

Pharmacological Reviews' 75th Year Anniversary: Past and Future—Editorial

I am excited and honored to be Editor in Chief of *Pharmacological Reviews* as it celebrates its 75th anniversary! *Pharmacological Reviews* enjoys a long and rich history of success, starting with its inception in 1949. The first editor was a pharmacology great, Louis S. Goodman, perhaps best known for the book he co-authored with Alfred Gilman, “The Pharmacological Basis of Therapeutics.” However, it was Dr. John Jacob Abel’s vision for the American Society of Pharmacology and Experimental Therapeutics (ASPET) to have a reviews journal. In 1933, Dr. Abel co-founded and served as the first President of ASPET and its first journal, aptly named the *Journal of Pharmacology and Experimental Therapeutics* (*JPET*). Fifteen years later, in 1948, his idea for a reviews journal was brought to and approved by the newly formed Board of Publications Trustees.

Inaugural Issue

The first issue of *Pharmacological Reviews* was published in April 1949, a 216-page issue comprising four articles, “The Metabolism of Adrenaline” by Z.M. Bacq (151 cites), “The Pharmacology of Adrenergic Blockade” by Mark Nickerson (492 cites), “The Interaction of Drugs and Plasma Proteins” by Avram Goldstein (528 cites), and “Anticholinesterase Drugs” by George B. Koelle and Alfred Gilman (173 cites), citation numbers at the time of writing (November 2023). A fun fact is that this issue was published as the second part of volume 95 of *JPET*, albeit with its own banner. Two more issues were published in the journal’s inaugural year, one on August 1 with three articles, and the other on December 1 with five articles. There were three issues published in 1950 and 1951, before the journal switched in 1952 to its long-standing four issues per year format, most often publishing on the 1st of March, June, September, and December. *Pharmacological Reviews* published its first standalone issue (separate from *JPET*) in 1951 as volume 3 (Stitzel, 1999).

First 5 Decades

The majority of issues from 1950 through the early 1990s consisted of one to three articles, commonly two. During this time, *Pharmacological Reviews* published 10 issues dedicated to symposia and workshops. The first, in 1954, was a “Physiology Symposium.” Although

a physiology symposium might, at first glance, seem at odds with a pharmacology reviews journal, this was most fitting. As Nobel Laureate, Otto Loewi, wrote in his introduction to this issue “pharmacology started from physiology, used its methods and has as its main goal the revealing of physiological function from the reactions of living matter to chemical agents” (Loewi, 1954). Other issues covered the first (1959) and second (1966) symposia on “Catecholamines,” “Cannabis” (1971), “Regulation of Catecholamine Metabolism in the Sympathetic Nervous system” (1972), and “Immunopharmacology” (1973) and workshops on “The Cell Surface: Implications for Toxicology” (1978), “Immunological Aspects of Toxicology” (1982), “Toxicology: Determinants of Susceptibility and Predictability” (1984), and “Pharmacology of Cyclosporine (Sandimmune)” (1990). Since that time, there have been no issues devoted to symposia or workshops. However, the editorial board often invites potential authors to contribute a comprehensive review article to *Pharmacological Reviews* based on symposia programmed at the annual ASPET meetings, as well as other relevant conferences.

Content Expansion

From the 1990s forward, the number of articles per issue gradually grew, ranging most often from four to eight per issue but interjected with issues containing upward of ten articles. These “blockbuster” issues were largely fueled by a strong pipeline of review articles coming from the International Union of Basic and Clinical Pharmacology (IUPHAR), the first of which was published in 1993. The most IUPHAR articles published in a single issue was five in 1998. As far as available records show, the most papers (in total) published in a single issue of *Pharmacological Reviews* was fourteen! This happened twice. First, in December 2005 and then in July 2012. The eight issues published over 2021 and 2022 averaged just over nine total articles per issue, four of those issues containing ten or eleven articles! These growing numbers led the board of *Pharmacological Reviews* to discuss and agree upon the ideas of increasing the number of issues per year to six, as well as to move to publishing reviews online as accepted. The impetus for these ideas was driven largely by getting articles disseminated more quickly to readership, and for authors to have their articles immediately available upon acceptance. This proposal was brought to and approved by the Publications Committee (formerly the Board of Publications Trustees) in 2022 and went into effect in 2023 with issues being

published on the 1st of January (four articles), March (six articles), May (six articles), July (six articles), September (eight articles), and November (seven articles). With a thriving editorial board and an excellent pipeline of articles, I am pleased to say that this transition has been very successful and will help continue to grow this prestigious journal.

New Features

Other advances in *Pharmacological Reviews* were the introduction of graphical abstracts in February 19, 2015 and open access to articles in December 2015. More recently, in June 2022, *Pharmacological Reviews* introduced “Social Media Ambassadors” to help promote published reviews on our social media channels, including X (formerly Twitter), Facebook, and LinkedIn. Social Media Ambassadors are trainees or early-stage investigators. Lindsey Galbo-Thomma (then graduate student at Wake Forest, USA), Rheure Lopes (then postdoctoral fellow at the University of Glasgow, UK), Joshua Lott (then graduate student at the University of Michigan, USA), and Karla Neves (then postdoctoral fellow at the University of Glasgow, UK) joined the Editorial Board as our inaugural Social Media Ambassadors and made their first posts on articles published in the July 2022 issue (Fig. 1).

Their top “Ambassador Picks” are listed on the home page of *Pharmacological Reviews*. Finally, in October 2022, the “Most Cited” section was added to the journal home page, allowing readers to easily access the most downloaded and most mentioned articles on the journal website.

Editorial Board: Bringing in the Experts

Given that the majority of *Pharmacological Reviews* articles are invited, a tremendous part of the journal's success is its dedicated Associate Editors, who are tasked with recruiting at least two review articles each year. This ensures a healthy pipeline of articles coming

from leaders in their respective field(s) of pharmacology. Associate Editors are asked to serve for a 3-year term. The Editor in Chief will invite Associate Editors who are effective in recruiting authors to serve multiple terms. Many Associate Editors agree to do so. Table 1 acknowledges Associate Editors who have served 10 or more years at the time of writing this editorial, according to available records.

Many of our dedicated Associate Editors, regardless of years of service, have been prolific in their recruiting efforts. A big shout-out must go to Robert Dantzer, Eliot Ohlstein, Gunnar Schulte, and Rhian Touyz for the impressive number of reviews they have recruited over the past 10 years. Of course, I would be remiss if I did not applaud every single one of our Associate Editors. Their commitment to the journal, their own standing in the field, and their, oftentimes, persuasive talents, have attracted an abundance of articles from leaders in pharmacology, including numerous Nobel laureates. Not to mention, a big thank you to Associate Editors who have authored articles for *Pharmacological Reviews*.

As Stitzel notes in his editorial for the 50th anniversary of *Pharmacological Reviews* (Stitzel, 1999), Nobel Prize winners publishing in *Pharmacological Reviews* to that time included Otto Loewi (1936), Henry H. Dale (1936), Corneille Heymans (1938), Carl Cori (1947), Julius Axelrod (1970), U. S. von Euler (1970), Earl Sutherland (1971), Sune Bergström (1982), Rita Levi-Montalcini (1986), George Hitchings (1988), Gertrude Elion (1988), Ferid Murad (1998), Louis Ignarro (1998), and Robert Furchgott (1998) (numbers in parentheses indicate year of Nobel Prize) (Stitzel, 1999). Since that time, the list has grown to include Robert J. Lefkowitz (2012) and David Julius (2021). Oftentimes, these Nobel laureates published multiple papers in *Pharmacological Reviews*.

Editorial Board Early Years

Historically, *Pharmacological Reviews* began with a male editorial board, all from the United States. Early on, however, *Pharmacological Reviews* invited the British Pharmacology Society and Scandinavian Pharmacology Society to have standing representation on the board. This followed from Sir John Gaddum of the British Pharmacology Society, who envisaged a review journal that was a joint venture of the three pharmacology societies, American, British, and Scandinavian. As described in the 50th anniversary of *Pharmacological Reviews* editorial, by former Editor in Chief, Robert Stitzel, the editorial board of *Pharmacological Reviews* had already been formed, and first issue published, before this came to light (Stitzel, 1999). However, before the second issue was published in 1951, Drs. John Gaddum, Miles Weatherall, and Joshua Burn, representing the British Pharmacology Society, and Dr. Erik Jacobsen and Ulf von Euler, representing the Scandinavian Pharmacology Society, were added to the editorial board. Later, it was agreed that



Fig. 1. 2022 *Pharmacological Reviews* Social Media Ambassador Inaugural Team.

TABLE 1
Associate Editors serving 10 or more years on the board of *Pharmacological Reviews* from 1996

| Associate Editor | Affiliation | Country | Date Started | Years of Service |
|---------------------|---|---------|--------------|-------------------|
| Arthur Atkinson Jr. | Northwestern University | USA | 1 Jan 1996 | 11 |
| Bertil Fredholm | Karolinska Institute | Sweden | 1 Jan 1996 | 18 |
| Charles Marsden | University of Nottingham | UK | 1 Jan 1996 | 10 |
| Ove Nedergaard | University of Southern Denmark | Denmark | 1 Jan 1996 | 11 |
| Raymond Ruddon | University of Michigan | USA | 1 Jan 1996 | 11 |
| Juoko Tuomisto | National Public Health Institute | Finland | 1 Jan 1996 | 11 |
| Per Magne Ueland | University of Bergen Institute of Medicine | Norway | 1 Jan 1996 | 14 |
| Daniel Simmons | Brigham Young University | USA | 1 Nov 1999 | 11 |
| Burt Sharp | University of Tennessee Health Science Center | USA | 1 Jan 2000 | 15 |
| Paul Insel | University of California, San Diego | USA | 22 Aug 2001 | 23 |
| Dan Longo | NIH then Harvard Medical School | USA | 22 Aug 2001 | 13 |
| Mark Mattson | National Institutes of Health | USA | 22 Aug 2001 | 14 |
| Theresa Shapiro | Johns Hopkins University | USA | 31 Jan 2002 | 12 |
| Anette Dolphin | University College London | UK | 12 Aug 2002 | 14 |
| Glenda Gillies | Imperial College School of Medicine | UK | 6 Aug 2003 | 11 |
| Steven Alexander | University of Nottingham | UK | 22 Nov 2004 | 19 ^{a,c} |
| Markku Koulu | University of Turku | Finland | 29 Jan 2007 | 14 |
| Ulf Simonsen | Aarhus University | Denmark | 15 Feb 2007 | 16 ^{a,c} |
| Michael Gottesman | National Institutes of Health (NCI) | USA | 19 Mar 2008 | 18 ^a |
| Martin Michel | Johannes Gutenberg University | Germany | 19 Mar 2009 | 15 ^a |
| Lynette Daws | University of Texas HSC at San Antonio | USA | 1 Jan 2010 | 12 ^b |
| Qiang Ma | National Institute for Occupational Safety & Health Centers for Disease Control & Prevention | USA | 1 Feb 2010 | 12 |
| Michael Nader | Wake Forest University | USA | 1 Feb 2010 | 13 |
| Eliot Ohlstein | Velicept Pharmaceuticals | USA | 1 Feb 2010 | 14 ^a |
| Finn Olav Levy | University of Oslo | Norway | 30 Jun 2010 | 13 ^{a,c} |
| Clive Page | Kings College London | UK | 26 Oct 2010 | 13 ^a |
| Yoshihiro Ishikawa | Yokohama City Univ Graduate School of Medicine | Japan | 21 Sep 2011 | 11 |
| Rhian Touyz | Research Institute of McGill University Health Centre | Canada | 28 Sep 2011 | 12 ^a |
| Richard Ye | The Chinese Univ of Hong Kong, Shenzhen | China | 17 Jul 2014 | 9 ^a |

^aStill serving on the board.

^bCurrent Editor in Chief.

^cBritish and Scandinavian Pharmacology Society representatives.

the Scandinavian Pharmacology Society would have four members on the editorial board of *Pharmacological Reviews*, one each to represent the four largest Scandinavian countries (Stitzel, 1999). This relationship continues to this day with Steve Alexander (UK) representing the British Pharmacology Society, and Jukka Hakkola (Finland), Finn Olav Levy (Norway), Gunnar Schulte (Sweden), and Ulf Simonsen (Denmark) representing the Scandinavian Pharmacology Society.

In the early years, the number of Associate Editors hovered around 8–10, increasing to around 20 in the early 2000s and remaining relatively steady at that number until David Sibley became Editor in Chief in 2010. His first action at that time was to dramatically increase the number of Associate Editors. He astutely recognized the need for a larger Associate Editor base if the pipeline of articles and impact factor of the journal were to increase. Dave rapidly increased the Associate Editor base to over 35 in his first years there! I was one of his early recruits. Since my time as Editor in Chief, I have emulated his excellent example. I especially want to give a big shout-out to the exceptional Editorial Board I have the privilege of working with, many of whom provide me with sage advice on unsolicited proposals and articles that the journal receives.

Expanding across the Globe

In recent times, the diversity of the editorial board has expanded considerably. Figure 2 shows the current

geographical diversity of our board. Although approximately a third of the board is represented by the United States (US), perhaps not surprising for a US-based journal, the increase in geographic diversity is impressive from recent times, jumping from nine countries in 2022 to 15 in 2023. Similarly, the number of women serving on the board increased from 4 to 12 over the same period.

The editorial board has been led by Editors in Chief, to whom we are indebted for forging the path for *Pharmacological Reviews* to grow and prosper (Table 2).

Impact

Thanks to our exceptional leadership and editorial board over the years, one of the most consistent achievements of *Pharmacological Reviews* has been its ability to keep current on content published, to include comprehensive reviews on new pharmacological spaces. This has undoubtedly contributed to the journal's ability to sustain its high impact factor, currently 21.1 and citation half-life, greater than 10 years! As shown in Fig. 3, *Pharmacological Reviews* has been consistent in maintaining its impressive impact factor for the long haul, averaging around 21 since 1994 with a few peaks and troughs along the way. According to currently available records, *Pharmacological Reviews* has enjoyed an impact factor as high as 44.7 in the early 1990s. According to exaly.com (see footnote to Table 3), the impact factor, extended impact factor, and H-index of *Pharmacological*

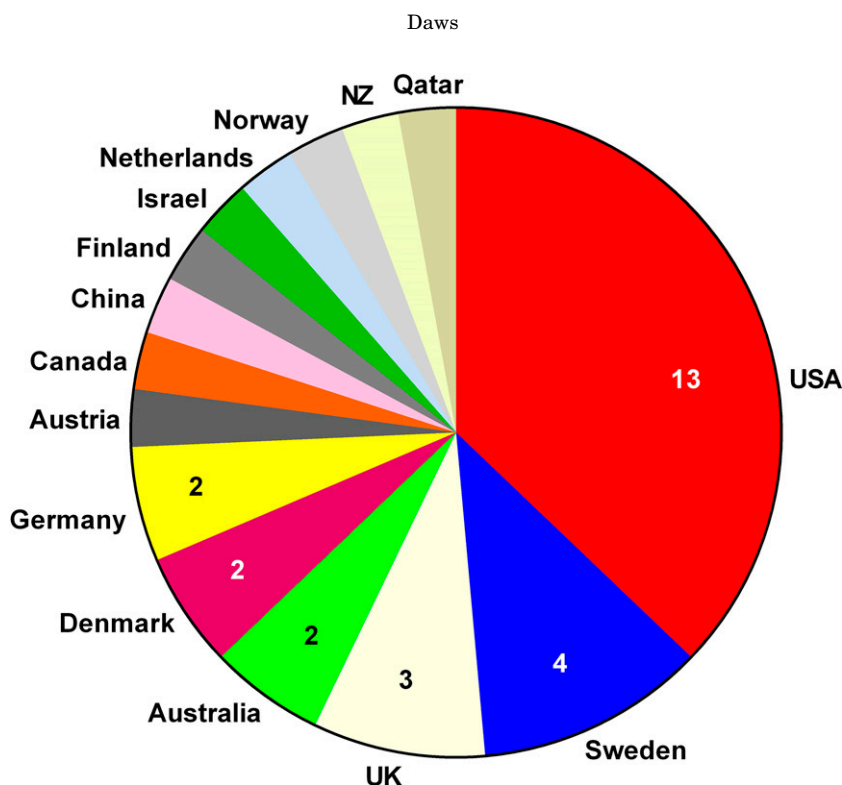


Fig. 2. Geographic diversity of Associate Editors as of 2023.

Reviews are in the top one percent of all journals covering similar space. *Pharmacological Reviews* ranks consistently higher than competing journals including *Trends in Pharmacological Research*, *Annual Reviews in Pharmacology*, and *Pharmacology and Therapeutics*. During my tenure as Editor in Chief, my main goal is to see these metrics climb. Some examples of the high caliber and high impact of *Pharmacological Reviews* articles are highlighted in Table 3.

Of course, one will notice that the most recent publication in Table 3 was in 2011. One may therefore wonder how more recent publications are faring in terms of citations. Table 4 shows data for reviews receiving the most citations over the period 2018–2021. As is evident, *Pharmacological Reviews* is continuing its tradition of publishing highly impactful articles. Consistent with this, a review published in February of 2023, titled

“Pharmacology of Heparin and Related Drugs: An Update,” senior author, Clive Page (a current *Pharmacological Reviews* Associate Editor) has already received 10,755 reads at the time of writing this editorial (November 2023). Several other articles published in 2022 and 2023 are among the current “most read” papers in *Pharmacological Reviews*, being well north of 1000 reads, boding favorably for future citations.

Many Thanks!

Of course, the success of *Pharmacological Reviews* would not be possible without the scientists who give

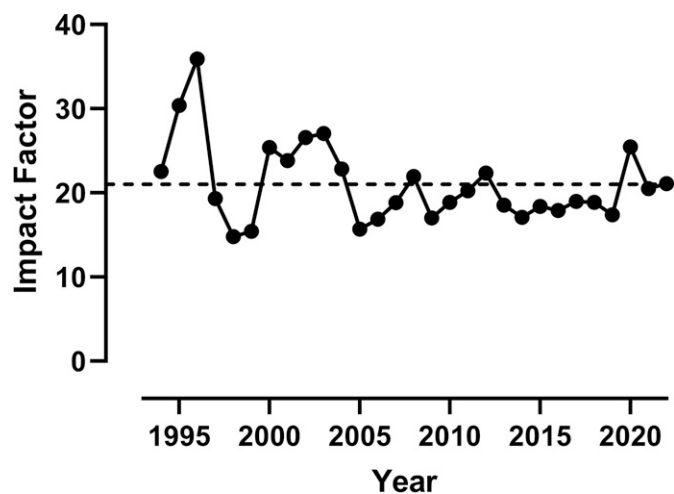


Fig. 3. Impact factors from 1994 to 2022. Dashed line represents the average impact factor over this period.

TABLE 2
Editors of *Pharmacological Reviews*

| Editor in Chief | Term |
|----------------------|--------------|
| Louis S. Goodman | 1954–1959 |
| Otto Kraye | 1949–1953 |
| George B. Koelle | 1960–1962 |
| George H. Acheson | 1963–1969 |
| Marion De V. Cotten | 1970–1977 |
| Paul L. Munson | 1977–1981 |
| James A. Bain | 1982–1988 |
| Robert E. Stitzel | 1989–1994 |
| David B. Bylund | 1995–2001 |
| Darrell R. Abernethy | 2001–2007 |
| Ross D. Feldman | 2008–2009 |
| David R. Sibley | 2010–2015 |
| Eric L. Barker | 2016–2021 |
| Lynette C. Daws | 2022–present |

TABLE 3
Top 25 most highly cited papers published in *Pharmacological Reviews*^a

| Title | First Author | Published | Citations |
|---|-----------------|-----------|-----------|
| Nitric Oxide: Physiology, Pathophysiology, and Pharmacology | S. Moncada | 1991 | 21,484 |
| The Effects of Plant Flavonoids on Mammalian Cells: Implications for Inflammation, Heart Disease and Cancer | E. Middleton | 2000 | 7076 |
| The Glutamate Receptor Ion Channels | R. Dingledine | 1999 | 5459 |
| Theoretical Basis, Experimental Design, and Computerized Simulation of Synergism and Antagonism in Drug Combination Studies | T.-C. Chou | 2006 | 5288 |
| Receptors for Purines and Pyrimidines | V. Ralevic | 1998 | 5150 |
| Pharmacological Implications of Microsomal Enzyme Induction | A.H. Conney | 1967 | 4747 |
| Long Circulating and Target-Specific Nanoparticles: Theory to Practice | S.M. Moghimi | 2001 | 4630 |
| Anthracyclines: Molecular Advances and Pharmacologic Developments in Antitumor Activity and Cardiotoxicity | G. Minotti | 2004 | 4447 |
| International Union of Pharmacology Classification of Receptors for 5- Hydroxytryptamine (Serotonin) | D. Hoyer | 1994 | 3979 |
| Glutamate Receptor Ion Channels: Structure, Regulation, and Function | S.F. Traynelis | 2010 | 3903 |
| Mechanisms of Antimicrobial Peptide Action and Resistance | M.R. Yeaman | 2003 | 3609 |
| International Union of Pharmacology. XXVII. Classification of Cannabinoid Receptors | A.C. Howlett | 2002 | 3515 |
| International Union of Pharmacology. XXV. Nomenclature and Classification of Adenosine Receptors | B.B. Fredholm | 2001 | 3385 |
| Actions of Caffeine in the Brain with Special Reference to Factors that Contribute to its Widespread Use | B.B. Fredholm | 1999 | 3224 |
| Purinergic Neves | G. Burnstock | 1972 | 3214 |
| The Membrane Actions of Anesthetics and Tranquilizers | P. Seeman | 1972 | 3195 |
| The Blood-Brain Barrier/Neurovascular Unit in Health and Disease | B.T. Hawkins | 2005 | 3169 |
| The Physiology, Signaling, and Pharmacology of Dopamine Receptors | J.-M. Beaulieu | 2011 | 3070 |
| International Union of Pharmacology. XXIII. The Angiotensin II Receptors | M. de Gasparo | 2000 | 2872 |
| The Sympathetic Nerve: An Integrative Interface Between Two Supersystems: The Brain and the Immune System | I.J. Elenkov | 2000 | 2849 |
| International Union of Pharmacology. XXII. Nomenclature for Chemokine Receptors | P.M. Murphy | 2000 | 2566 |
| The Endocannabinoid System as an Emerging Target of Pharmacotherapy | P. Pacher | 2006 | 2553 |
| Vascular Endothelial Growth Factor and Angiogenesis | A. Hoeben | 2004 | 2532 |
| Pharmacology of Bradykinin and Related Kinins | D. Regoli | 1980 | 2421 |
| Evolving Concepts in G Protein-Coupled Receptor Endocytosis: The Role in Receptor Desensitization and Signaling | S.S.G. Ferguson | 2001 | 2404 |

^aSources: Exaly.com, Google Scholar, and *Pharmacological Reviews* database as of November 18, 2023. Exaly.com “is a non-profit endeavour to address the absence of a comprehensive, unbiased, and independent bibliographic database. The project is absolutely independent with no link with publishers, research institutions, funding agencies, etc. whatsoever. The project is funded by individuals, and no public/corporate fund has been used”.

their valuable time to authoring the comprehensive and authoritative reviews we publish, and to those who volunteer their time to review these articles. The journal is indebted to you for your heroic efforts.

Stay Tuned for Special Content from Our Editors in 2024

As we look ahead to a year of 75th anniversary celebrations, you can look forward to special editorials in each issue. These will be authored by Martin Michel (author of six *Pharmacological Reviews* articles and Associate Editor for 15 years who continues in this role), David Sibley (former Editor in Chief), Rhian

Touyz (Associate Editor for 12 years who continues to serve on the board), and Ali Eid (one of the most recent additions to the editorial board) who will give his perspectives on *Pharmacological Reviews* and pharmacology now. The final issue in our anniversary year will include a special section with articles authored by investigators from the Department of Physiology and Pharmacology at the Karolinska Institute, Sweden, also celebrating 75 years. Associate Editor, Gunnar Schulte, a professor in receptor pharmacology in this department will author an article and an editorial for this issue. Given that the Scandinavian Pharmacology Society has been represented on the editorial board of *Pharmacological Reviews* for 75 years, this is a most fitting

TABLE 4
Top 10 most cited articles in the period 2018–2021

| Title | First Author | Published | Citations |
|--|---------------------|-----------|-----------|
| Ketamine and Ketamine Metabolite Pharmacology: Insights into Therapeutic Mechanisms | P. Zanos | Jun 2018 | 825 |
| REBUS and the Anarchic Brain: Toward a Unified Model of the Brain Action of Psychedelics | R.L. Carhart-Harris | Jun 2019 | 612 |
| Drug Resistance in Epilepsy: Clinical Impact, Potential Mechanisms, and New Innovative Treatment Options | W. Loscher | Jun 2020 | 406 |
| Interindividual Differences in Caffeine Metabolism and Factors Driving Caffeine Consumption | A. Nehlig | Mar 2018 | 403 |
| Endothelial Dysfunction in Atherosclerotic Cardiovascular Diseases and Beyond: From Mechanism to Pharmacotherapies | S. Xu | Jun 2021 | 364 |
| Drugs for Insomnia beyond Benzodiazepines: Pharmacology, Clinical Applications, and Discovery | T. Atkin | Feb 2018 | 295 |
| Is Oxytocin “Nature’s Medicine”? | C.S. Carter | Sep 2020 | 224 |
| Structure, Function, and Pharmacology of Glutamate Receptor Ion Channels | K.B. Hansen | Oct 2021 | 203 |
| RNA Drugs and RNA Targets for Small Molecules: Principles, Progress, and Challenges | A.-M. Yu | Sep 2020 | 197 |
| Psychedelics in Psychiatry: Neuroplastic, Immunomodulatory, and Neurotransmitter Mechanisms | A. Inserra | Jan 2021 | 120 |

celebration of joint anniversaries between the journal and the Karolinska Institute's Department of Physiology and Pharmacology. The final issue will also include a "look to the future" editorial from me. The future for *Pharmacological Reviews* is bright! With our current team, I see the journal only going from strength to strength. Thank you to all who help make *Pharmacological Reviews* one of the most prestigious journals in which to publish. We have much to celebrate! Cheers to more successes as we head to our centennial anniversary.

Lynette C. Daws
Editor in Chief

Acknowledgments

I would like to give my special thanks to the amazing journals management staff at ASPET for their help in digging through the archives to provide information contained in this editorial, Jackie Perry (Senior Publications Manager, Special Projects), Tracey Kirkbride (Journals Operation Manager), and Kristine Styron (Peer Review Coordinator). Without these dedicated and talented individuals, *Pharmacological Reviews* would not run as the incredibly well-oiled machine that it is. I would also like to give my thanks to Martin Michel for his very helpful input on data metrics included in this editorial.

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Stitzel RE (1999) Fifty years of *Pharmacological Reviews*: a historical perspective. *Pharmacol Rev* 51:3–6.