

Fertility and Sterility®

OFFICIAL JOURNAL OF THE AMERICAN SOCIETY FOR REPRODUCTIVE MEDICINE, Society for Reproductive Endocrinology and Infertility, Society of Reproductive Surgeons, Society for Assisted Reproductive Technology, Society for Male Reproduction and Urology, Society of Reproductive Biologists & Technologists (SRBT) and the Pacific Coast Reproductive Society.



Editors-in-Chief

CRAIG NIEDERBERGER, M.D.
Chicago, Illinois

ANTONIO PELLICER, M.D.
Rome, Italy

Video and New Media Editor

KURT BARNHART, M.D., M.S.C.E.
Philadelphia, Pennsylvania

Editorial Editors

ROBERT BRANNIGAN, M.D.
Chicago, Illinois

ZEV ROSENWAKS, M.D.
New York, New York

JACQUES DONNEZ, M.D., PH.D.
Brussels, Belgium

WILLIAM SCHLAFF, M.D.
Philadelphia, Pennsylvania

DAVID MELDRUM, M.D.
San Diego, California

MARK SIGMAN, M.D.
Providence, Rhode Island

RICHARD PAULSON, M.D.
Los Angeles, California

CARLOS SIMÓN, M.D., PH.D.
Valencia, Spain

Associate Editors

MATS BRÄNNSTRÖM, M.D., PH.D.
Gothenburg, Sweden

RICHARD LEGRO, M.D.
Hershey, Pennsylvania

OWEN DAVIS, M.D.
New York, New York

PAULINE MENDOLA, PH.D.
Hyattsville, Maryland

MICHAEL EISENBERG, M.D.
Stanford, California

RICHARD SCOTT, M.D.
Basking Ridge, New Jersey

NICOLÁS GARRIDO, PH.D.
Valencia, Spain

ANNE STEINER, M.D., M.P.H.
Chapel Hill, North Carolina

MARY STEPHENSON, M.D., M.Sc.
Chicago, Illinois

Specialty Editors

RENATO FANCHIN, M.D., PH.D.
Suresnes, France

JIM HOTALING, M.D., M.S.
Salt Lake City, Utah

SUSAN KLOCK, PH.D.
Chicago, Illinois

STEVEN R. LINDHEIM, M.D.
Dayton, Ohio

ROBERT JOHN NORMAN, M.D.
Adelaide, Australia

RANJITH RAMASAMY, M.D.
Miami, Florida

MARGRIT URBANEK, PH.D.
Chicago, Illinois

Interactive Associates

MICAH J. HILL, D.O., INTERACTIVE ASSOCIATE-IN-CHIEF
Bethesda, Maryland

KATHERINE CAMERON, M.D.
Philadelphia, Pennsylvania

LAURA COONEY, M.D.
Middleton, Wisconsin

ALI A. DABAJA, M.D.
Detroit, Michigan

JAMES M. DUPREE, M.D., M.P.H.
Ann Arbor, Michigan

JASON M. FRANASIAK, M.D., HCLD/ALD (ABB)
Basking Ridge, New Jersey

RANI FRITZ, D.O., PH.D., F.A.C.O.G.
New York, New York

AUDREY GASKINS, B.S.E.
Boston, Massachusetts

T. MIKE HSIEH, M.D.
San Diego, California

AMANDA KALLEN, M.D.
New Haven, Connecticut

DANIEL J. KASER, M.D.
Basking Ridge, New Jersey

JASON KOVAC, M.D., PH.D.
Carmel, Indiana

SCOTT MORIN, M.D.
Basking Ridge, New Jersey

RACHEL MOSES, M.D., M.P.H.
Salt Lake City, Utah

GEORGE PATOUNAKIS, M.D., PH.D.
Lake Mary, Florida

ALEXANDER M. QUAAS, M.D., PH.D.
Oklahoma City, Oklahoma

MARY SAMPLASKI, M.D.
Los Angeles, California

Managing Editor

MEREDITH SAULS
Birmingham, Alabama

Former Editors

PENDLETON TOMPKINS, M.D., EDITOR 1950-1952

M. EDWARD DAVIS, M.D., EDITOR 1953-1969

LUIGI MASTROIANNI, JR., M.D., EDITOR 1970-1975

ROGER D. KEMPERS, M.D., EDITOR 1976-1997

ALAN H. DeCHERNEY, M.D., EDITOR 1997-2011

Assistant Managing Editor

THEA RYAN
Birmingham, Alabama

Editorial Board

MOHAMED ABOULGHAR, M.D. <i>Cairo, Egypt</i>	OLIVIER DORNEZ, M.D., PH.D. <i>Avignon, France</i>	ISAAC KLIGMAN, M.D. <i>New York, New York</i>	MARY ELLEN PAVONE, M.D., M.S.C.I. <i>Chicago, Illinois</i>
PAUL S. ALBERT, PH.D. <i>Bethesda, Maryland</i>	SHELLEY EHRLICH, M.D., S.D. <i>Cincinnati, Ohio</i>	EFSTRATIOS KOLIBIANAKIS, M.D., PH.D. <i>Thessaloniki, Greece</i>	ALAN PENZIAS, M.D. <i>Waltham, Massachusetts</i>
AYMAN AL-HENDY, M.D., PH.D. <i>Nashville, Tennessee</i>	ESTHER EISENBERG, M.D., M.P.H. <i>Bethesda, Maryland</i>	PHILIPPE KONINCKX, M.D., PH.D. <i>Bierbeek, Belgium</i>	MARK PERLOE, M.D. <i>Atlanta, Georgia</i>
MINA ALIKANI, PH.D., H.C.L.D. <i>New York, New York</i>	NAVID ESFANDIARI, D.V.M., PH.D. <i>Lebanon, New Hampshire</i>	STEPHEN KRAWETZ, PH.D. <i>Detroit, Michigan</i>	ELIZABETH PUSCHECK, M.D. <i>Detroit, Michigan</i>
MARK BAKER, PH.D. <i>Callaghan, Australia</i>	ASGERALLY FAZLEABAS, PH.D. <i>Grand Rapids, Michigan</i>	ALLEN R. KUNSELMAN, M.A. <i>Hershey, Pennsylvania</i>	GWENDOLYN P. QUINN, PH.D. <i>Tampa, Florida</i>
VALERIE BAKER, M.D. <i>Stanford, California</i>	EVE FEINBERG, M.D. <i>Chicago, Illinois</i>	DOLORES LAMB, PH.D. <i>Houston, Texas</i>	CATHERINE RACOWSKY, PH.D. <i>Boston, Massachusetts</i>
EMILY S. BARRETT, PH.D. <i>Rochester, New York</i>	ANNA PIA FERRARETTI, M.D. <i>Bologna, Italy</i>	DAN LEBOVIC, M.D. <i>Madison, Wisconsin</i>	DANIEL RAPPOLEE, PH.D. <i>Detroit, Michigan</i>
PEDRO BARRI, M.D., PH.D. <i>Barcelona, Spain</i>	MARCO FILICORI, M.D. <i>Bologna, Italy</i>	WILLIAM LEDGER, M.D. <i>Randwick, Australia</i>	MARY RIDDLE, PH.D. <i>State College, Pennsylvania</i>
ANGELINE BELTSOS, M.D. <i>Glenview, Illinois</i>	DAVID FRANKFURTER, M.D. <i>Washington, D.C.</i>	LARRY LIPSHULTZ, M.D. <i>Houston, Texas</i>	JARED ROBINS, M.D. <i>Chicago, Illinois</i>
ZEEV BLUMENFELD, M.D. <i>Haifa, Israel</i>	JUAN A. GARCIA-VELASCO, M.D. <i>Madrid, Spain</i>	DANELLE LOBDELL, M.S., PH.D. <i>Research Triangle Park, North Carolina</i>	JAY SANDLOW, M.D. <i>Milwaukee, Wisconsin</i>
FRANCISCO BOLUMAR, M.D., PH.D. <i>Madrid, Spain</i>	WILLIAM GIBBONS, M.D. <i>Houston, Texas</i>	TYCHO LOCK, M.D. <i>Utrecht, Netherlands</i>	JOSEPH SANFILIPPO, M.D. <i>Pittsburgh, Pennsylvania</i>
ANDREA BORINI, M.D. <i>Bologna, Italy</i>	MARK GIBSON, M.D. <i>Salt Lake City, Utah</i>	JASON T. MACHAN, PH.D. <i>Providence, Rhode Island</i>	PETER SCHLEGEL, M.D. <i>New York, New York</i>
ERNESTO BOSCH, M.D. <i>Valencia, Spain</i>	SUZANNE GILBOA, PH.D. <i>Atlanta, Georgia</i>	NICK MACKLON, M.D., PH.D. <i>Southampton, United Kingdom</i>	BEATA SEEBER, M.D., M.S.C.E. <i>Innsbruck, Austria</i>
NANCY BRACKETT, PH.D. <i>Miami, Florida</i>	PAUL GINDOFF, M.D. <i>New York, New York</i>	GUILLERMO MARCONI, M.D. <i>Buenos Aires, Argentina</i>	JAMES SEGARS, M.D. <i>Baltimore, Maryland</i>
RICHARD BRONSON, M.D. <i>Stony Brook, New York</i>	ELIZABETH GINSBURG, M.D. <i>Boston, Massachusetts</i>	PETER MCGOVERN, M.D. <i>Newark, New Jersey</i>	MARCOS FELIPE SILVA DE SA, M.D., PH.D. <i>Riberao Preto, Brazil</i>
JOHN BUSTER, M.D. <i>Providence, Rhode Island</i>	JEFFREY GOLDBERG, M.D. <i>Cleveland, Ohio</i>	MARCOS MESEGUER, PH.D. <i>Valencia, Spain</i>	STEVEN D. SPANDORFER, M.D. <i>New York, New York</i>
ETTORE CAROPPO, M.D. <i>Bari, Italy</i>	MARC GOLDSTEIN, M.D. <i>New York, New York</i>	LISA MORAN, PH.D. <i>Adelaide, Australia</i>	H. IRENE SU, M.D., M.S.C.E. <i>La Jolla, California</i>
JOHN CASHY, PH.D. <i>Chicago, Illinois</i>	SUSAN GOLOMBOK, PH.D. <i>Cambridge, United Kingdom</i>	STEVEN NAKAJIMA, M.D. <i>Stanford, California</i>	CARLOS SUELDO, M.D. <i>Fresno, California</i>
WILLIAM CATHERINO, M.D., PH.D. <i>Bethesda, Maryland</i>	MARK GOODARZI, M.D., PH.D. <i>Los Angeles, California</i>	CAMRAN NEZHAT, M.D. <i>Stanford, California</i>	NAO SUZUKI, M.D., PH.D. <i>Kanagawa, Japan</i>
JORGE E. CHAVARRO, M.D., SC.D. <i>Boston, Massachusetts</i>	MICHELE R. HACKER, SC.D. <i>Boston, Massachusetts</i>	ERNEST NG, M.D. <i>Hong Kong</i>	HUGH TAYLOR, M.D. <i>New Haven, Connecticut</i>
YOUNG MIN CHOI, M.D., PH.D. <i>Seoul, Republic of Korea</i>	ROGER HART, M.D. <i>Perth, Australia</i>	MICHELLE NISOLLE, M.D., PH.D. <i>Liege, Belgium</i>	NATHAN R. TREFF, PH.D. <i>Basking Ridge, New Jersey</i>
ANA COBO, PH.D. <i>Valencia, Spain</i>	KATHLEEN HOEGER, M.D. <i>Rochester, New York</i>	ROBERT OATES, M.D. <i>Boston, Massachusetts</i>	ALFREDO ULLOA-AGUIRRE, M.D., D.Sc. <i>Mexico City, Mexico</i>
CHRISTOPHER DE JONGE, PH.D. <i>Minneapolis, Minnesota</i>	HE-FENG HUANG, M.D. <i>Hangzhou, PR China</i>	KUTLUK OKTAY, M.D. <i>New York, New York</i>	MONICA VAZQUEZ-LEVIN, PH.D. <i>Buenos Aires, Argentina</i>
PAUL DEVROEY, M.D., PH.D. <i>Brussels, Belgium</i>	HEATHER GIBSON HUDDLESTON, M.D. <i>San Francisco, California</i>	STEVEN ORY, M.D. <i>Margate, Florida</i>	MOSHE WALD, M.D. <i>Iowa City, Iowa</i>
DOMINIQUE DE ZIEGLER, M.D. <i>Paris, France</i>	ALAYMAN H. F. HUSSEIN, M.B.B.CH., M.Sc., M.D. <i>El-Minia, Egypt</i>	KELLY PAGIDAS, M.D. <i>Providence, Rhode Island</i>	ROBERT WILD, M.D., PH.D., M.P.H. <i>Oklahoma City, Oklahoma</i>
THOMAS D'HOOGHE, M.D., PH.D. <i>Leuven, Belgium</i>	KEITH ISAACSON, M.D. <i>Newton, Massachusetts</i>	FIRUZA PARIKH, M.D. <i>Mumbai, India</i>	ELENA YANUSHPOLSKY, M.D. <i>Boston, Massachusetts</i>
MICHAEL DIAMOND, M.D. <i>Augusta, Georgia</i>	CALEB KALLEN, M.D., PH.D. <i>Philadelphia, Pennsylvania</i>	(EDITOR, INDIAN EDITION)	HEPING ZHANG, PH.D. <i>New Haven, Connecticut</i>
ANUJA DOKRAS, M.D., PH.D. <i>Philadelphia, Pennsylvania</i>	SULEENA KANSAL KALRA, M.D., M.S.C.E. <i>Philadelphia, Pennsylvania</i>	LAURI PASCH, PH.D. <i>San Francisco, California</i>	CYNTHIA ZIEMER, M.Div., Psy.D. <i>Oak Park, Illinois</i>
MARIE-MADELEINE DOLMANS, M.D., PH.D. <i>Brussels, Belgium</i>	EDWARD KIM, M.D. <i>Knoxville, Tennessee</i>		
ALICE D. DOMAR, PH.D. <i>Waltham, Massachusetts</i>	S. SAMUEL KIM, M.D. <i>Kansas City, Kansas</i>		