



Review

Regulating Death and Disease: Exploring the Roles of Metacaspases in Plants and Fungi

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Abstract: Identified over twenty years ago and distantly related to animal caspases are a group of cysteine proteases known as metacaspases. Throughout the years, much like caspase roles in metazoans, metacaspases have been shown to be involved in regulating cellular death in non-metazoan organisms. Yet, continued research on metacaspases describes these proteins as intricate and multifunctional, displaying striking diversity on distinct biological functions. In this review, we intend to describe the recent advances in our understanding of the divergence of metacaspase functionality in plants and fungi. We will dissect the duality of metacaspase activity in the context of plant-pathogen interactions, providing a unique lens from which to characterize metacaspases in the development, immunity, and stress responses of plants, and the development and virulence of fungi. Furthermore, we explore the evolutionary trajectory of fungal metacaspases to delineate their structure and function. Bridging the gap between metacaspase roles in immunity and pathogenicity of plant-pathogen interactions can enable more effective and targeted phytopathogen control efforts to increase production of globally important food crops. Therefore, the exploitation and manipulation of metacaspases in plants or fungi represent new potential avenues for developing mitigation strategies against plant pathogens.

Keywords: metacaspases; programmed cell death; plant immunity; plant pathogens; pathogenicity; fungal pathogens



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1. Introduction

Plant pathogens are responsible for devastating agricultural losses across a wide array of crops, exacerbating the burden of global food insecurity [1]. Successful plant pathogens must bypass plant defenses while plants must employ a vast range of controlled defense mechanisms to subvert potential pathogenicity [2,3]. This complex interaction entails utilizing a variety of mechanisms, such as pathogen effector proteins and host resistance genes [4]. Intriguingly, a common denominator observed in these plant-pathogen interactions is the implementation and regulation of cellular death. Plant immune responses rely on precise and regulated cell death to impede pathogen invasion while ensuring the protection of the surrounding host cells [5]. Conversely, cell death is an important aspect in the maintenance of pathogen fitness, as it enables the pathogen to effectively cause disease and circumvent defense strategies executed by the plant host [6].

Initially, the regulation of cell death was only known in metazoan organisms. It was found that programmed cell death (PCD), the precise removal of unwanted cells following specific signals, in animals was coordinated by caspases [7,8]. Caspases are proteins found within the family of cysteine proteases. Their name is derived from their composition and amino acid specificity: cysteine aspartic-specific proteases [9]. Given the highly regulated network involved in PCD, caspases are initially synthesized as zymogens, or inactive enzymes. Caspases consist of a prodomain located at the N-terminus, followed by the p20

Regulating Death

Mara Buchbinder



Regulating Death:

Regulating the Body Austin Sarat, Susanna Lee, 2025-08-05 How legal regulation of the body is practiced and justified
Regulating the Body examines the practice of legal regulation of the body and how it has been justified The essays in this anthology trace the ideological moral and religious arguments for increasing the reach of regulation and authorizing punishment for infractions Bringing together leading scholars in the law and humanities this volume examines the practices and discourses used to regulate the body concentrating on scenarios where ethical and legal inconsistencies abound The regulations examined herein range from the sale of gametes parental rights over children's genetic information debates about masking discourse regarding vaccines and abortion anti transgender legislation and the control of inmates bodies on death row These are situated within a cultural and political environment that values regulation and punishment over our long standing constitutional protections At a time where rhetoric around regulation of the body is becoming increasingly incendiary Regulating the Body reveals worsening legal hypocrisies and unmasks the threats to both personal autonomy and the claims of law itself

Deaths After Police Contact David Baker, 2016-10-18 This book investigates death after police contact in England and Wales in the twenty first century It examines how regulatory bodies construct accountability in such cases Cases of death after police contact have the potential to cause deep unease in society They highlight the unique role of the police in being legitimately able to use force whilst at the same time being expected to preserve life People who are from Black or Minority Ethnic backgrounds or have mental health issues or are dependent on substances are disproportionately more likely to die in these cases and this emphasises the sensitive nature of many of these deaths to society Deaths after Police Contact examines police legitimacy and the legitimacy of police regulators in these cases The book argues that accountability is produced by a relatively arbitrary system of regulation that investigates such deaths as individual cases rather than attempting to learn lessons from annual trends and patterns that might prevent future deaths It will be of great interest to scholars and upper level students of policing and criminal justice

Novel Plant Molecules Regulating the Interaction with Pathogenic and Beneficial Fungi Silvia Proietti, Ivan Baccelli, Richard Hickman, Antonio Leon-Reyes, Laura Bertini, 2021-03-26

The Regulatory Regime of Food Safety in China Guanqi Zhou, 2017-05-23 This book examines the decade from 2004 to 2013 during which people in China witnessed both a skyrocketing number of food safety crises and aggregating regulatory initiatives attempting to control these crises Multiple cycles of crisis regulatory efforts indicated the systemic failure of this food safety regime The book explains this failure in the social foundations for the regulatory governance of food safety It locates the proximate causes in the regulatory segmentation which is supported by the differential impacts of the food regulatory regime on various consumer groups The approach of regulatory segmentation does not only explain the failure of the food safety regime by digging out its social foundation but is also crucial to the understanding of the regulatory state in China

Turkey's Necropolitical Laboratory Banu Bargu, 2019-10-08 Building on

critical and contemporary theory these essays address the multiple ways in which the Turkish regime controls its citizens through physical destruction structural violence and exposure The 12 case studies include counterinsurgency warfare enforced disappearances cemeteries monuments prisons courts and the army *Regulating the End of Life* Sue Westwood,2021-09-09 *Regulating the End of Life* Death Rights is a collection of cutting edge chapters on assisted dying and euthanasia written by leading authors in the field Providing an overview of current regulation on assisted dying and euthanasia both in the UK and internationally this book also addresses the associated debates on ethical moral and rights issues It considers whether just as there is a right to life there should also be a right to death especially in the context of unbearable human suffering The unintended consequences of prohibitions on assisted dying and euthanasia are explored and the argument put forward that knowing one can choose when and how one dies can be life extending rather than life limiting Key critiques from feminist and disability studies are addressed The overarching theme of the collection is that death is an embodied right which we should be entitled to exercise with appropriate safeguards as and when we choose Making a novel contribution to the debate on assisted dying this interdisciplinary book will appeal to those with relevant interests in law socio legal studies applied ethics medical ethics politics philosophy and sociology *Unraveling the Molecular Mechanisms of Cytokine Signaling in Regulating Inflammatory Diseases* Wai Po Chong,Jian Zheng,Huawei Mao,2025-04-09 Chronic and dysregulated inflammation play a significant role in the pathogenesis of autoimmune diseases and inflammatory diseases Despite the prevalence and impact of these diseases the molecular mechanisms underlying cytokine regulation in these inflammatory diseases remain poorly understood This special issue aims to address this knowledge gap by discovering the intricate network of cytokine signaling pathways in immunoregulation during inflammatory diseases By unraveling these molecular mechanisms we can gain valuable insights into the dysregulation of cytokines in immune responses This deeper understanding will enable us to identify specific molecules signaling pathways and cellular interactions that contribute to disease progression Such knowledge is crucial for the development of targeted therapeutic interventions that can restore immune balance and mitigate the detrimental effects of inflammation Moreover the elucidation of these molecular mechanisms may also provide opportunities for the discovery of novel therapeutic targets By understanding the key molecules or pathways that drive the dysregulation of cytokine signaling pathways researchers can develop innovative approaches to modulate or manipulate these targets ultimately leading to the development of more effective treatments for autoimmune and inflammatory diseases *Scripting Death* Mara Buchbinder,2025-08-05 How the legalization of assisted dying is changing our lives Over the past five years medical aid in dying also known as assisted suicide has expanded rapidly in the United States and is now legally available to one in five Americans This growing social and political movement heralds the possibility of a new era of choice in dying Yet very little is publicly known about how medical aid in dying laws affect ordinary citizens once they are put into practice Sociological studies of new health policies have repeatedly demonstrated

that the realities often fall short of advocacy visions raising questions about how much choice and control aid in dying actually affords Scripting Death chronicles two years of ethnographic research documenting the implementation of Vermont's 2013 Patient Choice and Control at End of Life Act Author Mara Buchbinder weaves together stories collected from patients caregivers health care providers activists and legislators to illustrate how they navigate aid in dying as a new medical frontier in the aftermath of legalization Scripting Death explains how medical aid in dying works what motivates people to pursue it and ultimately why upholding the right to die is very different from ensuring access to this life ending procedure This unprecedented in depth account uses the case of assisted death as an entry point into ongoing cultural conversations about the changing landscape of death and dying in the United States Corporate Manslaughter and Regulatory Reform P. Almond, 2013-01-17 This book provides an account of the international emergence of corporate manslaughter offences to criminalise deaths in the workplace during the last twenty years identifying the limitations of health and safety regulation that have prompted this development Dynamics of Cell Fate Decision Mediated by the Interplay of Autophagy and Apoptosis in Cancer Cells Iman Tavassoly, 2015-02-16 This interdisciplinary thesis introduces a systems biology approach to study the cell fate decision mediated by autophagy A mathematical model of interaction between Autophagy and Apoptosis in mammalian cells is proposed In this dynamic model autophagy acts as a gradual response to stress Rheostat that delays the initiation of bistable switch of apoptosis to give the cells an opportunity to survive The author shows that his dynamical model is consistent with existing quantitative measurements of time courses of autophagic responses to cisplatin treatment To understand the function of this response in cancer cells he has provided a systems biology experimental framework to study quantitative and dynamical aspects of autophagy in single cancer cells using live cell imaging and quantitative fluorescence microscopy This framework can provide new insights on function of autophagic response in cancer cells

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