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Father of Rice Green Revolution Improving of Rice Yield

International Rice Germplasm Center of IRRI, Philippine is Renamed To T.T. Chang Genetic Resources Center for His Contribution and Memory*

** World famous International Rice Research Institute, Los Baños, Laguna, Philippines*

Dr. T.T. Chang, Ph.D.
Member of Academia Sinica, Taipei
April 3, 1927– March 24, 2006

Born in Shanghai
A Brilliant Rice Geneticist and Breeder

張德慈院士

(IR8 Photo is Kindly Provided by Dr Shaobing Peng (IRRI)
IR8 is a rice high yield strain established by IRRI.

• TE-TZU (T. T.) CHANG 張德慈院士

Birth place:	Shanghai, China
Birth date:	April 3, 1927
Citizenship:	Taiwan, Republic of China
Education:	B.S.A., University of Nanking, 1949 MS., Cornell University, 1954 Ph.D., University of Minnesota, 1959
Scholastic honors:	Phi Kappa Phi, Gamma Sigma Delta, Sigma Xi
Positions held:	Junior Specialist, Sino-U.S. Joint Commission on Rural Reconstruction (JCRR), Canton and Taipei, China, 1949-52. Senior Rice Specialist, JCRR, Taiwan, 1959-61. Geneticist, International Rice Research Institute (IRRI) Philippines. 1961-75; Leader, Rice Genetic Resources Program, 1975-83, Head, International Rice Germplasm Center, 1983-91; Principal Geneticist, 1985-91. Visiting Professor, University of the Philippines at Los Banos (UPLB), 1962-91. Advisor, Taiwan Agricultural Research Institute, Taichung, Taiwan, 1988-94. Special Consultant, Committee of International Technical Cooperation, Government of R.O.C., Taipei, Taiwan, Nov. 1994 to June 1997.

Other professional appointments:

Member, FAO-IAEA Committee on Crop Research Date, (Vienna), 1964-67.

FAO-TAC Consultant at Beltsville Meeting (leading to establishment of the IBPGR), 1973.

Member, Plant Breeding Study Group, Van der Have Seeds, Inc. (leading to the Plant Breeding Perspectives book), 1975-79.

Chair, Rice Advisory Committee, International Board for Plant Genetic Resources (IBPGR), (Rome) 1976-85.

Advisor, Genbank project of The Rockefeller Foundation and Chinese Academy of Agricultural Sciences, Beijing, China, 1980-86.

Member and/or chair of several committees of the American Society of Agronomy and Crop Science Society of American, 1982-90.

Weseman Distinguished Foreign Visiting Scientist (for the 1984 Plant Science Lecturer series). Iowan State University. 1984.

Member, Committee on Managing Global Genetic Resources:

Agricultural Imperatives, National Research Council (USA), 1986-92.

Chairman, Work Group on the National Seed Storage Laboratory Expansion Program, National Research Council (USA), 1987-88.

Advisor, USAID-NBPGR Genebank project (India), 1987-89.

Consultant, United Nations University (Tokyo), 1991.

Head, International Short Course on Plant Genetic Resources, University of California (Davis), July-August, 1992.

Panel of advisors, wheat germplasm subprogram, CIMMYT (Mexico), 1992.

Vice President, Society for the Advancement of Breeding Researches in Asia and Oceania (SABRAO), 1985-89; President, 1989-93.

Member, Research Advisory Council, Taiwan Provincial Department of Agriculture & Forestry, R.O.C., 1992-2002.

Member, Advisory Committee on Crop Germplasm, Taiwan Provincial Government, R.O.C., 1995 to2002.

Member, Expert Working Group on Genetic Resources, APEC-ATC, Chinese-Taipei

Honors/awards:

Hohn Scott Award and medal (for the invention of IR8 dwarf rice), The City of Philadelphia, 1969.

Fellow, American Society of Agronomy (ASA), 1978.

International Service in Agronomy Award, American Society of Agronomy, 1980.

Fellow and Chartered Biologist, The Institute of Biology (U.K.), 1982.

Honorary Fellow. Crop Science Society of the Philippines, 1985.

Fellow, Crop Science Society of America (CSSA). 1985.

Honorable mention as a Citation Classic on the decimal code

For growth stages of cereals (by Zadok, Chang and Konzok, 1974) by the Current Contents (1985).

Outstanding Achievement Award, University of Minnesota, 1986.

Rank Prize in Agronomy and Nutrition, Rank Prize Funds, (London), 1988.

Frank N. Meyer Award and Medal in Plant Germplasm, Crop Science Society of America (CSSA), 1990.

Honorary Research Fellow, China National Rice Research Institute (Hanzhou), and Ninghsia Academy of Agriculture & Forestry (Ninchuan), China, 1990.

International Service in Crop Science Award (for research and training), Crop Science Society of America, 1991.

Honorary Fellow, Society for teh Advancement of Breeding Research in Asia and Oceania (SABRAO), 1993.

SINAG (Guiding Light) Award, IRRI Junior Researchers, Inc. (Los Banos, Philippines), 1994.

Foreign Associate, National Academy of Sciences of the U.S.A. (in the Division of Plant Science, Soil Science & Microbiology), 1994.

Fellow, National Academy of Agricultural Sciences, India, 1996.

Fellow, The Third World Academy of Sciences (Trieste), 1996.

Member, the Academia Sinica (National Academy of Arts and Sciences of the Republic of China), 1996.

Fellow the Pontifical Academy of Sciences (Vatican City), 1997.

Tyler World Prize for Environmental Achievement, The Tyler Prize (U. S. C., L. A.), 1999.

Other activities: Invited speaker to more than 50 international symposia on plant genetics, rice breeding, plant germplasm, biotechnology, agricultural development, and prehistory-anthropology.

Advised more than 30 MS and PhD degree holders: taught in short courses numbering over one thousand trainees who came from various parts of the world.

Publications: Authored/co-authored articles more than 250 in scientific journals, books, proceedings, manuals, handbooks, reports and encyclopedias.

(Sincerely provided by Prof Yie-Ie C. Hsing,
Institute of Plant and Microbial Biology,
Academia Sinica)

• 張德慈院士生平簡介

先生名德慈。上海市人。1927 年〔民國十六年〕4 月3 日生。先生家學淵源，世代皆書香子弟。父積善公，聖約翰大學畢業，係早年庚子賠款公費留美學生。先生行四，上有三姊，下有一弟。先生自幼聰穎，早承庭訓，戮力向學。聖約翰中學畢業，先於聖約翰大學進修農學，旋即考入南京私立金陵大學農藝系，1949 年獲學士學位後，在廣州師從錢天鶴先生、沈宗瀚先生及蔣彥士先生等任職中國農村復興聯合委員會〔簡稱農復會〕技佐、1950 年來台任技士。1952 年赴美進修，專攻植物遺傳育種學，分別於1954 年獲康乃爾大學碩士、1959 年獲明尼蘇達大學博士。

1959 年先生學成返國，回任農復會技正職，開始先生為人所稱道之不朽鴻業—水稻品種之改良。先生首將未命名有半矮生習性之台中在來一號水稻，經檢定、試驗、與示範後，予以命名推廣，績效良好，奠定台灣秈型稻種改良之基礎，同時亦建立了台灣水稻育種程序之標準規範。

1961 年先生赴菲律賓參與國際稻米研究所〔International Rice Research Institute 簡稱IRRI 〕之工作，任遺傳學家職。先生首將台中在來一號引入印度試種，因其具有耐肥高產之特性，在該地適應極佳，迅即大規模推廣栽培，為熱帶地區增產糧食，創綠色革命之先聲，此亦為台中在來一號揚名國際之濫觴。

先生更進一步與IRRI 育種家利用台灣之低腳烏尖、矮子尖等帶有半矮生習性基因〔*sd1*〕之親本與熱帶高桿低產品種雜交，育成多個性能優異、國際馳名之優良品種，其中命名為IR8 之高產耐肥新品種，其表現更超越台中在來一號，在東南亞迅速傳播，成就非凡，創較原有品種增加三倍之高產紀錄。由於此等半矮性高產品種的推廣種植，解決了當時〔1966 至1968 年〕之普遍糧荒，也避免了當初所預測1972 至1973 年會發生之糧食危機。對此廣大區域高人口密度國家之糧食供應有莫大貢獻。因為IR8 的育成先生與IRRI 育種同仁在1969 年榮獲美國費城約翰史考特獎〔John Scott Award 〕。1988 年先生又榮獲英國蘭克獎基金會〔Rank Prize Foundation〕所頒予之農藝與營養獎金及獎狀，推崇先生等造福開發中國家，在糧食增產上的卓越貢獻。

1970 年12 月11 日諾貝爾和平獎頒予墨西哥國際玉米與小麥改良中心〔International Maize and Wheat Improvement Center 簡稱CIMMYT〕的 Norman Borlaug 博士，表彰其1968 年之後的小麥綠色革命奇蹟與貢獻；先生等1966 年之IR8 綠色革命之貢獻，相較不遑多讓，而竟未受獎，令人扼腕。

先生自1962 年至1991 年主持IRRI 國際稻作遺傳資源中心〔International Rice Germplasm Center〕[1] 之水稻遺傳資源計畫。在先生之策劃領導下，亞洲與非洲國家二十多國參加蒐集工作，在1972 至1985 年間，從窮鄉僻野徵集各種農家品種與野生稻種，共獲得四萬四千份，使不斷被改良品種替代的舊品種與野生親緣種不致消失。現IRRI 保存有八萬五千份稻種，已成為全球最大作物種源，供給全球稻作人員暨稻農之稻種已逾七十萬份。世界水稻改良品種近九成以上親本均利用IRRI 種源，作為增產、早熟、抗病、抗蟲與品質改良之用，由先生所領導推動之國際水稻種源交換與合作研

究數量，已高佔全世界各種作物之首位。

1970 年代，植物遺傳種源保存屬一新興學門，先生憑其IRRI 自行探索的經驗及與外界廣泛接觸，凝聚多種科學技術，創建種源中心制度，先生即被推崇為一具有創始性的實踐者，先生在此一新興領域所撰寫之論文，已逾六十篇；其中1984 年在美國愛荷華大學〔Iowa State University〕植物科學講座〔Plant Science Lecture〕所講述之六篇論文1. Principles of genetic conservation; 2. Collection of crop germplasm; 3. Preservation of crop germplasm; 4. Evaluation and documentation of crop germplasm; 5. Germplasm enhancement and utilization; 6. Crop history and genetic conservation: Rice -- a case study. 已被奉為經典。先生由於此項成就，繼1980 年獲得美國農藝學會的國際農藝服務獎後，再度於1990 年10 月在美國作物學會〔CSSA〕年會上，獲頒法蘭克梅耶植物種源獎〔Frank N. Meyer Award and Medal in Plant Germplasm〕，成為亞洲獲此殊榮之第一人。

此外先生也致力於水稻進化演變史及中國稻作歷史之研究。先生提出以地球板塊移動過程，推論出稻屬〔genus *Oryza*〕在Gondwana 超級洲開始分化，隨地球板塊之分裂與轉動，在稻屬下有二十二種〔species〕終至分佈於現今之非洲、南美洲、澳洲及南亞與東南亞。此項推論為作物演進史上最有豐富材料並彙集地質、地理與生物知識之一學說，已為生物界學者所認同。先生藉此學說，肯定稻作之祖先，早在中國境內存在，在秈.二型馴化與分化過程上，吾國亦扮演一重要角色，並駁斥稻作僅在印度分化之偏見。此又為先生在生物科技上之另一創見與貢獻。

繼1990 年獲得美國作物學會之法蘭克梅耶植物種源獎後，先生在1991 年11 月再度榮獲該會之作物學國際服務獎〔International Service in Crop Science Award〕，亦為亞洲得此獎之第一人。

在IRRI 工作逾三十年後，先生在1992 年自該所退休，返國定居。是年起，先生又受聘為國家作物種源中心顧問及省政府農林廳農業研究評議員。1992 年3 月先生以亞洲育種研究協進會會長身份主辦國際性討論會。夏間應美國加州大學之邀，主持國際植物遺傳資源保存訓練班，秋間參與墨西哥國際玉米與小麥改良中心〔CIMMYT〕小麥資源工作的諮詢工作。1994 年至1997 年先生受聘為我國海外技術合作委員會特約顧問。先生在農業科技學術上的積極帶領及參與，依舊僕僕風塵，可謂退而不休，令人肅然起敬，由衷欽佩。

先生雖退休返國，然來自國際間之獎項、榮譽依然不斷，例如：1993 年亞太育種學會〔Society for the Advancement of Breeding Research in Asia and Oceania，簡稱SABRAO〕禮聘先生為榮譽研究員；1994 年 IRRI 青年科學家協會致贈“明燈獎”〔SINAG, Guiding Light Award〕，表彰先生在植物遺傳育種研究之帶領，有如一盞燈塔上指引方位之明燈，孺慕之情溢於言表。同年先生當選為美國國家科學院國外院士〔Foreign Associate, National Academy of Sciences of the U.S.A.〕。1996 年先生當選第21屆中央研究院院士、第三世界科學院院士〔Fellow, The Third World Academy of Science〕及印度國家農業科學院院士〔Fellow, National Academy of Agricultural Science, India〕。1997 年4 月18 日，天主教教宗若望保祿二世任命楊振寧及先生同為教廷「宗座科

學院」院士〔Fellow, The Pontifical Academy of Sciences 〕。1999 年先生獲頒泰勒世界環境成就獎〔Tyler World Prize for Environmental Achievement 〕等。先生於泰勒世界成就獎典禮立將獲頒之獎金支票轉捐母校明尼蘇達大學，飲水思源，令人動容。

先生向極重視身教言教，46 年以降，總計發表250 餘篇科學研究論文，培植水稻科研專家人數逾二千〔含指導之30 餘位碩、博士研究生〕且遍及全球。先生亦有感於早年留美，幸得.學金資助，令先生受惠良多，不敢或忘。先生認為台灣在農業進展過程中，得自農家出身子弟並就讀農業職校畢業者所造就之貢獻尤大。是以設立“中華農學會張德慈先生獎學金”，特頒予農職、農專學生之獎勵。晚年先生猶關心年輕學子之養成教育，乃經常提筆書寫雋永小品，傳授科學家之成長與涵養，其中常為人所記憶者，諸如：“農藝學家與農友”、“略談農業研究與倫理”以及“一個生命科學家的心得與樂趣”等，先生善為人師，諄諄教誨，循循善誘，亦師亦友，常為學子所稱道。

先生平日克己自律，澹泊名利，生活儉樸。1997 年任職海外會期間，曾於下公車時，行走失衡，跌跤傷及足部；2003 年又因呼吸困難，兩度進出馬偕醫院，雖經插管、調養，體力大不如前，醫師推定餘時六月。唯在受洗皈依基督，將身體與時間完全交託上帝之後，反略見起色。近一年來，先生更能在夫人陪同，散步於漁人碼頭、餵馬於馬場或登樓運動、遠眺，莫此為樂。先生時有童心未泯，屢央求夫人允其攀爬頂樓水塔邊梯，以目窮遠景，夫人環抱邊梯不允。2006 年3 月24 日，先生由看護陪同登樓運動，一時童心又起，撥開看護之手，逕攀水塔邊梯至第四級，遠眺四周美景，片刻旋即滑落，即無生命跡象，經送馬偕醫院急救，回天乏術，一代哲人自此隕落。

夫人華思美女士，台北一女中畢業。於1960 年來歸先生，鴻案相莊四十有六年，勤儉持家，服恃先生無微不至。先生早年，馳騁國際學術舞台，展其驥足；及至先生晚年，遠離塵囂，移居淡水，終日與稻田鷺鷥為鄰，閒雲野鶴，均有賴夫人之相伴與調護。先生與夫人育有二子，長子張定安君，美國密西根大學醫學博士，業醫；次子張傑文君，美國柏克萊大學哲學博士，專長物理化學。長媳應善修女士，腎臟科醫師，懸壺濟世、相夫教子，事親至孝，恪盡婦職。孝子賢孫，皆善紹家風，為人所稱羨。

綜觀先生之生平，畢其一生於遺傳育種研究，奠定台灣水稻珍貴遺傳種源為世界利用之基業，其學術足以傳世，其立身足為遺範，享年八十，福壽全歸，今雖歸返天家，安息主懷，然其鴻業常存，永為後學所景仰。

[1] 菲律賓IRRI 董事會主席Dr. Kei Otsuka 已宣佈，即日起將該中心改名為“張德慈遺傳資源中心”〔T. T. Chang Genetic Resources Center 〕，以紀念張院士。

（台大農藝系謝兆樞教授謹書）

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✾ Review ✾

• What is *IRRI?*

The International Rice Research Institute (IRRI) is an autonomous, nonprofit agricultural research and training organization with offices in more than ten nations. The Institute's main goal is to find sustainable ways to improve the well-being of present and future generations of poor rice farmers and consumers while at the same time protecting the environment.

Most of IRRI's research is done in cooperation with national agricultural research and development institutions, farming communities, and other organizations of the world's rice-producing nations.

IRRI was established in 1960 by the Ford and Rockefeller foundations in cooperation with the government of the Philippines. Its research activities began in 1962 and are now estimated to have touched the lives of almost half the world's population.

The Institute's research headquarters has laboratories and training facilities on a 252-hectare experimental farm on the main campus of the University of the Philippines Los Banos, about 60 kilometers south of the Philippine capital, Manila. Besides doing rice research, IRRI is also very active in local communities°Xproviding educational scholarships, organizing income-generating training activities, and arranging other community projects that will help improve living conditions in the poor communities that neighbor the Institute.

http://www.irri.org/about/about.asp.

• IR8, IRRI first high-yielding modern rice variety

The Green Revolution in rice was dependent on the introduction of semi-dwarf, high yielding INDICA cultivars for growing in tropical areas. The dwarfing gene originated from a Chinese cultivar, Dee-geo-woo-gen, which was used in a breeding program in Taiwan during the 1950s to produce the highly successful Taichung Native 1 (TN-1), and later at the International Rice Research Institute (IRRI) in the Philippines to produce IR-8, the so-called 'miracle rice'. TN-1 and IR-8 have subsequently been used as parents in breeding programs to produce many of the commercial semi-dwarf indica cultivars grown in tropical and semi-tropical areas, and also in developing JAPONICA cultivars for growing in the more temperate Republic of Korea and California.

[From: Hedden, Peter, 2003. The genes of the Green Revolution. Trends in Genetics. 9(1): 5-9.]

IR8 is a name almost symbolic of the Green Revolution