Table of Contents

Preface 1

Committee Membership 3

Acknowledgments 5

PLENARY LECTURE

High-Intensity Focused Ultrasound (HIFU) using Sonablate® devices for the treatment of benign prostatic hyperplasia and localized prostate cancer: 18-year experience
Toyoaki Uchida 9

PHYSICAL STUDIES

Characterization and quantification of MTU fields with a fiber-optic displacement sensor
Julian Haller, Klaus-Vitold Jenderka, Volker Wilkens, and Christian Koch 19

Heating of tissues in vivo by pulsed focused ultrasound to stimulate enhanced HSP expression
Tamara Kujawska, Janusz Wójcik, and Andrzej Nowicki 24

Development of HIFU treatment for lower extremity varicose veins
Naohiko Senoo, Hiroyuki Ushijima, Jun Suzuki, Kiyoshi Yoshinaka, Juno Deguchi, Shu Takagi, Tetsuro Miyata, and Yoichiro Matsumoto 30

Optoacoustic imaging for guiding and monitoring HIFU therapy
Parag V. Chitnis, Hans P. Brecht, Richard Su, and Alexander A. Oraevsky 36

A new acoustic lens design for electromagnetic shock wave lithotripters
Pei Zhong, Nathan Smith, Neal W. Simmons, and Georgy Sankin 42
3D MRI-controlled transurethral ultrasound prostate therapy: Experimental validation of numerical simulations
Mathieu Burtnyk, William Apoutou N'Djin, Ilya Kobelevskiy, Michael Bronskill, and Rajiv Chopra

Measurements of HIFU-induced lesions in BSA gel phantoms for HIFU treatment of varicose veins of lower extremity
Hiroyuki Ushijima, Naohiko Senoo, Jun Suzuki, Mitsuhsia Ichiyanagi, Kiyoshi Yoshinaka, Juno Deguchi, Shu Takagi, Tetsuro Miyata, and Yoichiro Matsumoto

CAVITATION/MICROBUBBLE MONITORING AND BIOEFFECTS

The mechanical effects of ultrasound contrast agents on micro-vessels
N. Hosseinkhah and K. Hynynen

Histological findings in the brain after focused ultrasound ablation combined with definity using parameters suited for transcranial application
Natalia Vykhodtseva, Yuexi Huang, and Kullervo Hynynen

Feedback loop process for controlling inertial cavitation: Experimental evidence
Claude Inserra, Abbas Sabraoui, Lina Reslan, Jean-Christophe Bera, Bruno Gilles, and Jean-Louis Mestas

Synchronized passive imaging of single cavitation events
Jérôme Gateau, Jean-François Aubry, Mathieu Pernot, Daurian Chauvet, Anne-Laure Boch, Mathias Fink, and Mickaël Tanter

Cavitation detection using a fibre-optic hydrophone: A pilot study
V. Bull, J. Civale, I. Rivens, and G. R. ter Haar

Temperature change from oscillating bubbles within a capillary network induced by focused ultrasound
Shaoying Liu, Nazanin Hosseinkhah, and Kullervo Hynynen

Evaluation of local density enhancement of microcapsules in artificial blood vessel during exposure to focused ultrasound
Ryusuke Nakamoto, Kohji Masuda, Nobuyuki Watarai, Yuto Taguchi, Toshikazu Kato, Takashi Yoshinaga, Yoshitaka Miyamoto, and Toshio Chiba
Analysis for acoustic characterization of microbubbles under ultrasound exposure
Wataru Baba, Yoji Nakamura, Mitsuhisa Ichijyanagi, Kiyoshi Yoshinaka, Teiichiro Ikeda, Shu Takagi, and Yoichiro Matsumoto

Gel phantom containing controlled air to test triggered HIFU exposure sequence
Kengo Takimoto, Tatsuya Moriyama, Ryo Takagi, Shin Yoshizawa, and Shin-ichiro Umemura

MR-HIFU

Usage of Magnetic Resonance Guided Focused Ultrasound Surgery (MRGFUS) in oncology
Yair Bauer

Application of MR-guided focused pulsed ultrasound for destroying clots in vitro using thrombolytic drugs
V. Hadjisavvas, K. Ioannides, and C. Damianou

3D conformal MRI-guided transurethral ultrasound therapy: Results of gel phantom experiments
W. A. N'Djin, M. Burtnyk, S. McCormick, M. Bronskill, and R. Chopra

MR-HIFU enhanced volumetric ablations
Charles Mougenot, Bruno Quesson, Christ Moonen, and Shunmugavelu Sokka

Heart ablation using a planar rectangular high intensity focused ultrasound transducer and MRI guidance
Andreas Couppis, Christakis Damianou, Kleanthis Ioannides, Nicos Mylonas, Demitris Iosif, Panagiotis Kyriakou, Cyril Lafon, Francoise Chavrier, Jean-Yves Chapelon, and Alain Birer

MR-guided focused ultrasound robot for performing experiments on large animals
N. Mylonas and C. Damianou

Tissue necrosis monitoring for HIFU ablation with T1 contrast MRI imaging
San-Chao Hwang, Ching Yao, Ih-Yuan Kuo, Wei-Cheng Tsai, and Hsu Chang
Investigations into thermally mediated drug delivery using a preclinical system for MRI-guided focused ultrasound
Robert Staruch, Rajiv Chopra, and Kullervo Hynynen 163

Evaluation of hand-held strain imaging for guiding HIFU ablation: In vivo results compared with MR-images
Jérémy Chenot, David Melodelima, Hubert Parmentier, Rémi Souchon, and Jean-Yves Chapelon 168

DEVICE

Effects of tracking error on lesion formation in high intensity focused ultrasound liver tumor tracking treatments
Cheng Chieh-Fang, Lin Win-Li, and Chen Yung-Yaw 177

Fabrication of CMUT cells with gold center mass for higher output pressure
Hyo-Seon Yoon, Min-Chieh Ho, Nikhil Apte, Paul Cristman, Srikant Vaithilingam, Mario Kupnik, Kim Butts-Pauly, and Butrus T. Khuri-Yakub 183

Selecting random distributed elements for HIFU using genetic algorithm
Yufeng Zhou 189

A pilot study of catheter-based ultrasound hyperthermia with HDR brachytherapy for treatment of locally advanced cancer of the prostate and cervix
Chris J. Diederich, Jeff Wootton, Punit Prakash, Vasant Salgaonkar, Titania Juang, Serena Scott, Xin Chen, Adam Cunha, Jean Pouliot, and I. C. Hsu 195

Ablation produced using a toroidal high intensity focused ultrasound device is independent of hepatic perfusion
David Melodelima, William A. N'Djin, Julia Favre, Hubert Parmentier, Michel Rivoire, and Jean Yves Chapelon 200

Multilayer array transducer for nonlinear ultrasound imaging
Neil R. Owen, Peter J. Kaczkowski, Tong Li, Dan Gross, Steven M. Postlewait, and Francesco P. Curra 206
Effects of Lamb waves in a single-element high intensity focused ultrasound transducer
    Kenji Otsu, Yasuhiro Kaneshima, Shin Yoshizawa, and Shin-ichiro Umemura 211

Design and fabrication of a wide-aperture HIFU annular array transducer for the treatment of deep-seated tumors
    Gin-Shin Chen, Hsu Chang, Yi-Yuan Kuo, Winli Lin, Wen-Shiang Chen, and Wen-Yih Tseng 215

Electronic beam steering for increasing the coagulated volume created with a toroidal transducer
    J. Vincenot, D. Melodelima, F. Chavrier, and J. Y. Chapelon 221

A method of estimating pressure and intensity distributions of multielement phased array high intensity focused ultrasonic field at full power using a needle hydrophone
    Yu Ying, Shen Guofeng, Bai Jingfeng, and Chen Yazhu 227

BUBBLE-ENHANCED HIFU

Heating location control of HIFU treatment enhanced with microbubbles
    T. Nishihara, H. Utashiro, M. Ichiyanagi, K. Yoshinaka, S. Takagi, and Y. Matsumoto 235

Minimally invasive intracardiac intervention using high intensity focused ultrasound
    Takashi Mochizuki, Taizou Kihara, Kazunori Itani, Kouji Ogawa, Shin Yoshizawa, Shin-ichiro Umemura, Gontaro Kitazumi, Yasumasa Katsuike, and Toshio Chiba 241

An investigation of high intensity focused ultrasound thrombolysis
    Cameron Wright, Kullervo Hynynen, and David Goertz 246

THEORETICAL CALCULATION

A simulation model for predicting the temperature during the application of MR-guided focused ultrasound for stroke treatment using pulsed ultrasound
    V. Hadjisavvas and C. Damianou 253
A TR-induced algorithm for hot spots elimination through CT-scan HIFU simulations
Nicolas Leduc, Kohei Okita, Kazuyasu Sugiyama, Shu Takagi, and Yoichiro Matsumoto 259

Symptomatic improvement in uterine myomas after MRgFUS: 4 year follow up
Kaoru Funaki and Hidenobu Fukunishi 265

The effect of the elastic body assumption on the focusing of ultrasounds in inhomogeneous media
Takaaki Shimura, Kohei Okita, Shu Takagi, and Yoichiro Matsumoto 269

BIOEFFECTS AND DRUG DELIVERY

Immune system modulation with LOFU and HIFU treatment of prostate cancer
C. Guha, Z. Huagang, W. Chen, R. Carlosn, and N. T. Sanghvi 277

Color doppler sonographic evaluation of peak systolic velocity and pulsatility index in artery after pulsed HIFU exposure
Feng-Yi Yang, Wei-Hsiu Chiu, and Chi-Fang Yeh 283

HIFU as a neoadjuvant therapy in cancer treatment

A study of micro-bubble enhanced sonoporation

Standing waves in small animal models investigating ultrasound disruption of the blood-brain barrier
Meaghan A. O'Reilly, Yuexi Huang, and Kullervo Hynynen 301

A novel pinhole-assisted mechanical scanning 28-kHz ultrasonic device to open the blood-brain barrier
Hao-Li Liu, Pin-Yuan Chen, and Kuo-Chen Wei 306

Sonoporation-induced apoptosis and cell cycle arrest: Initial findings
Wenjing Zhong, Wai Hung Sit, Jennifer M. F. Wan, and Alfred C. H. Yu 312
An experimental model using cultured cardiac myocytes for a study of the generation of premature ventricular contractions under ultrasound exposure
Nobuki Kudo and Masaya Yamamoto

Ultrasound-induced DNA damage and signal transductions indicated by gammaH2AX
Yukihiro Furusawa, Yoshisada Fujiwara, Qing-Li Zhao, Mariame Ali Hassan, Ryohei Ogawa, Yoshiaki Tabuchi, Ichiro Takasaki, Akihisa Takahashi, Takeo Ohnishi, and Takashi Kondo

Ultrasound-targeted bubble liposome destruction enhances AG73-mediated gene transfer by improvement of intracellular trafficking
Daiki Omata, Yoichi Negishi, Yoko Endo-Takahashi, Ryo Suzuki, Kazuo Maruyama, Motoyoshi Nomizu, and Yukihiko Aramaki

Characterisation of gene delivery using liposomal bubbles and ultrasound

Intramuscular injection of angiogenic gene with bubble liposomes followed by ultrasound exposure to improve angiogenesis
Yoichi Negishi, Keiko Matsuo, Yoko Endo-Takahashi, Kentaro Suzuki, Yuuki Matsuki, Norio Takagi, Ryo Suzuki, Kazuo Maruyama, and Yukihiko Aramaki

Novel siRNA-loaded bubble liposomes with ultrasound exposure for RNA interference
Yoko Endo-Takahashi, Yoichi Negishi, Ryo Suzuki, Kazuo Maruyama, and Yukihiko Aramaki

Anti-tumor mechanism in IL-12 gene therapy using liposomal bubbles and ultrasound
Ryo Suzuki, Yusuke Oda, Risa Koshima, Keiichi Hirata, Tetsuya Nomura, Yoichi Negishi, Naoki Uto-guchi, Shinsaku Nakagawa, and Kazuo Maruyama

Anti-tumor effects from dendritic cell-based cancer immunotherapy using liposomal bubbles and ultrasound
<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR-guided unfocused ultrasound disruption of the rat blood-brain</td>
<td>Kelly A. Townsend, Randy L. King, Greg Zaharchuk, and Kim Butts Pauly</td>
<td>356</td>
</tr>
<tr>
<td>barrier</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood-brain barrier disruption caused by ultrasound bursts combined</td>
<td>Nathan McDannold, Yongzhi Zhang, and Natalia Vykhodtseva</td>
<td>361</td>
</tr>
<tr>
<td>with microbubbles depends on anesthesia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influence of waveform on cell viability during ultrasound exposure</td>
<td>Timur Saliev, Loreto B. Feril, Donald A. McLean, Katsuro Tachibana,</td>
<td>367</td>
</tr>
<tr>
<td>and Paul A. Campbell</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p53 response to ultrasound: Preliminary observations in MCF7 human</td>
<td>Janis M. Burns and Paul A. Campbell</td>
<td>371</td>
</tr>
<tr>
<td>breast cancer cells</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultrasound-assisted gene transfer to adipose tissue-derived stem/</td>
<td>Yoshitaka Miyamoto, Hitomi Ueno, Rei Hokari, Wenji Yuan, Shuichi Kuno,</td>
<td>377</td>
</tr>
<tr>
<td>progenitor cells (ASCs)</td>
<td>Takashi Kakimoto, Shin Enosawa, Yoichi Negishi, Kiyoshi Yoshinaka,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yoichiro Matsumoto, Toshio Chiba, and Shuji Hayashi</td>
<td></td>
</tr>
<tr>
<td>TREATMENT PLANNING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultrasound image-guided tracking algorithm for moving-tumor treatment</td>
<td>Kai-Hsiang Chang, Ming-Chih Ho, Chi-Chuan Yeh, Feng-Li Lian, Jia-</td>
<td>385</td>
</tr>
<tr>
<td></td>
<td>Yush Yen, and Yung-Yaw Chen</td>
<td></td>
</tr>
<tr>
<td>Real-time tissue change monitoring on the Sonablate® 500 during high</td>
<td>Wo-Hsing Chen, Narendra T. Sanghvi, Roy Carlson, and Toyoaki Uchida</td>
<td>391</td>
</tr>
<tr>
<td>intensity focused ultrasound (HIFU) treatment of prostate cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-volume heating strategy to shorten treatment time in ultrasound</td>
<td>Xiang Ji, Guofeng Shen, Jingfeng Bai, and Yazhu Chen</td>
<td>397</td>
</tr>
<tr>
<td>surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design of a filter against ultrasound image noise for remote diagnosis</td>
<td>Yen-Yu Chen</td>
<td>402</td>
</tr>
<tr>
<td>Title</td>
<td>Authors</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Cooling time reduction for focused ultrasound surgery by dynamically adjusting sonication time</td>
<td>Li Dehui, Shen Guofeng, Bai Jinfeng, and Chen Yazhu</td>
<td>412</td>
</tr>
<tr>
<td>MRI-guided transurethral ultrasound therapy of the prostate gland: Simulations under clinical conditions</td>
<td>W. A. N'Djin, M. Burtnyk, I. Kobelevskiy, M. Bronskill, and R. Chopra</td>
<td>418</td>
</tr>
<tr>
<td>BUBBLE DYNAMICS SIMULATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The dynamics of histotripsy bubbles</td>
<td>Wayne Kreider, Michael R. Bailey, Oleg A. Sapozhnikov, Vera A. Khokhlova, and Lawrence A. Crum</td>
<td>427</td>
</tr>
<tr>
<td>Numerical simulation of cavitation in ultrasound field</td>
<td>Yoshiaki Tamura, Nobuo Tsurumi, and Yoichiro Matsumoto</td>
<td>431</td>
</tr>
<tr>
<td>Numerical study of the effective combination of microbubbles and ultrasound in HIFU therapy</td>
<td>Kohei Okita, Kazuyasu Sugiyama, Kenji Ono, Shu Takagi, and Yoichiro Matsumoto</td>
<td>437</td>
</tr>
<tr>
<td>Numerical modeling of non-spherical response of therapeutic encapsulated microbubbles to ultrasound</td>
<td>Chao-Tsung Hsiao and Georges L. Chahine</td>
<td>443</td>
</tr>
<tr>
<td>NANOPARTICLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLINICAL STUDIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulation of temperature field induced by 8-element phased array HIFU transducer with concave spherical surface</td>
<td>Wujun Sun, Ping Zhang, Xiaojing Zhang, Xiqi Jian, and Zhihua Li</td>
<td>459</td>
</tr>
</tbody>
</table>
Salvage high-intensity focused ultrasound for the recurrent prostate cancer after radiotherapy in Japan
S. Shoji, M. Nakano, Y. Nagata, and T. Uchida

High-intensity focused ultrasound for the treatment of localized and locally advanced hormone-resistant prostate cancer: 2,5 year outcome
V. A. Solovov, S. Y. Dvoynikov, and M. O. Vozdvizhenskiy

**CLINICAL MR-HIFU**

Diffusion weighted MR imaging to evaluate treatment results after volumetric MR-guided high intensity focused ultrasound of uterine fibroids: Influence of different B-values
M. J. Voogt, B. Keserci, Y. S. Kim, H. Rhim, H. K. Lim, C. Mougenot, M. O. Kohler, M. van den Bosch, K. L. Vincken, and L. W. Bartels

Efficacy of magnetic resonance-guided focused ultrasound surgery for bone metastases pain palliation
Motohiro Kawasaki, Hirofumi Nanba, Tomonari Kato, Toshikazu Tani, and Takahiro Ushida

Author Index