

# Soft Matter

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## IN THIS ISSUE

ISSN 1744-683X CODEN SMOABF 5(17) 3129–3364 (2009)



### Cover

See A. Bunge *et al.*, pp. 3331–3339.  
Lipid membranes coated on LbL-particles have similar properties as free-standing membranes as revealed by NMR and fluorescence methods. Image reproduced by permission of Daniel Huster from *Soft Matter*, 2009, **5**, 3331.



### Inside cover

See S. Semrau *et al.*, pp. 3174–3186  
Numerically determined shape of a fully phase separated giant lipid vesicle. Background: fluorescence image of liquid ordered and liquid disordered lipid domains. Image reproduced by permission of Stefan Semrau from *Soft Matter*, 2009, **5**, 3174.

## EDITORIAL

3145

### Themed issue: membrane biophysics

Biomembranes are thermodynamic ensembles with interesting features beyond the scope of single molecules. The role of thermodynamic observables, susceptibilities, and how they are influenced by thermodynamic variables is the most prominent topic of this themed issue on membrane biophysics.



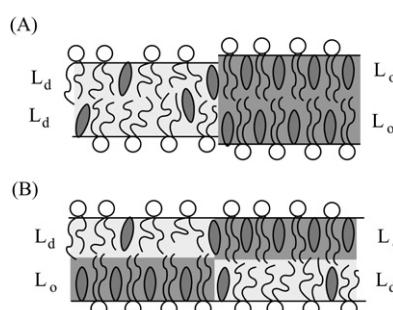
## EMERGING AREA

3148

### Trans-monolayer coupling of fluid domains in lipid bilayers

Sylvio May\*

Compositional coupling between the two leaflets of a fluid lipid bilayer tends to register domains and affects the phase behavior of the membrane. The coupling strength is likely caused by a dynamic chain interdigitation mechanism.



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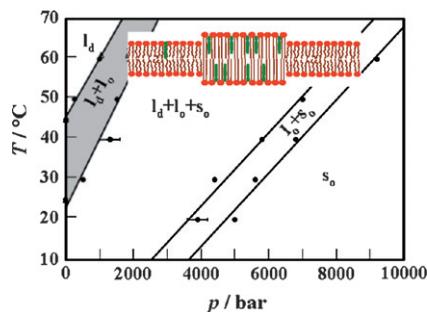
## REVIEWS

3157

**Effect of pressure on membranes**

Roland Winter\* and Christoph Jeworrek

Using thermodynamic, spectroscopic and scattering experiments, the temperature and pressure dependent structure and phase behavior of model biomembranes was studied. Applying pressure-jump relaxation techniques yielded additional information about the kinetics of lipid phase transformations.

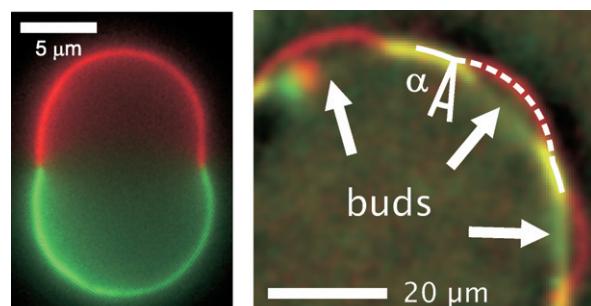


3174

**Membrane heterogeneity – from lipid domains to curvature effects**

Stefan Semrau\* and Thomas Schmidt

In this review we discuss state-of-the-art models for membrane microstructure on the basis of key experiments, the basics of single-molecule tracking experiments in live cells and a new unbiased analysis method for single-molecule position data.

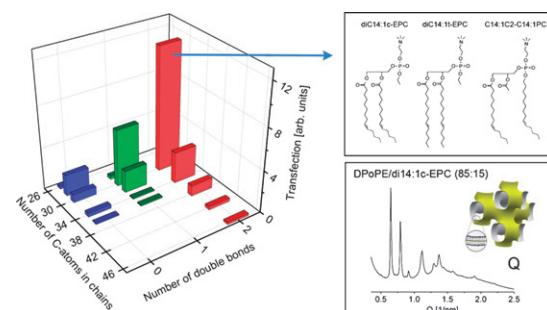


3187

**Cationic phospholipids: structure–transfection activity relationships**

Rumiana Koynova\* and Boris Tenchov

Cationic phosphatidylcholines with two monounsaturated 14:1 chains exhibit maximum transfection activity and strongly promote cubic phase formation in zwitterionic membrane phosphatidylethanolamine.

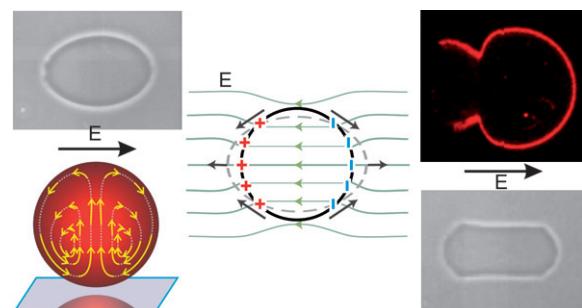


3201

**Vesicles in electric fields: Some novel aspects of membrane behavior**

Rumiana Dimova,\* Natalya Bezlyepkina, Marie Domange Jordö, Roland L. Knorr, Karin A. Riske, Margarita Staykova, Petia M. Vlahovska, Tetsuya Yamamoto, Peng Yang and Reinhart Lipowsky

This review focuses on electric field effects on giant vesicles, such as electrodeformation, -poration and -fusion, and reports novel observations like lipid flows, bursting instability of charged vesicles and cylindrical deformations.



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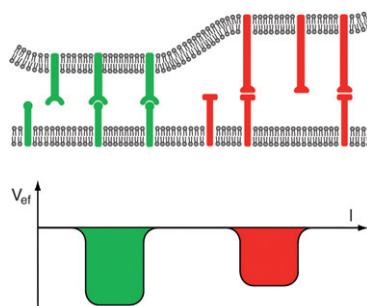
## REVIEWS

3213

**Adhesion of membranes *via* receptor–ligand complexes: Domain formation, binding cooperativity, and active processes**

Thomas R. Weikl, Mesfin Asfaw, Heinrich Krobath, Bartosz Rózycki and Reinhard Lipowsky

This review discusses theoretical models for cell adhesion in which the cell membranes are described as elastic sheets and the receptors and ligands as anchored single molecules.

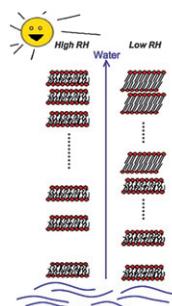


3225

**Diffusional transport in responding lipid membranes**

Emma Sparr,\* Christoffer Åberg, Peter Nilsson and Håkan Wennerström

Diffusion in lipid membranes that respond to gradients with structural changes, leads to a coupling of structure and transport. In particular phase transformations can induce strongly non-linear behaviour.

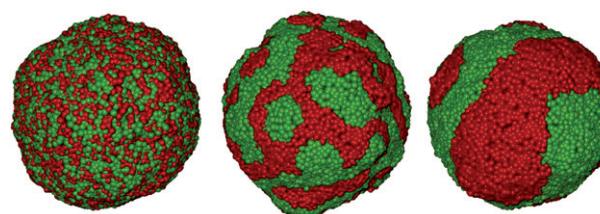


3234

**Phase behavior of multicomponent membranes: Experimental and computational techniques**

Luis Bagatolli\* and P. B. Sunil Kumar\*

This review includes basic foundations on membrane model systems and experimental approaches applied in the membrane research area, stressing on recent advances in the experimental and computational techniques.



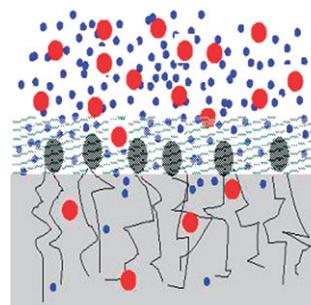
## TUTORIAL REVIEW

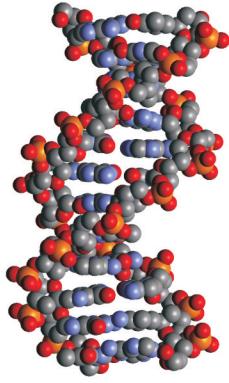
3249

**Experimental approaches to membrane thermodynamics**

Peter Westh\*

This review demonstrates how weak and non-specific membrane interactions such as membrane hydration and small-molecule membrane partitioning can be elucidated from different thermodynamic measurements.





# Polymeric Biomaterials conference

University of Reading, UK  
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Philippe Dubois (Mons)

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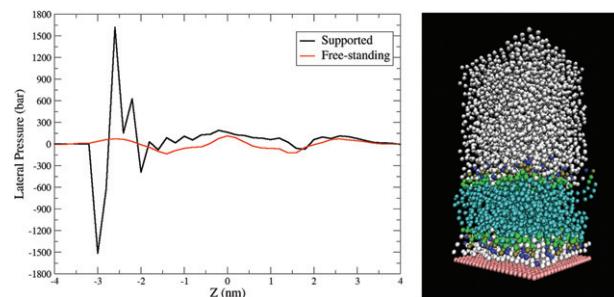
3258



### Asymmetric nature of lateral pressure profiles in supported lipid membranes and its implications for membrane protein functions

Chenyue Xing, O. H. Samuli Ollila, Ilpo Vattulainen and Roland Faller\*

Lateral pressure profiles in supported lipid bilayers are significantly altered in comparison to free bilayers suggesting a novel mechanism for protein inactivation.



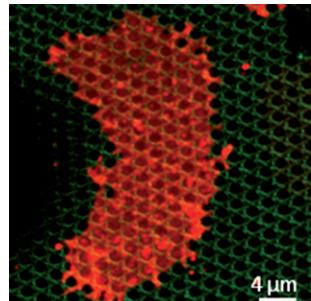
3262



### Elasticity mapping of apical cell membranes

Tamir Fine, Ingo Mey, Christina Rommel, Joachim Wegener, Claudia Steinem and Andreas Janshoff\*

A new view of the apical cell membrane of epithelial cells. Local elastic properties of isolated cell membranes on porous substrates probed by force indentation mapping are revealed.



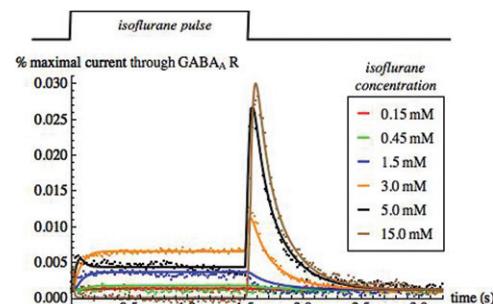
## PAPERS

3266

### A kinetic model of ion channel electrophysiology: bilayer-mediated effects of agonists and anesthetics on protein conformational transitions

Robert S. Cantor,\* Kathryn S. Twyman, Pavle S. Milutinovic and Rainer Haseneder

A kinetic model of bilayer-mediated agonist and anesthetic modulation of postsynaptic ion channels is used to predict anesthetic-induced currents through GABA<sub>A</sub> receptors, in excellent agreement with electrophysiological results.



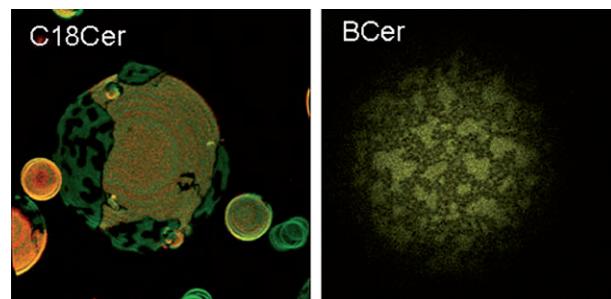
3279



### Asymmetry determines the effects of natural ceramides on model membranes

Dolores C. Carrer, Eva Kummer, Grzegorz Chwastek, Salvatore Chiantia and Petra Schwille\*

Symmetric ceramides increase compartmentalization while asymmetric ceramides produce mixing and re-shuffling.



**Analyst**  
Interdisciplinary detection science  
www.rsc.org/analyst  
Volume 134 | Number 4 | April 2009 | Pages 821–838

**Journal of Materials Chemistry**  
www.rsc.org/materials  
Volume 19 | Number 29 | 7 August 2009 | Pages 5057–5260

**Critical Review**  
S. Thayumanavan et al.  
Amphiphilic nanoassemblies for the detection of peptides and proteins using fluorescence and mass spectrometry

**PAPER**  
Alberto Facchetti et al.  
The preferential electrocatalytic oxidation of aromatic polyimides and MWCNTs on enediol groups and their analytical implications in food domains

**PAPER**  
Céline L. Pichot et al.  
Lattice structure of the  $\beta_2$ -phase studied by second harmonic generation and X-ray diffraction measurements

**FEATURE ARTICLE**  
Thomas Proffen and Hyunsoo Kim  
Advances in total scattering analysis

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0003-2650(2009)134:4;1-G  
0003-2650(2009)19:29;1-N

## Materials for Detection web theme

The *Analyst* and *Journal of Materials Chemistry* joint web theme on Materials for Detection explores all aspects of novel materials for bio- and chemosensing applications, ranging from peptide and protein detection to sensing of environmental pollutants. The Guest Editor of this web theme is Professor Charles Martin, University of Florida, USA. All the articles included appear in regular issues of *Journal of Materials Chemistry* or *Analyst*.

### Articles include:

#### Critical Review:

#### **Amphiphilic nanoassemblies for the detection of peptides and proteins using fluorescence and mass spectrometry**

Malar A. Azagarsamy, Andrea Gomez-Escudero, Volkan Yesilyurt, Richard W. Vachet and S. Thayumanavan, *Analyst*, 2009, **134**, 635 - 649

#### Paper:

#### **SERRS coded nanoparticles for biomolecular labelling with wavelength-tunable discrimination**

Fiona McKenzie, Andrew Ingram, Robert Stokes and Duncan Graham, *Analyst*, 2009, **134**, 549 - 556

#### Feature Articles:

#### **Functional DNA directed assembly of nanomaterials for biosensing**

Zidong Wang and Yi Lu, *J. Mater. Chem.*, 2009, **19**, 1788 - 1798

#### **Highly encoded one-dimensional nanostructures for rapid sensing**

Sung-Kyoung Kim and Sang Bok Lee, *J. Mater. Chem.*, 2009, **19**, 1381 - 1389

#### Guest Editor



**Charles Martin**  
University of Florida, USA

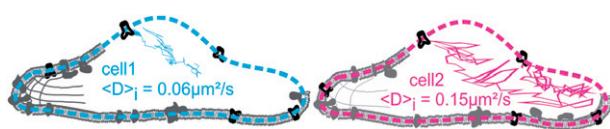
## PAPERS

3287

 **Cell-to-cell variability in the diffusion constants of the plasma membrane proteins CD59 and CD147**

Stefan Wieser, Julian Weghuber, Michael Sams,  
Hannes Stockinger and Gerhard J. Schütz\*

We used single-molecule fluorescence microscopy to demonstrate cell-to-cell variability in the diffusion constants of the GPI-anchored protein CD59 and the transmembrane protein CD147.

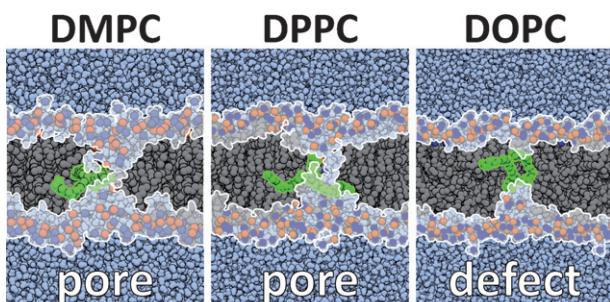


3295

**Thermodynamics of flip-flop and desorption for a systematic series of phosphatidylcholine lipids**

Nicolas Sapay, W. F. Drew Bennett and D. Peter Tieleman\*

Phospholipid flip-flop is an important biological process involved in cell growth and signaling. We show the thermodynamics of phosphatidylcholine lipid flip-flop depends strongly on the structure and length of the lipid tails.

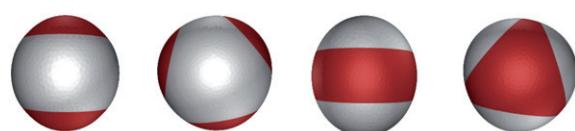


3303

**Polymorphism of vesicles with multi-domain patterns**

Erwin Gutleiderer, Thomas Gruhn and Reinhard Lipowsky\*

It is shown that vesicle membranes exhibit stable multi-domain patterns that consist of more than two intramembrane domains. These patterns arise from the competition between bending and line energies.

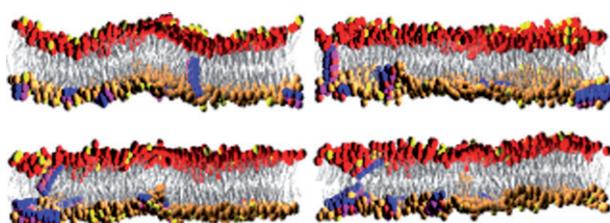


3312

**Effects of induced tension and electrostatic interactions on the mechanisms of antimicrobial peptide translocation across lipid bilayer**

Lianghui Gao\* and Weihai Fang

Mesoscopic simulations reveal that an antimicrobial peptide translocates across an acidic lipid bilayer *via* an initial parallel adsorption state, perpendicular insertion state, and a final parallel adsorption state, but can cross zwitterionic lipid bilayers by skipping the first state.



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- Polymer Science in Everyday Life
- Advances in Colloidal and Nanosize Polymer Materials
- Young Polymer Scientists: Contributions, Nurturing and Networking

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- Professor Kiyohito Koyama  
Yamagata University, Japan
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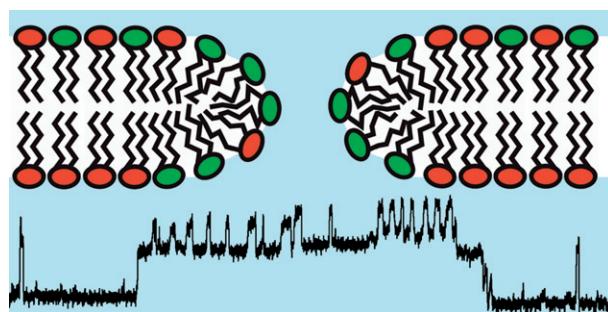
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## PAPERS

3319

**The thermodynamics of lipid ion channel formation in the absence and presence of anesthetics. BLM experiments and simulations**Katarzyna Wodzinska,\* Andreas Blicher\*  
and Thomas Heimburg

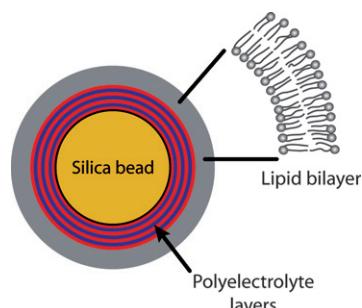
Lipid membranes close to transitions display quantized current events indistinguishable from those reported for protein channels, which can be 'blocked' by anesthetics.



3331

**Characterization of lipid bilayers adsorbed on spherical LbL-support**Andreas Bunge,\* Martin Fischlechner, Martin Loew,  
Anna Arbuzova, Andreas Herrmann and Daniel Huster

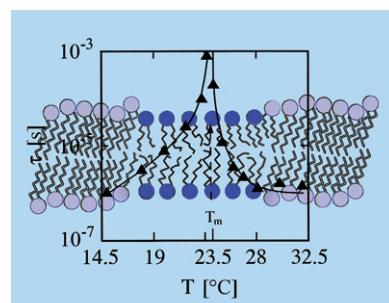
Structural and dynamic properties of lipid bilayers on layer-by-layer (LbL) polyelectrolyte coated particles have been studied using solid-state nuclear magnetic resonance and fluorescence methods.



3340

**Slowing down in lipid bilayers: domain structure fluctuations and axial diffusion**Beate Brüning, Elke Wald, Wilfried Schrader,  
Ralph Behrends and Udo Käatze\*

Fluctuations of the lipid bilayer domain structure slow near the gel-fluid phase transition, revealing features of critically demixing binary liquids. In contrast to the head group reorientational motions, the axial diffusion of the whole lipid molecule couples to the slowing fluctuations.

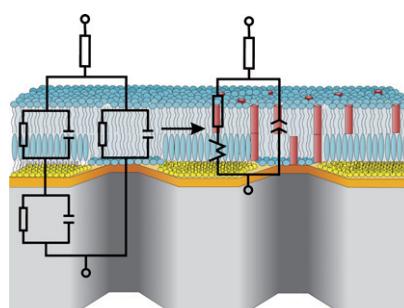


3347

**Impedance analysis of gramicidin D in pore-suspending membranes**

Eva K. Schmitt, Conrad Weichbrodt and Claudia Steinem\*

Gramicidin D was inserted into pore-suspending membranes resulting in such high peptide concentration that it became readily possible to sensitively monitor its electrical activity by means of impedance spectroscopy.



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Peterson AA, Vogel F, Lachance RP, et al., *Energy Environ. Sci.*, 2008, **1**, 32, DOI: 10.1039/b810100k

On the use of cyclic voltammetry for the study of anodic electron transfer in microbial fuel cells  
Fricke K, Harnisch F, Schroder U, *Energy Environ. Sci.*, 2008, **1**, 144, DOI: 10.1039/b802363h

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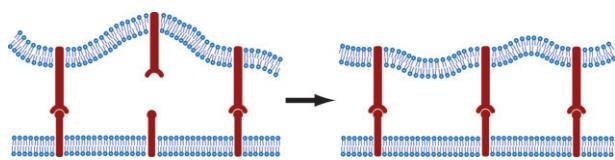
## PAPERS

3354

## Binding cooperativity of membrane adhesion receptors

Heinrich Krobath, Bartosz Rózycki, Reinhard Lipowsky and Thomas R. Weikl\*

Receptor–ligand bonds in cell adhesion zones ‘smoothen out’ the membranes. The smoothening facilitates the formation of additional bonds and, thus, leads to a cooperative binding of receptors and ligands.



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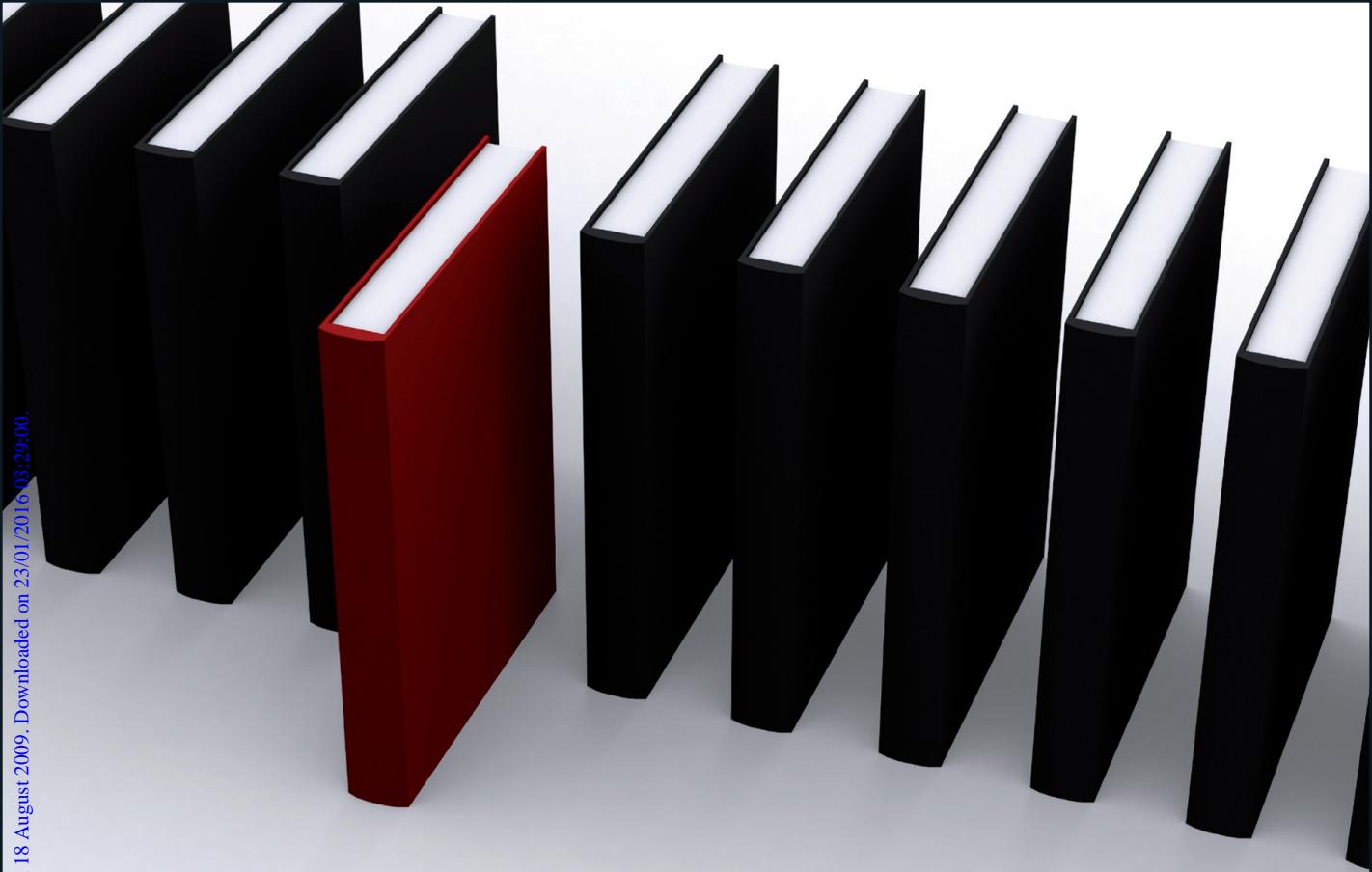
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