council researchers presented 29 papers, and Council Distinguished Scientist Sheldon J. Segal chaired a session on male reproduction and andrology.
- In December, the Horizons program sponsored the Prevention of Mother-to-Child Transmission [of HIV/AIDS] Symposium in Washington, DC. Council presenters were joined by researchers from USAID, the Centers for Disease Control and Prevention, Family Health International, and UNICEF.

Some of the news outlets in which Council staff were quoted or appeared in the later part of 2003 were: *The New York Times*, *Washington Post*, *Boston Globe*, *Chicago Tribune*, and *International Herald Tribune*; *NBC Nightly News* and *The Early Show* (CBS News); *Newsweek*, *U.S. News and World Report*, *Time*, *Nature*, *Science*, and *New Scientist*; Reuters News Service and MarketWatch.com, Inc.

More information on these events and presentations can be found at www.popcouncil.org/mediacenter. ■

Spray-on contraceptive trial begins

Testing that could result in the first-ever contraceptive delivered by a spray is slated to begin this year in Australia. The trial will assess one or more formulations of Nestorone® in a spray to determine a formulation that could suppress ovulation.

The product brings together the Metered-Dose Transdermal System (MDTS®) developed by FemPharm Pty Ltd., a wholly owned subsidiary of Acrux Limited, and Nestorone, a versatile synthetic progestin extensively studied by the Population Council.

MDTS is a small and easy-to-use drug applicator that will deliver a pre-set, fast-drying dose of Nestorone to the skin, creating an invisible, subdermal reservoir from which the drug will slowly be absorbed into the bloodstream.

Sandra P. Arnold, vice president of Corporate Affairs for the Population Council, noted that the goal of the partnership with Acrux is to "provide women with a contraceptive delivery system that is affordable, safe, reversible, and easy to use."

The clinical trial will be conducted at the Sydney Centre for Reproductive Health Research, under the direction of principal investigator Ian Fraser, and will take less than two years. Fraser is a member of the Population Council's International Committee for Contraception Research and a professor of reproductive medicine at the University of Sydney. Acrux Limited is a group of companies engaged in the development of proprietary transdermal and cosmeceutic products, using technology licensed from Monash University, Melbourne, Australia. ■



Karen Tweedy-Holmes

Stress—a path to male contraception?

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enzyme not known to be present in Leydig cells until studies published by the Hardy lab. (The adrenal gland is the source of CORT and adrenalin, another hormone triggered by stress and well known for causing the "fight-or-flight" reaction.) These derivatives of androgens may convince the "gatekeeper" that sufficient testosterone is being produced to shut down secretion.

One of the challenges of creating a male contraceptive is retaining sexual function and masculine traits (products of testosterone) while counteracting fertility (sperm), given that the biological functions are tied so closely together. "We suspect that the 11 β -HSD enzyme may be taking testosterone and making it into something else—maybe novel derivatives that differ from normal testosterone but are biologically active," Hardy says. "If so, we'll want to study whether the derivatives can be useful for fulfilling testosterone's functions unrelated to the production of sperm...and then we can proceed to closing the gate on testosterone." ■

"The functional roles of 11 β -HSD1: Vascular tissue, testis and brain," by D.J. Morris, A.S. Brem, R. Ge, P.H. Jellinck, R.R. Sakai, and M.P. Hardy, appeared in *Molecular and Cellular Endocrinology*, vol. 203, 2003. "Expression of 11 β -hydroxylase in rat Leydig cells," by G.-M. Wang, R.-S. Ge, S.Y. Latif, D.J. Morris, and M.P. Hardy, appeared in *Endocrinology*, vol. 143, 2002.

Expanding life and work options for adolescents

For nearly a decade, the Population Council has conducted research on the enormous potential of the world's more than one billion young people (ages 15 to 24), the diversity of their needs, and the challenges they face in making the transition to adulthood, especially in the most impoverished communities of the developing world. The educational and livelihood options open to them—or lack thereof—will shape the future of this largest generation of youth and the future of our global society.

The Population Council is focusing on interventions that can improve access to schooling and work opportunities. Researchers are evaluating programs designed to help adolescents emerge as healthy, informed adults with productive skills that will permit them to be full participants in work, family, and community life. The Council also is seeking to gauge whether expanded life options affect adolescent girls' sexual initiation, marriage, childbearing, and overall health.

The Council is studying 11 programs in nine countries that serve populations between the ages of 10 and 25. Total enrollment in these programs exceeds 20,000 young people,

The legal age of marriage in Bangladesh is 18, yet the median age at marriage is 14.7 years.

— Demographic and Health Surveys, 1999/2000

predominately girls. Activities range from vocational training workshops to sports activities and life-skills education (e.g., training in health and hygiene). Approaches being introduced in Bangladesh, Burkina Faso, Egypt, Ethiopia, Guatemala, India, Kenya, South Africa, Vietnam, and other countries are being assessed to determine the most viable, cost-effective options for improving opportunities for youth. Below are details about one such project, in Bangladesh.

With a land area slightly larger than Greece, Bangladesh is the eighth most populous country on earth. Family planning policies initiated by the Bangladesh government in the 1970s helped reduce the average number of births per woman from 6.2 in the early 1970s to about 3.5 today. Nevertheless, during that period the population grew from 66 to over 138 million, propelled by “population

momentum,” the tendency for a youth-heavy population to keep growing because of the sheer number of people entering their reproductive years. Eighty percent of Bangladesh's future population growth is likely to result from population momentum; a five-year rise in women's average age at first childbirth could avert 40 percent of that growth.

Eighteen is the legal marriage age for girls in Bangladesh, yet 47 percent of young women marry before age 15. Council research on whether work opportunities for girls change marriage patterns* has indicated that paid employment, an option previously not available to many young women in Bangladesh, opens new possibilities beyond the traditional path of marriage and motherhood. In addition to delaying marriage, formal work allows women to build savings and expand their social skills.

During the past three years, the Population Council has collaborated with two of Bangladesh's most innovative service organizations on a pilot program to make savings plans, micro-credit, and life-skills training accessible to 18,000 girls in three of the country's rural districts. On the basis of the Council findings, its partners in the study—the Bangladesh Rural Advancement Committee (BRAC) and the Centre for Mass Education and Sciences (CMES)—plan to broaden the initiative to a national program for rural boys as well as girls and to add specific financial and business training skills to current program offerings.

Council senior associate Sajeda Amin, who was the principal investigator for the pilot program, is enthusiastic about studying the expanded program. She explained: “As in the pilot, 30 girls and boys from a village will form a club. BRAC or CMES will conduct 30 to 40 sessions on general topics ranging from diet to negotiating the risks and constraints that poor youth face in their everyday lives. These sessions will be followed by 20 more sessions, developed during the pilot phase, that teach specific skills for getting jobs or running a small business. For example, if a member wants to produce pickles or sell quilts in the local market, she or he will learn basic cost-benefit analysis on how to assess potential markets, develop and implement a marketing plan, secure loans, and manage accounts.” Amin and her colleagues plan to follow the program over the long term, map-

New opportunities for the most vulnerable girls

Examples of livelihood programs that the Population Council is evaluating in nine countries:

- In four villages in the rural Upper Egyptian governorate of Al Minya, Save the Children and the Egyptian ministries of youth and sports and of education have launched ISHRAQ (Enlightenment), a pilot program that offers literacy training, life skills, and sports for out-of-school adolescent girls between the ages of 13 and 15.
- Using Council research, the Kenya Rural Enterprise Program has modified the traditional microfinance model to accommodate the needs of vulnerable girls in areas with high HIV levels. “Tap and Reposition Youth” (TRY) offers a basic business-management training program through which youth (ages 16 to 22) learn how to access credit to start or expand a business and gain related skills.
- In India, the Self-Employed Women's Association (SEWA), which serves over 600,000 low-income women, has formed an adolescent component of its program for girls ages 13 to 19 in 20 villages in rural Gujarat. The girls meet four times a week and are offered training in life skills and livelihoods such as forestry and nursery, milk cooperatives, and water management.

ping the paths participants take, including the age at which they marry. ■

* “Adolescent Girls' Adventure: Baseline Survey Report on Rural Adolescents in Bangladesh,” a monograph by Sajeda Amin, Simeen Mahmud, and Lopita Huq, was published in 2001 by UNICEF and the Ministry of Women and Children Affairs. The study was funded by UNICEF-Dhaka, The Andrew W. Mellon Foundation, the U.K. Department for International Development, and the U.S. Agency for International Development.

Maternal warmth: New hope for low-birth-weight infants

Every year, more than 20 million infants are born weighing less than five-and-a-half pounds. These low-birth-weight babies are at increased risk of respiratory and gastrointestinal conditions. Low birth weight accounts for nearly one-quarter of the world's 7 million annual infant deaths. Most infant deaths (99 percent) occur in poor countries and are attributable to inadequate access to health care. Less than half the women in developing countries give birth in health facilities and few of the hospitals in the poorest countries have the capacity to provide the intensive care needed to promptly stabilize low-birth-weight and premature newborns.

Kangaroo Mother Care was developed in 1979 at the Maternal and Child Institute of Bogotá, Colombia, specifically to care for low-birth-weight and premature infants in hospitals without sufficient personnel or incubators to lessen the risk of hypothermia and life-threatening respiratory conditions. In Kangaroo Mother Care the mother keeps her baby upright at her breast in constant skin-to-skin contact, helping to regulate the baby's temperature. At the same time, skin-to-skin contact promotes breastfeeding on demand and maternal-infant bonding.

Population Council researcher Nancy Sloan and others have demonstrated that Kangaroo Mother Care prevents respiratory illness in hospital-born, low-birth-weight infants. However, there is no evidence that such care reduces infant mortality, because it is applied only to stabilized infants (those free of major disease, able to suckle or tolerate tube feeding, and with stable body temperature). Most infant mortality occurs prior to stabilization. Nevertheless, Kangaroo Mother Care could prove to be the best means of stabilizing low-weight babies born *outside* of medical settings. For example, in such countries as Bangla-

desh, almost all women give birth at home and one-third of the babies are low birth weight.

Sloan and a multidisciplinary team of researchers from Ecuador, Bangladesh, and the United States adapted Kangaroo Mother Care for community-based implementation. In Community-based Kangaroo Mother Care, all pregnant women are taught to provide 24-hour skin-to-skin contact immediately after delivery (even while sleeping), to breastfeed on demand, and to delay bathing their newborns. They also are told that healthy, active babies signal when they are ready to stop being held skin to skin, while others will continue to be comfortable with Kangaroo Care for a longer period.

In a recently completed pilot study, funded by The William and Flora Hewlett Foundation and conducted by the Population Council, the Bangladesh Rural Advancement Committee, and Mitra and Associates, local workers taught Community-based Kangaroo Mother Care to 35 expectant or recently delivered women. At one month after delivery, over 75 percent of the mothers and 85 percent of women with low-birth-weight babies reported they had initiated skin-to-skin care.

With the support of Save the Children's Saving Newborn Lives Program and the Population Council, Sloan and her colleagues are embarking on a larger study in Bangladesh to determine whether Community-based Kangaroo Mother Care stabilizes low-birth-weight infants whose mothers give birth at home and helps prevent newborn and infant mortality. ■

"Adaptation of Kangaroo Mother Care for community-based application," by I. Quasem, N. L. Sloan, A. Chowdhury, S. Ahmed, B. Winikoff, and A. M. R. Chowdhury, appeared in the December 2003 *Journal of Perinatology*.

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The Population Council is an international, non-profit, nongovernmental organization that seeks to improve the well-being and reproductive health of current and future generations around the world and to help achieve a humane, equitable, and sustainable balance between people and resources. The Council conducts biomedical, social science, and public health research and helps build capacities in developing countries. Established in 1952, the Council is governed by an international board of trustees. Its New York headquarters supports a global network of 20 regional and country offices.

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How long do we live?

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between 1980 and 1995. A reduction of two or three years may not seem like a big difference on the individual level, but the societal implications are considerable. "In the long run," Bongaarts says, "two or three years can have a substantial impact on the total future expenditures on pensions and health care for the elderly."

So how high can life expectancy rise? Scholars are divided into two camps: the optimists predict life expectancy as great as 100 years by 2050, and the pessimists think we may be nearing the maximum.

Although the new findings do not resolve this debate, the study lends more support to the pessimists' point of view—which may be good news in terms of future expenditures on programs for the elderly. ■

Former Council vice president remembered

W. Parker Mauldin, former Population Council vice president, died on January 16 at the age of 89 in Charlottesville, VA. Calling him "one of the architects of the Population Council," Council president Linda Martin praised him as "a leading demographer who made original and influential contributions to the evaluation and implementation of family planning programs. Throughout his career, Parker was committed to improving the lives of women and men in the developing world."

Mauldin came to the Council in 1957 as part of the staff of the then Demographic Division. One of his early assignments involved spending a year in India to help establish the first United Nations Demographic Training and Research Centre in Bombay (now Mumbai). He became director of the Council's Demographic Division in 1967, served as vice president from 1969 to 1974, and was acting president from October 1974 to early 1976. Mauldin left the Council in 1979 but rejoined it as a senior associate and had an adjunct appointment until 1997. ■



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Stress—a path to male contraception?

Human beings have long known from simple observation that men and women lose some of their sexual characteristics as they grow older, and research has confirmed this observation. Aging decreases the secretion of sex hormones (known as androgens in men), reduces sperm production, and lowers fertility.

Clinical studies have shown that stress also reduces the production of testosterone (the androgen that stimulates sperm production), but until now the mechanism by which it does so has been all but unknown. A recent study by a laboratory at the Population Council's Center for Biomedical Research (CBR) has shed light on this process.

This CBR lab conducts studies of testosterone secretion under the leadership of senior scientist Matthew Hardy. Co-editor-in-chief of the *Journal of Andrology*, the official journal of the American Society of Andrology, Hardy joined the Council in 1991. His team studies androgen secretion, stress, and environmental toxicants as they relate to male fertility and contraception. Besides providing insight into the development of hormone-based, long-term, reversible male contraception, this research may be valuable in androgen replacement during aging.

The investigators conducted an experiment to determine the levels of glucocorticoid in male rats under stress. Known as CORT or "the stress hormone," glucocorticoid has the same effect in humans

and rats—it directly inhibits testosterone secretion in Leydig cells, which are located in the testes. Levels of CORT can increase tenfold under stress.

The researchers housed rats in a burrow-like setting and let nature take its course; the rats soon established a hierarchy of dominance that placed the subordinate males under great stress. After 14 days, the levels of hormone in their blood were compared. The subordinate rats had 500 percent higher levels of CORT, and six- to tenfold reductions in testosterone, while the dominant rats had values for these hormones that were virtually unchanged.

If that were the end of the story—stress elevates CORT, which inhibits testosterone secretion—the relationship would be simple and solved. But Leydig cells are also protected from the effects of CORT by an enzyme (11 β -HSD) that modulates stress and acts as a "gatekeeper," controlling testosterone secretion. This enzyme was discovered by the late Council researcher Carl Monder and localized to the testis in collaboration with David Phillips, also at CBR. 11 β -HSD was found to be more abundant in the testes of the dominant rats. So it would seem that the enzyme restrains CORT from lowering testosterone levels.

However, 11 β -HSD is in turn inhibited by androgens synthesized from testosterone and related hormones. The inhibitor is the product of an adrenal

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